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A Firm's Strategic Behaviour in Networks: How Strategic Behaviour and Network Positions of the Focal Firm Influence the Firm's Performance

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Gracella Mahabier

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A Firm's Strategic Behaviour in Networks: How Strategic Behaviour and Network Positions of the Focal Firm Influence the Firm's Performance

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Graduation committee:

Chairman	**: Prof. Cees van Beers**
First Supervisor	**: Dr. Erik den Hartigh**
Second Supervisor	**: Dr. ir. Wolter Lemstra**

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Author:	**Gracella Mahabier**
Student number:	**4055381**
Email:	**G.V.Mahabier@student.tudelft.nl**
Date:	**September, 2011**

MSc. Management of Technology
Faculty of Technology, Policy and Management
Delft University of Technology
The Netherlands

TU Delft

EXECUTIVE SUMMARY

Many firms are nowadays engaged in strategic alliances for their success and survival and are therefore determined to maintain or even increase their performance. Various strategy scholars focused on the impact of business strategies on performance; whereas network scholars examined the impact of the network position of the firm on its performance. However, there is a need to integrate both research streams to gain an in-depth insight in the strategic behaviour of firms, network position and firm performance and in how they are related to each other. This may help firms mainly operating in networks within high tech industry sectors to achieve competitive advantage over competitors. This indicates that research aimed at *gaining* and *providing* insight in *how to investigate or determine* if and how strategic behaviour and network position are related and influence the firm performance is needed first. The motivation for this case study research came from that need.

The first objective of the research is to focus on whether insight in the strategic behaviour, network position and performance of a focal firm can be obtained from case studies; and if and how strategic behaviour and network position are related and impact the firm performance over time. The second objective is to determine and propose a comprehensive research design for future researchers who may attempt to conduct a case study research to into the possible relationships between strategic behaviour, network position and performance of the firm. To meet the research objectives, a case study approach has been undertaken. A multiple-case study design was chosen, since it allows cross-case analysis and may also enhance the validity of a study. The two sources of evidence included documents and archival records. From the preliminary analysis of available cases for the course MOT9592, two cases were selected based on the selection criteria for cases. The two cases were: (1) Apple iPod vs. Microsoft Zune; and (2) SACS vs. DVD-A. Both cases were about high tech firms within their networks, engaged in technology standards battles with competitors during the technological life cycle of a high tech product category. The aspects of strategic behaviour, network position and firm performance that had to be obtained from the case studies were established after the literature review. From the results obtained from the case studies it became evident that the research outcomes were influenced by practical difficulties, such as research approach, data limitation, bias and theory problem. Therefore the research focus shifted towards determining and proposing a comprehensive research design (research protocol, research scenario and “stylesheet”). This research design includes all recommended steps for successfully undertaking a case study research.From an academic perspective this exploratory case study research contributes to *an increase in knowledge*, by providing valuable insights in the core concepts strategic behaviour, network positions and firm performance and the possible relationships between those concepts. This research also has social relevance, since it determined and proposed a comprehensive research design, including a research “stylesheet”, which can be used by future researchers who may attempt to conduct a case study research to into the possible relationships between strategic behaviour, network position and performance of the firm. Nevertheless, there were also limitations in this research, which were all related to the research design. Therefore, in further research it is recommended to use the proposed research design.

Keywords: Strategic behaviour, Network position, Performance,Technology life cycle dimension, Case study research, Research Design

DEDICATION

"This Master of Science thesis is dedicated:

To the loving memory of my late father, Soesielkoemar Mahabier, who always instilled the importance of high education to his daughters;

To my beloved mother Kala Mahabier-Ramcharan and wonderful sisters Karishma & Anishma for their continuous blessings, love and encouragement throughout life; and

To my dear husband Ashwin Adhin for his endless support, love, guidance and belief in me."

ACKNOWLEDGEMENTS

This master thesis deals with the research that has been executed over the period of February 2011 – September 2011 to fulfill the requirements for the degree of Master of Science in Management of Technology at the Delft University of Technology.
Two years ago I came from Suriname with my bachelor's degree to The Netherlands to realize the dream of getting my master's degree at the Delft University of Technology. I believe that dreams can come true, only if you believe in them and want to pursue them. Finally, I can see my dream coming true. At the conclusion of my research, I would like to take the opportunity to express gratitude to some important people who have contributed to the completion of my research and MSc. study and made my journey through life unforgettable.

First of all, I would like to express my sincere gratitude to my first supervisor dr. Erik den Hartigh for guiding me friendly and in a motivating way throughout the length of my master thesis project. He truly has been the ideal thesis supervisor. He always gave me the freedom to work with my own deadlines and whenever I experienced difficulties during the research trajectory, I could just send an email and expect a reply on it soon. I am heartily thankful to him, since his countless advices and discussions from the start till completion of the master project, have really helped me to improve and complete my research. Next, I would like to acknowledge my second supervisor dr.ir. Wolter Lemstra for his helpful suggestions and comments during all our meetings. His suggestion to do a preliminary analysis on two case studies first instead of starting with a number of case studies changed the direction of my initial research plan. That preliminary analysis eventually became an in-depth case study research with the focus on determining a comprehensive research design for future researcher. I would also like to thank Prof. Cees van Beers, the chairman of my graduation committee for his useful comments during the Kick-off and Green-light meeting.

I owe my deepest gratitude to the four most important persons in my life for their endless support and love: my Mother, Husband and Sisters, who are my Happiness, my Inspiration, my Life, and my World. Despite being miles apart, we were always close at heart. My beloved, hardworking and caring mother Kala Mahabier-Ramcharan has always made life easy for me and inspired me to achieve all my goals in life. I also want to thank my lovely sisters: mr. Karishma Rampersad-Mahabier and drs. Anishma Mahabier for their continued encouragement and love from childhood till date. My sisters have been my role-models and I am so proud to be their sister. Finally, I want to thank the person who came into my life and changed it forever, my dear husband Ashwin Adhin MSc. Words are not enough to thank him for making this journey to The Netherlands possible and making me believe in my dreams. His unconditional love, understanding, patience and belief in me guided me towards realizing my dreams.

Lastly, I offer my appreciation to everyone who supported me in any respect during my journey of two years in The Netherlands and especially during my master thesis project.

Gracella Mahabier
Delft, The Netherlands
September 13, 2011

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1. INTRODUCTION

This chapter provides a brief background of the research. It describes the problem statement, the research objective, research questions and significance of the research. Furthermore the core concepts of interest are briefly introduced and after describing the research scope and research method, the structure of the thesis is presented at the end of this chapter.

1.1 PROBLEM STATEMENT

Nowadays many firms are getting engaged in strategic alliances for their success and survival. Strategic alliances are agreements between firms for cooperation in order to improve their competitiveness and performance through shared resources and to develop and commercialize innovative products or technologies (Gulati, 1998; Ireland, Hitt & Vaidyanath, 2002; Schilling, 2008). In their research Gulati, Nohria & Zaheer (2000) argued that through strategic networks a firm can achieve (1) access to information, resources, markets, and technologies; (2) advantages from learning, scale, and scope economies; and (3) strategic objectives, such as sharing risks and outsourcing. Hoffmann (2007) described that firms are embedded in a dense network of inter-organizational relationships with customers, suppliers, competitors and complementors, and goal-oriented management of those relationships can allow firms to reach a certain level of competitiveness. The competitiveness is also significantly influenced by the positioning of the firm within the network (Gulati, 1998). This means that by having a certain position within the interconnected network, a firm may achieve competitive advantages in the network.

The strategic behaviour of a firm refers to all the strategic actions taken by the firm in order to influence the environment to gain competitive advantage over its competitors (Teece, 2007). Since firms are nowadays occupied in strategic alliances, it really becomes important to look at the effect of strategic behaviour of firms in an alliance network in order to improve the firm's performance. What also might affect the performance of the firm is the position the firm takes within the network. This position might evolve over time. From a managerial point of view, an in-depth understanding of how to deal with challenges, such as (1) changes in network configuration and development over time; (2) maintaining interorganizational relationships effectively; (3) improving cooperation between firms within a network, and (4) gaining maximum value from the networked environment for improved firm performance, is important for the overall success of a firm (Hoffmann, 2007).

While strategy scholars have examined the impact of business strategies on performance (Leitner and Gueldenberg, 2010; Gibcus and Kemp, 2003) or alliance strategies on performance (Hoffmann, 2007), network scholars investigated the impact of network positions on performance (Gulati *et al.*, 2000; Tsai, 2001; Zaheer & Bell, 2005; Powell, Koput, Smith-Doerr, & Owen-Smith, 1999). However, research aimed at exploring if strategic behaviour of a focal firm and its network position are related and if and how strategic behaviour and network position relate to the firm performance is underdeveloped. For instance, Venkatraman, Lee and Iyer (2008) argued that the firm performance depends on how the firm's business strategy interacts with its network position. However, in their research, the focus was on the interaction of network positions with two business strategy variables

only 'market scope' and 'product scope', influencing firm performance in the software market. In-depth knowledge of the strategic behaviour of firms and combining that with research on network positions can help firms mainly operating in networks within high tech industry sectors to achieve competitive advantage over competitors, if they know how strategic behaviour and network positions may possibly impact the firm performance. However, to be able to gain in-depth knowledge of strategic behaviour, network position and firm performance and to provide that knowledge to firms, research on how to gain and provide insight is needed fist. This indicates that the focus has to be on gaining and providing insight in how to investigate strategic behaviour, network position and firm performance; but also on which research design to follow.

1.2 RESEARCH OBJECTIVE

As a solution to the research problem mentioned in the previous section, it would be good to focus on exploring the three following core concepts: (1) the strategic behaviour, (2) the network position and (3) the performance of the focal firm. This would include an investigation of:

- the strategic behaviour a focal (central) firm in a networked environment, which means exploring which strategies are used or which strategic decisions and choices are made by the focal firm; and if this strategic behaviour influences the firm's performance;
- the dynamic network positions of the selected focal firm over time; and if and how these network positions are related to the strategic behaviour and/or influence the performance of the firm.

This research, however, aims at *gaining* and *providing* insight in *how to investigate or determine* best (1) the strategic behaviour, the network position and the performance of a focal firm over time; and (2) if and how strategic behaviour and network position are related and influence the firm performance. The objective of the research is twofold:

First Research objective

On one hand the first objective is to focus on whether insight in (1) the strategic behaviour, network position and performance of a focal firm within a network over time and (2) if and how strategic behaviour and network position are related and impact the firm performance over time, can be obtained by conducting case studies. In other words, the objective is to evaluate to which extent the case study approach is suitable to investigate the core concepts and to examine whether there is a relation between strategic behaviour, network position and firm performance.

Remark: Basically, a comprehensive literature study will be performed first to get insight in what is already researched and published by previous scholars about the three core concepts and after that two case studies will be conducted. The case studies will be conducted by using existing case reports, which have been made by second year students of the MSc in Management of Technology program for the MOT9592 course. It is also important to mention here that an important conference paper, written by den Hartigh, Ortt, van de Kaa and Stolwijk (2009) and titled "Technology Standards Battles and Networks during the Technology Lifecycle: The Battle Between HD-DVD and Blu-ray", has been used extensively within this research. [More detailed information about the literature review and case studies has been provided in section 1.7. Detailed information about the case reports and the MOT9592 course has been provided in section 3.1.1] After the case analysis it will be evaluated

whether the chosen research design to investigate the research problem resulted in viable research outcomes and helped achieving this first objective.

Second Research objective

On the other hand the second objective is to determine and propose a comprehensive research design for future researchers who might attempt to conduct a case study research into the possible relationships between strategic behaviour, network position and performance of the firm This proposed research design will contain all the recommended steps based on prior scholarly work on case study research and the outcomes from the case studies performed during this research.

Remark: As has been mentioned within the remark to the first objective, after the case analysis the findings will be evaluated to examine how the research design can be improved. A comprehensive research design contains all the recommended steps for successfully conducting a case study for addressing the first research objective. The research design will be recommended to future researchers who are willing to undertake a case study research into the possible relationships between the same core concepts as in this research (strategic behaviour, network position and firm performance) by making use of the same collection of available case reports.

1.3 RESEARCH QUESTIONS

The addressed research objectives refer to a theory-oriented research project, which means that exploratory knowledge is required (Verschuren & Doorewaard, 1999). Moreover, exploratory research helps to determine the best research design and therefore the research question will also be exploratory of nature. For this research, the following main question has been addressed:

> ***"How to determine if and how a focal firm's strategic behaviour and its position within a network of interorganizational relations are related and impact the focal firm's performance over time?"***

In order to answer the main research question, a set of sub-questions have been formulated. The sub-questions have been derived for each research objective.

For the purpose of the first objective - to evaluate to which extent the case study approach is suitable to obtain insight in the strategic behaviour, network position and performance of a focal firm in a network and to examine whether there is a relation between strategic behaviour, network position and firm performance - the following sub-questions have been formulated:

1. Insight in which aspects of strategic behaviour, network positions and firm performance has to be obtained from the case studies?
   [Remark: Insight in the aspects of strategic behaviour, network positions and firm performance considered in this research will be provided by performing a literature study]

2. How can it be determined if insight in the aspects of strategic behaviour, network positions and firm performance being studied and their possible relations can be obtained from the case studies?

- Which of the aspects of the strategic behaviour, network positions and performance of the focal firm (addressed in research question 1) have been obtained from the case studies?
- Is there a possible relationship between strategic behaviour and network position of a firm?
- Is there a possible relationship between strategic behaviour and performance of a firm?
- Is there a possible relationship between network position and firm performance?

[Remark: Insight in whether the aspects of the strategic behaviour, network positions and performance *can be obtained from case studies and whether relationships among these aspects exist will be provided while conducting the case studies.]*

For the purpose of the second objective - to determine and propose a comprehensive research design for future researchers attempting to conduct a case study research into the possible relationships between strategic behaviour, network position and performance of the firm - the following sub-questions have been formulated:

3. Which practical issues may have influenced the results obtained from case studies and which recommendations can be provided in order to overcome them in further research?
   [Remark: Insights in whether there are practical issues influencing the research outcomes and recommendations on how to overcome them, will be provided after analyzing data obtained from the case studies.]

4. What constitutes a comprehensive research design for conducting a case study research into the possible relationships between strategic behaviour, network position and performance of the firm?
   [Remark: This question may be answered based on the answers to question 2 and 3. If the research outcomes are possibly influenced by practical issues and some recommendations have been provided by the researcher to overcome those issues in further research, the focus will shift towards giving recommendations to future researchers on a comprehensive research design for a case study research into the possible relationships between strategic behaviour, network position and performance of the firm.]

1.4 OUTCOMES OF THE RESEARCH

The research will be exploratory of nature. The main purpose of exploratory research is to reach a better understanding of the research problem. This includes identifying the concepts which should be measured within the study (Verschuren & Doorewaard, 1999).

The main outcome of the research is *gaining* and *providing* better understanding in how to investigate the strategic behaviour, network positions of focal firms in a networked environment and the firm performance. The research may also provide insights in how to investigate if and how those concepts relate to each other. This outcome is twofold:

1. One outcome is to *gain* more insight in how to investigate the concepts of interest and their possible relationships. This means getter a better understanding of how to best determine the strategic behaviour, network positions and firm performance.

2. The second outcome is to *provide* a research design that may serve as a guide for future researchers and will help in providing insight in how to investigate the concepts of interest through a case study research. The research design includes all recommended steps for conducting a case study research. This recommended research design is for those researchers who may want to explore a similar research problem (about strategic behaviour, network position, performance of a firm and their possible relations); using the existing cases from the same collection of cases that has been used by the current researcher.

1.5 SIGNIFICANCE OF THE RESEARCH

The research field on managing networks strategically and on network positions is relatively young and only few empirical literature studies have been conducted in this field (Thomas, 1984; Dittrich *et al.*, 2007). Moreover, research based on gaining and providing insight in how to investigate certain concepts may show to have scientific as well as social significance or relevance.

Scientific Relevance: This research tries to fill the scientific gap between research on strategic behaviour and research on network characteristics and will increase the scientific knowledge about how to investigate the strategic behaviour, network position, firm performance and their possible relationships. From an academic perspective this research will then contribute to *an increase in knowledge*, particularly in the field of research on alliances and strategic networks from the perspective of a focal firm, by providing valuable insights in the core concepts strategic behaviour, network positions and firm performance and the possible relationships between those concepts.

Social relevance: This research will provide an insight in how to investigate the core concepts of interest and their possible relationships and will focus on whether this insightcan be obtained from case studies. This means that the research will help to determine a *comprehensive research design*. As mentioned before, one of the outcomes of this research is a clear recommended research design including a research "stylesheet". This particularly shows the social relevance of this research, because the recommended research design, accompanied by the "stylesheet", will prove to be relevant for future researchers attempting to undertake a case study research.

1.6 CORE CONCEPTS

This section aims at clarifying the core concepts and their definitions as used within this thesis. In order to gain insights in the concepts strategic behaviour and network positions of a focal firm in a network and how these concepts influence the firm performance, definitions of strategic behaviour, focal firm, network, network positions and firm performance are important. These definitions are briefly provided in this section. Also since in this research the technology life cycle and business ecosystem perspective also play an important role; these concepts are also defined in this section. More elaboration on all core concepts will be further provided in Chapter 2.

1.6.1 FIRM'S STRATEGIC BEHAVIOUR

A firm's strategic behaviour deals with all strategic actions, including all strategies that are used, strategic decisions or choices that are made, taken by firm in order to maintain a sustainable position in the market (Teece, 2007).

Various scholars have defined strategy differently in their studies. Where Chandler (1961) defined strategy as "the determination of the basic long-term goals and objectives of an enterprise and the adoption of courses of actions and the allocation of resources necessary for carrying out these goals", Porter (1996) argued that "strategy is the creation of a unique and valuable position, involving a different set of activities." Firms should deliberately choose a different set of activities to outperform competitors.

1.6.2 FOCAL FIRM WITHIN THE NETWORK

According to Hoffmann (2007), firms are embedded in a dense network of interorganizational relationships with customers, suppliers, competitors, and complementors. Interorganizational relationships are an important source of competitive advantage and goal-oriented management of all alliances of a focal firm is important for improving firm performance and achieving competitive advantages. The positioning of the focal firm in the network significantly influences its competitiveness. The term *"focal firm"* refers to the firm playing a central role by means of consistently operating value adding processes on both sides of the focal point within its network. Figure 1 shows a focal firm with its innovation partners and their contributions (Ritter and Gemünden, 2003).

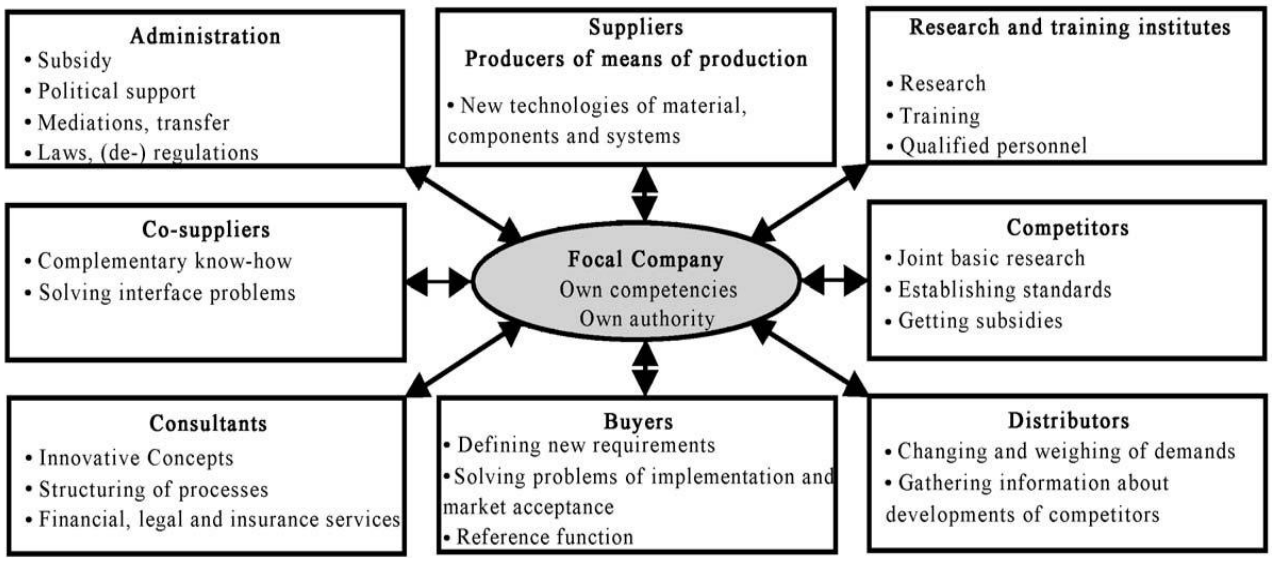

Figure 1: Focal firm with innovation partners and their contributions (adopted from Ritter and Gemünden, 2003, pg. 746)

1.6.3 NETWORK POSITION

The term network position in this context refers to the structural position of the focal firm within its network of interfirm relationships. This structural position can be either central or peripheral, based on the total number and diversity of network ties (Powell *et al.*, 1996).

1.6.4 FIRM PERFORMANCE

For the purpose of this study, firm performance refers to 'technology dominance' or 'standardization' (the relative market share of the technology platform) and financial performance (ROA/profitability).

- Technology dominance or standardization refers to the standard dominance achieved by a new technology in the operating market, which is usually marked by a market share of 50% or more (Schilling, 2010; den Hartigh & van Asseldonk, 2004). Market share refers to the portion of a product's unit sales in the overall market, compared to those of other alternatives.
- Return on total assets (ROA) is calculated by dividing the operating income, i.e., earnings before interest and taxes, by total assets of the firm (Hawawini *et al*, 2003).

1.6.5 BUSINESS ECOSYSTEM PERSPECTIVE

In their paper, den Hartigh& van Asseldonk (2004) argued that in technology battles, competition takes place between networks, consisting of multiple firms performing different roles, around a common technological platform. Such networks are referred to as 'business ecosystems'. A business ecosystem is defined as "a network of suppliers and customers around a core technology, who depend on each other for their success and survival". Figure 2 shows a business ecosystem with its main actors.

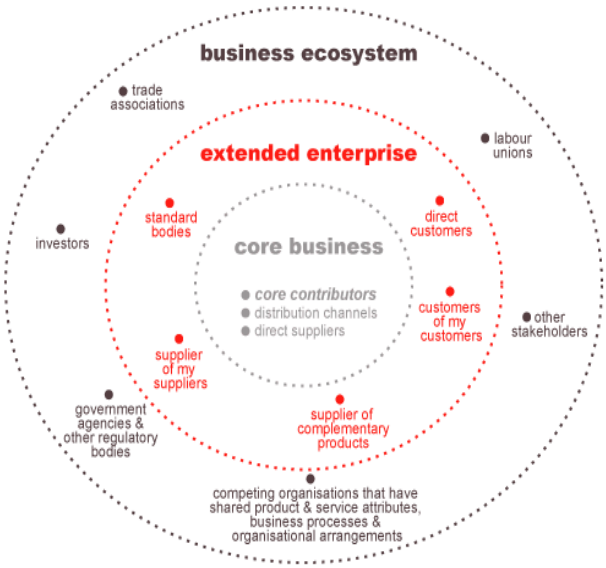

Figure 2: Business ecosystem (Source: http://www.provenmodels.com/574)

The business ecosystem is determined by what is defined as the core technology (by the researcher). That means that if the researcher defines Apple's iPod as the core technology, Apple can be seen as the focal firm and other firms like Toshiba (providing the disk drive), Texas Instruments (providing the Firewire port) and Sony (which provided the battery for the iPod, are important members of the iPod business ecosystem (den Hartigh & van Asseldonk, 2004).

[Remark: In-depth elaboration on the Apple iPod business ecosystem will be provided in Chapter 3, where the case study on the technology standards battle between Apple iPod and Microsoft Zune has been conducted.]

1.6.6 TECHNOLOGY LIFE CYCLE

The *Technology Life Cycle* was described by Suarez's study in 2004 (Suarez, 2004). Suarez distinguished five phases in the development process of a high-tech product category: 'R&D build up', 'Technological feasibility', 'Creating the market', 'Decisive battle' and 'Post dominance.' Ortt and Schoormans (2004) described the development and diffusion of a product category by a technology pattern which can be distinguished into three main phases: invention, market introduction and industrial production and large-scale diffusion as can be seen in Figure 3.

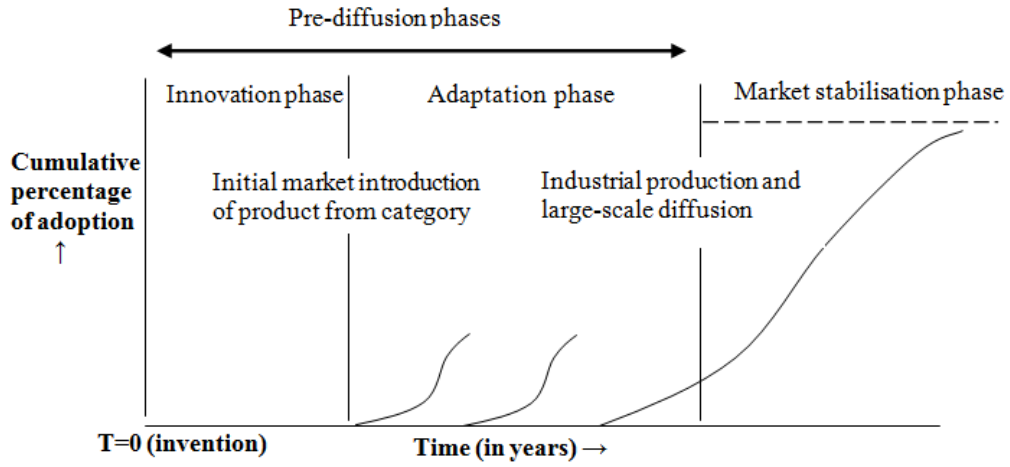

Figure 3: The pattern of development and diffusion of high-tech product categories (Adopted from Ortt, 2009)

Invention is defined as the first demonstration of the working principle of the new high-tech product category. Commercialization refers to the first sales of the product/technology and large-scale industrial production means that in the market adaptation phase products are made-to-order or in very small batches. The large scale industrial production marks the beginning of the market stabilization phase, where diffusion may take off, and the product technology in a specific configuration may become the dominant standard, which means achieving a market share of over 50%.

By combining Suarez' model (Suarez, 2004) with the model of Ortt and Schoormans (2004), the 'technology life cycle dimension', as seen in Figure 4 can be used for analyzing standards battles.

Innovation phase (I)		Adaptation phase (II)		Market stabilization phase (III)
R&D buildup (Ia)	Technological feasibility (Ib)	Creating the market (IIa)	Decisive battle (IIb)	Post dominance (III)

Figure 4: Technology life cycle dimension (Adopted from den Hartigh et al, 2009, pg.5)

Ortt and Schoormans' model and the 'technology life cycle dimension', have been used in this research while conducting the case studies, since the selected cases are all about technology standards battles of two competing product categories/technologies from two main supporting

firms. More elaboration on the standard battles and technology life cycle dimension has been provided in Chapter 3 of this thesis.

1.7RESEARCHMETHOD

If the research question and aims of this research are exploratory of nature and if knowledge about the research topic is quite limited, qualitative research methods can lead towards gaining in-depth insights (Verschuren & Doorewaard, 1999; van der Velde & Anderson, 2004; Yin, 2003). Case study research is the most commonly used qualitative and effective research method in order to get valuable insights and outcomes (Yin, 1994; Darke *et al*, 1998; Eisenhardt, 1989).

According to Yin (2003) the case study research method is "an empirical inquiry that investigates a contemporary phenomenon within its real-life context; when the boundaries between phenomenon and context are not clearly evident; and in which multiple sources of evidence are used". Within a case study research an in-depth, longitudinal investigation of a "case", which can be an instance or event, can be conducted. The case study research involves a systematic way of data collection and analysis which may result in gaining insight in why the instance/event took place. It also provides insight in issues which may be researched more comprehensively in future. Because the main purpose of this research is to gain and provide insight in how to investigate or determine best strategic behaviour, network position and performance of a firm in a networked environment, undertaking a case study research seemed most appropriate.

In this case study research first a literature research has been performed and after that two case studies have been conducted. More information about literature research and case studies are detailed next.

1.7.1 LITERATURE RESEARCH

Literature research refers to the process of searching for applicable literature related to the concepts being studied in quality academic literature databases (Levy and Ellis, 2006). Before starting the research an overall idea of what is already known about the research topic and also which relevant literature is available, is important. Literature review is very important in order to get an overview of the research area, to determine the importance of and the controversial issues within the research area and to ascertain who the key contributors to the scientific field of knowledge are. Most importantly by using prior empirical studies, important theoretical insights have been gained, which resulted in chapter two of this thesis.

Since the aim of the research is to gain and provide insight in how to investigate or determine best the strategic behaviour, the network position and the performance of a focal firm over time; and if and how strategic behaviour and network position are related and influence the firm performance, literature has been judged as relevant and selected based on the following criteria:

- Only scientific literature (books, high quality journals/papers)
- Year of publication: not older than 5-6 years, unless crucial for the intended research)
- The content should include concepts like, strategic behaviour, strategies, firm performance, networks, network dynamics, research design, and case study research.

- Impact factor (IF): a measure of the frequency with which the average article in a journal has been cited in a particular year.

Selection process of relevant literature

A description of how relevant literature has been selected is as follows:

- First of all, some of the papers/books/journals have been recommended by the first supervisor of this research, Dr. Erik Den Hartigh and some by Ir. Elissa Anggraeni.
- Other papers/books/journals (such as: den Hartigh *et al*, 2009; Ortt and Schoormans, 2004; Schilling, 2010; van de Kaa, 2009; den Hartigh & van Asseldonk, 2004; Moore, 1996; Shapiro, 1989;) have been read and used before for assignments (for other MSc. courses) and which contain information about the core concepts of interest, have been selected therefore.
- Papers/books/journals about research methodology, most importantly about case study research (such as Yin, 1994; Eisenhardt, 1989; Miles & Huberman, 1994; Darke *et al.*, 1998; Verschuren & Doorewaard, 1999).
- The rest of the literature has been found and selected by using the comprehensive research platform *ISI Web of Knowledge* and the multidisciplinary database *SCOPUS* and lastly by using search engine *Google Scholar.*
    - Search terms that were used: strategic behaviour, networks, network perspective, network position, strategies, firm performance, case study research.
    - After selection of each relevant journal/paper or book, a forward and backwards search in references and citations has led towards finding other relevant literature.

1.7.2 CASE STUDIES

Considering the exploratory nature of the research questions in this research, case study seemed to be the apt research method here. This research therefore involves a longitudinal analysis of cases in order to investigate the core concepts of interest. In particular, a multiple case design is chosen to describe, rank and explore data. Using case studies makes it possible to investigate relationships between variables over time and also results in exploring if the reality (case studies) corresponds well with the theory (Yin, 2003).

Selection of the Cases

For this research case reports made by students for particular courses within the MSc program Management of Technology at the Faculty of Technology, Policy and Management, TU Delft have been used and analyzed. An overview of the total number of available cases per course and the year of submission can be seen in table 1.

A preliminary investigation/analysis of the case reports took place. Overviews of the results from the preliminary analysis can be found in Tables 19-23 (See Appendices 1-5). From the preliminary analysis, it seemed that the case reports contained the useful information about the variables of interest in this research (strategic behaviour, network positions, and firm performance). Moreover, these case reports were all are about cases in which high-tech firms with their networks of interorganizational relationships in different industry sectors were involved in the development and introduction of high-tech product categories to consumer markets and where the strategic behaviour and network dynamics are of great importance and influence. These firms are engaged in standards battles with competitors during the technological life cycle of a high tech product category. In this

context it's necessary to mention that the high-tech products and/or technologies dealt with in the case studies are consumer products, which means that it is produced for and used by the consumers (end-users). Examples of high-tech products/technologies are computers, software, smartphones, etc. (den Hartigh & van Asseldonk, 2004).Furthermore, all the cases have been researched, analyzed and reported in the last four years(2007-2010), which means that the information is quite up-to date and utilizable for this research. Therefore exploring the strategic behaviour, network positions and performance of those high tech firms in each case study in order to find a possible relationship between these three concepts seem to be doable by using these cases/case reports.

Table 1: The total number of cases per course and year of submission

Course Code	Course	Year	# Cases
MOT9591	Innovation Strategy and Systems	2007	6
MOT9591	Innovation Strategy and Systems	2008	3
MOT9592	Innovation Strategy and System B	2009	3
MOT9592	Standards Battles, Technology Patterns, and Business Ecosystems	2010	6
MOT1431	Technology and Strategy	2010	13

For this research a multiple case design has been used and therefore two cases have been selected from the collection of cases based on certain selection criteria. The selection procedure, including the selection criteria and information about the background of the case reports, has been detailed in section 3.1.1. More importantly it has to be mentioned that the conference article by den Hartigh *et al.* (2009) will be used extensively as a key guide for conducting the case studies. The paper provides information about the changes in the structure and composition of networks supporting technologies during the phases of the technology life cycle. A case study of the technology battle between the HD DVD and Blu-ray technologies has been performed to identify these changes.

Constraints and drawbacks of the chosen method

It is time-consuming to collect data from case studies, and even more time-consuming to analyze the data. Also, compared to data from quantitative methods, data from case studies is predominantly non-numerical. Moreover, the sample is small and idiosyncratic, which makes it difficult to establish confidence in the data (Yin, 2003; Darke *et al.*, 1998).

In this research multiple case study design has been used and because of the fact that every case study is context dependent, different sources of information are needed (Yin, 2003; Verschuren & Doorewaard, 1999). Hence a multi-method research is necessary. The multi-method research refers to the fact that both qualitative and quantitative data collection methods are used, such as desk research and interviews.However, in this research interviews have not been conducted. The initial idea was conduct interviews, but the analysis of the case reports alone took more time than planned due to the depth of the analysis. Due to the time constraint, the case studies have been conducted with documents and archival data as the only data sources and after having obtained findings from the case studies, the focus shifted towards determining and proposing a comprehensive research design for further research.

1.8 RESEARCH SCOPE

The research will try to provide insight in how to investigate certain aspects of the core concepts 'strategic behaviour', 'network positions' and 'performance' of a focal firm within a network, as well as insight in how to determine if and how those aspects relate to each other. Furthermore, a comprehensive research design will be proposed.

To avoid complexity and due to time constraint demarcation of the research project was needed. Since it was important to determine which aspects of strategic behaviour, network position and performance had to be considered in this research, the following three questions were defined for the demarcation:

1. Which aspects of strategic behaviour have to be considered in this research?
2. Which aspects of network positions have to be considered in this research?
3. Which aspects of firm performance have to be considered in this research?

The various aspects of strategic behaviour, network positions and firm performance which are considered in this research have been selected based on the preliminary analysis of the case reports. The case reports focus on high technology firms and their respective business ecosystems, engaged in standard technology battles around a common technology platform in high tech industry sectors. The content of the case reports showed which aspects were important for a firm in order to attain competitive advantage over competitors.

The next three sub-sections provide a list of aspects of strategic behaviour, network positions and firm performance which are considered in this research. Behind each aspect reference(s) to relevant literature are placed in brackets. These aspects are explored in detail in the next chapter.

1.8.1 ASPECTS OF STRATEGIC BEHAVIOUR

The following aspects of strategic behaviour will be investigated in this research:

- Porter's generic strategies: Cost Leadership, Differentiation and Focus (Porter, 1985)
- Hoffmann's Alliance strategies: shaping, adapting, and stabilizing strategy (Hoffmann, 2007)
- Business ecosystems strategies: shaper strategy (keystone, dominator), adapter strategy and reserving the right to play (den Hartigh& van Asseldonk, 2004; Iansiti & Levien, 2004)
- Standard support strategies: pricing strategy, appropriability strategy, timing of entry, marketing communications, distribution strategy, commitment (van de Kaa, 2009)

Strategy scholars have focused on how environmental factors affect the strategic behaviour of the focal firm. There is a distinction between internal and external environmental factors.
Internal environmental factors are factors originating from the internal environment of the firm (i.e. the internal aspects of the focal firm) such as organizational culture, company culture and financial resources. In the resource-based view (RBV) of the firm, the internal environment of the firm is central and focuses on how a firm can attain competitive advantages by effectively augmenting its own (internal) resources.
External environmental factors include economic, political, social and technological factors that come from the external environment of the focal firm and its network. According to Neblett (2004), external environmental factors originate irrespective of any single firm's operating situation and

influence all firms within the industry; in particular it may influence the corporate strategy. Economic factors are factors like inflation rate, economic growth that may affect the purchasing power of potential customers and the firm's cost of capital. Political factors include government legal issues and regulations to which the firm must comply, for example tax policy, trade restrictions and tariffs, employment laws. Social factors are factors that empathize on protecting and improving the welfare of society as whole and the interests of the firm. Social responsibility for example is a social factor. Technological factors like R&D activity or rate of technological change may influence the competitive position of firms.
However, looking at the impact of these environmental factors on strategic behaviour is beyond the scope of this study. These factors are assumed as constant and are not considered when determining of and how aspects of strategic behaviour are related to aspects of network position and firm performance are related.

1.8.2 ASPECTS OF NETWORK POSITIONS

The following aspects of network positions will be investigated in this research:

- Network characteristics in the network perspective of strategy: alliance degree and structural holes (Venkatraman *et al.*, 2008; Ahuja, 2000; Zaheer & Bell, 2005)
- Network characteristics like 'network size', 'network diversity' and 'network structure' (den Hartigh *et al.*, 2009)

1.8.3 ASPECTS OF FIRM PERFORMANCE

The following aspects of firm performance will be investigated in this research:

- Technology dominance or standardization(den Hartigh& van Asseldonk, 2004)
- Financial performance: ROA/Profitability(Hawawini *et al.*, 2003)

1.9STRUCTURE OF THE THESIS

An overview of the thesis outline has been illustrated in figure 5.

This thesis is divided into six chapters.

In *Chapter 1*, the introductory chapter, an overview of the problem statement, research objective, research questions, significance of the research, core concepts, research scope, research method and lastly the thesis outline, have been presented.

In *Chapter two* a comprehensive literature review has been conducted, where the core concepts have been highlighted supported by prior literature. The theoretical views from prior literature served as a frame of reference during the actual data collection and analysis procedures of this research. Since the nature of the research question was exploratory, no propositions have been formulated to guide the research. Also, no theoretical framework has been developed at the end of this chapter.

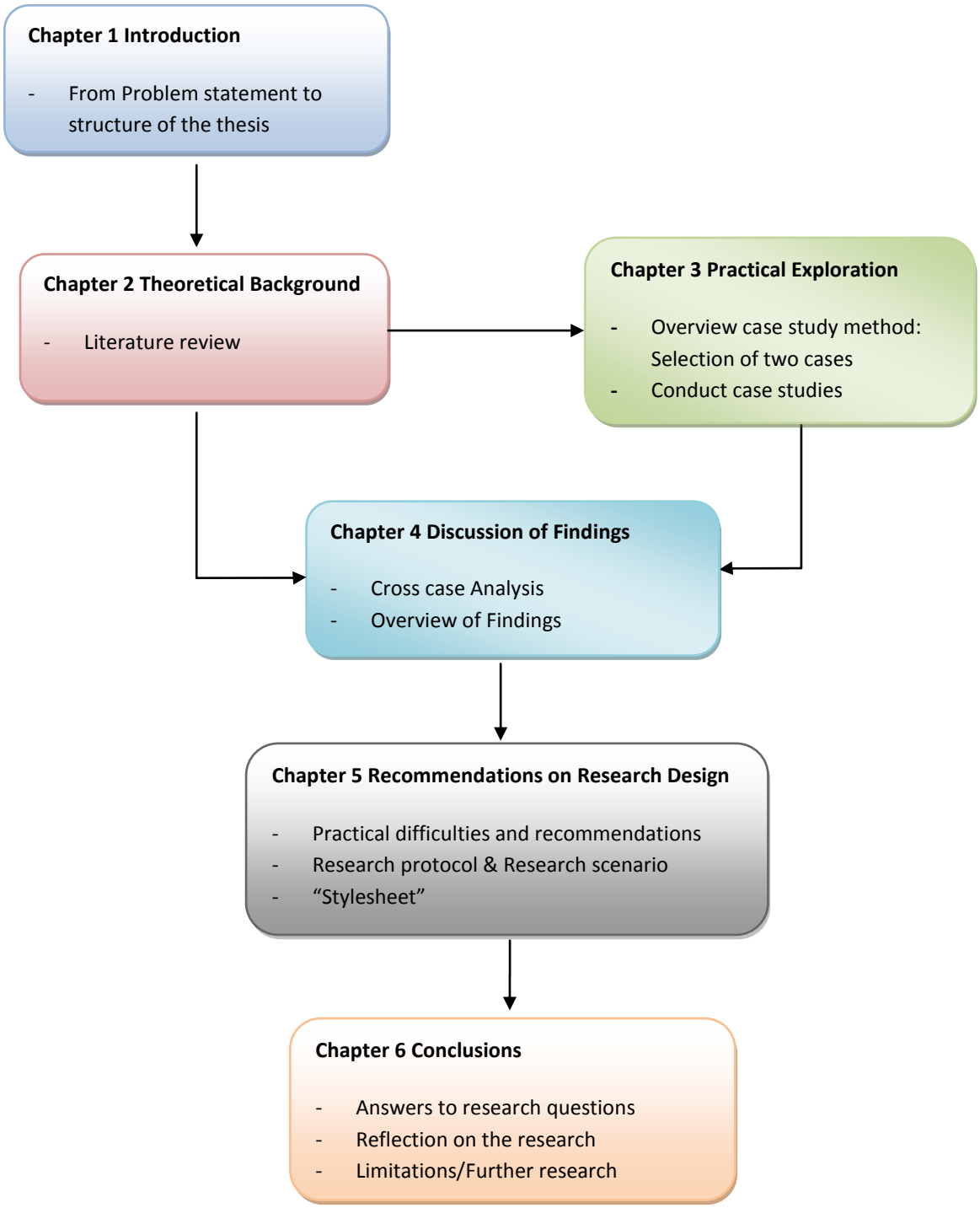

Figure 5: Structure of the thesis

Chapter three provides a practical exploration of the research topic, starting with an overview of the case study method that has been applied for this research. Two cases are then selected and both case studies are conducted: (1) Apple iPod vs. Microsoft Zune; and (2) SACS vs. DVD-A. The first case study detailed about the technology standards battle between two specific configurations of MP3 players, namely Apple iPod and Microsoft Zune, whereas the second case study detailed the technology standards battle between the audio formats Super Audio CD (SACD) from Sony and DVD Audio (DVD-A) from the DVD Forum for dominance in the Hi-fi digital audio market. Both cases are about high tech firms with their networks of inter-organizational relationships, which are engaged in

technology standards battles with competitors during the technological life cycle of a high tech product category. Each case study includes a brief background, a case description, followed by an in-depth analysis and validity check and finally a concluding section.

In *Chapter four* a cross case analysis has been conducted and based on the theoretical views or hypotheses from existing literature studies (presented in Chapter two) and the practical evidence from case analysis (presented in Chapter three), the main research outcomes are discussed. This chapter also hints towards practical issues that challenged the researcher during this research and possibly influenced the research outcomes, which are further elaborated in the next chapter.

Chapter five elaborates on the practical issues and provides recommendations to overcome each of these issues. Based on the recommendations and previous research methodologies, a new research design has been determined and proposed. First, a research protocol has been developed and based on the research protocol a research scenario has been proposed for future researchers. Also, a "stylesheet", comprising of all recommended steps about how to do this research, has been generated as well.

Chapter six, the concluding chapter, provides the answers to the research question based on everything that have been discussed in previous sections; a reflection on the (results of the) research by the researcher, and finally some limitations and important implications for further research.

2. THEORETICAL BACKGROUND

This chapter provides a theoretical exploration of the core concepts of the research, supported by theoretical arguments from prior research. The chapter begins with a review on the concept of network position, followed by a review on respectively the strategic behaviour and firm performance. The next section summarizes researched relationships between the concepts from existing literature. The chapter finally ends with an overall conclusion.

2.1 NETWORK POSITION

Before delving into the concept of network position, first some definitions of the context in which the research takes place, which is a network of interfirm relationships, is needed. Other terms like alliance portfolio, alliance networks are used synonymously for networks throughout the thesis.

A network is defined as a number of actors with different goals, interests and resources who depend on each other for the realization of their goals (Bruijn & ten Heuvelhof, 2008). Networks can be intra- and inter-organizational, which means that not only the internal structure of a firm may have the characteristics of a network, but firms can also be a part of an external network. Firms with different capabilities needed for the development of a new technology or for penetrating a new market usually form strategic alliances to pool their resources in order to collectively develop the product or market faster or less costly. Strategic alliances are voluntary agreements between firms for cooperation in order to improve their competitiveness and performance through exchange and sharing of resources and to develop and commercialize innovative products, technologies or services (Gulati, 1998; Ireland *et al.*, 2002; Schilling, 2008). Firms with similar capabilities may also collaborate on development projects to share costs and risks of the project or to speed up market development and penetration (Schilling, 2008).

Gulati (1998) argued that a firm's *alliance portfolio* and its network position in an industry can have a strong impact on its overall performance. An *alliance portfolio,* also termed an 'egocentric network' can be defined as a firm's set of direct ties (Ozcan & Eisenhardt, 2009). The term alliance portfolio is apt for this research, since the alliance portfolio refers to the alliance network considered from the perspective of the focal firm, which means that the focus is on all the alliances that the observed firm has (Hoffmann, 2007). According to Ozcan & Eisenhardt (2009), networks do not simply evolve by themselves, but because of the fact that firms adjust their alliance portfolios, which changes the networks in which they operate.

According to Hoffmann (2007) a firm establishes alliances based on three factors: (1) its attractiveness to other firms, due to its own resource endowment; (2) former inter-organizational relationships; and (3) on its position within the inter-organizational network. Powell *et al.* (1996) defined network position as the structural position of a focal firm within its network. This structural position can be either central or peripheral, based on the total number and diversity of network ties. In his paper, Hallen (2008) argues that a firm acquires an initial network position once it has formed its first direct ties. The formations of all the future network ties that follow are influenced by this

initial network position of the firm. In their research Rowley and Baum (2008) examined how firms' partner choices affect their network positions, improving or worsening them over time. In prior researches, the main focus of research on partner selection was on firms' partner strategies, but according to the network strategy perspective firms tend to partner strategically to gain network-based advantages like embeddedness and bridging positions, which lead to better firm performance.

As stated before in Chapter 1, only particular aspects of network position are considered in this research. These aspects have been considered based on the available cases and information included in those cases. The next sub sections provide a brief scientific background of these aspects of network positions.

2.1.1 ALLIANCE DEGREE AND STRUCTURAL HOLES

In a research conducted by Venkatraman *et al.* (2008), two frequently examined network characteristics in the network perspectives of strategy have been presented, namely *alliance degree* and *structural holes*.

Alliance degree is an important network positional characteristic, since it refers to the degree of direct and indirect network ties as well as the attractiveness of the focal firm to link with many firms within a business ecosystem. A firm's total number of network ties reflects its strategic intent to form relationships with the right set of partners and to create a network position that can provide competitive advantages. Through the alliance degree, the firm has access to the complementary resources from the network, in order to increase its performance.

Structural holes are gaps between firms that are not connected; hence they are gaps in resource flows like information and products. Burt (1992) introduced the theory of structural holes and showed that firms occupy network positions that allow bridging of structural holes in order to attain advantage from resource access, information and control. This can be explained as follows. According to Burt a structural hole is the link that bridges two networks that would be unconnected without that link. A firm occupying a position on this structural hole might benefit from its position, since it can control the two networks that are connected by the structural hole. The firm might for example accumulate social capital from structural holes. Zaheer & Bell (2005) share this view by proposing that firms enhance their performance by bridging structural holes. Firms with a network position, which they defined as "access to structural holes", can positively influence their performance by enhanced efficiency, increased access to information and resources, and a better maintenance of possible threats and opportunities.

2.1.2 NETWORK SIZE, DIVERSITY AND STRUCTURE

In their research paper, den Hartigh *et al.* (2009) identified and discussed three important network characteristics, namely 'network size', 'network diversity' and 'network structure'.

- The *network size* is assessed by the total number of actors in the network, whereas the network diversity is determined by the type of actors involved in the network.
- The *network structure* can be assessed by the *generic structure* and *density of the network* and the *presence of structural holes*. The *generic structure* of the network refers to the way the actors are located in the network. One type of network structure is the core-periphery structure, which is a structure where actors are located in either the core or the periphery of

the network. The actors located in the core of the network are closely connected to each other and to all other actors in the network, whereas actors located in the periphery of the network are only closely connected to some actors in the core of the network, but not to each other.

- *Network density* refers to the number of connections between actors within the network. *Structural holes* are already mentioned before. In their paper, den Hartigh *et al.* (2009) summarized findings from several empirical studies on these network characteristics during the technological life cycle and explained how these network characteristics may change over time during the different phases of the technology lifecycle.

Table 2 provides an overview of the network characteristics during the different phases of the technology lifecycle.

Table 2: Overview of Networks characteristics during the Technology Life cycle (Adopted from den Hartigh et al., 2009, pg. 14)

	Innovation I		**Adaptation II**		**Market Stabilization III**
	R&D Buildup (Phase Ia)	**Technological feasibility (Phase Ib)**	**Creating the market (Phase IIa)**	**Decisive battle (Phase IIb)**	**Post dominance (Phase III)**
Network size	*Small; stable*	*Small; slow growing*	*Medium; fast growing*	*Large; still growing*	*Large; first growing, later stable*
Network diversity	*Low, stable diversity;* *Actors for research*	*Low, but growing diversity;* *Actors for development*	*Medium, fast growing diversity;* *Actors for development and production*	*High, growing diversity;* *Actors for production and diffusion*	*High, stable to declining diversity;* *Actors for production and diffusion*
Network structure	*Low density;* *Core-periphery structure;* *Few structural holes*	*Fast growing density;* *Amorphous structure;* *Hardly any structural holes*	*High, stable density;* *(Radical?) change in structure;* *Unknown structural holes*	*High, stable density;* *Hub-spoke structure;* *Many structural holes*	*Declining density;* *Chain structure;* *Many structural holes*

According to a research conducted by Dittrich, Duysters & Man (2007), purposeful changes in the network structure can lead towards strategic change processes within a firm. This means that external relations in a company's alliance network can be instrumental in strategic change processes. The authors also theorized that exploration strategies, aimed at innovating and business

development, and exploitation strategies, aimed at making the most of existing competences, require different network structures.

2.2STRATEGIC BEHAVIOUR

Hambrick and Fredrickson (2001) defined strategy as "the means by which a firm may pursue its goals and objectives". According to Coyne and Subramaniam (1996), strategy can be defined as a handful of decisions that (1) drive or shape most subsequent actions of a firm; (2) are not easily changed once made, and (3) have the greatest impact on whether a firm meets its goals or strategic objectives. This definition is in accordance with the view of Carpenter *et al.* (2009) on strategy. According to Carpenter *et al.* (2009) strategy is all about making choices that provide a firm with some measure of competitive advantage. Figure 6 portrays the central position of strategy in a firm. Strategy is how the firm aims to realize its mission and vision, whereas goals and objectives determine how well the strategy is succeeding.

Figure 6: Central position of Strategy (adopted from Carpenter et al.., 2009, chapter 5)

Mintzberg (1992) distinguishes the "five P's for strategy", namely 'strategy as a plan', 'strategy as a ploy', 'strategy as a pattern', 'strategy as a position' and 'strategy as a perspective':

- Strategy as a ***Plan*** is characterized by the consciously intended actions or guidelines to deal with particular situations.
- Strategy as a ***Ploy*** refers to a specific maneuver intended to outwit competitors.
- Strategy as a ***Pattern*** refers to observed regularities and consistencies in the behaviour of a firm over time. Thus, strategy is a pattern in a stream of actions, a consistency in behaviour, whether or not intended. As shown in figure 7, there is a relation between intended strategies and realized strategies. Intended strategy is in actual fact the desired strategy, and realized strategy is what is actually implemented. The realized strategy is a consequence of deliberate and emerging strategies. Deliberate strategies are the intended strategies that get realized; whereas emergent strategies are realized strategies that were never intended on purpose. Figure 7 also

shows that some of the intended strategies do not get realized (the unrealized strategies), perhaps due to misjudgments about the environment, or changes in either during implementation (Mintzberg, 1978; Mintzberg & Water, 1985).

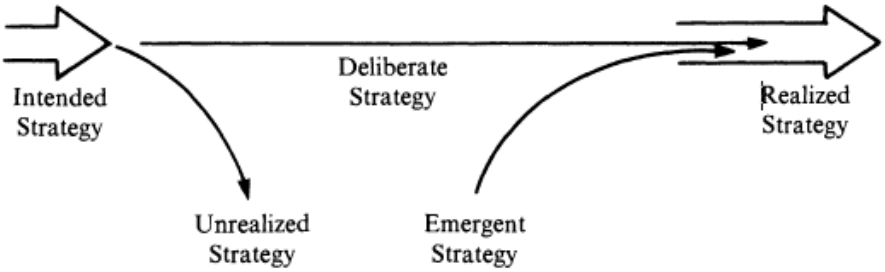

Figure 7: Type of strategies (Adopted from Mintzberg, H., 1978, pg. 945)

- Strategy as a ***Position***, thus as a means of locating or positioning a firm in a competing environment in order to compare the performance of the firm with the performance of its competitors.
- Strategy as a ***Perspective***, shared by members of an organization, through their intentions and / or by their actions.

According to the research objectives of this research, strategy is viewed as a 'pattern of behaviour' and as a 'position in the environment'. After all, the main interest is to gain insight in how to investigate the strategic behaviour of a focal firm, positioned in a competitive networked environment, and also the impact of the firm's behaviour on its network position and performance over time.

In his research, Gulati (1998) developed a social network perspective to the study of strategic alliances and discussed how this perspective provides new insights on important factors that may influence the strategic behaviour and performance of firms. From his point of view, strategic behaviour of firms in alliance networks can be understood by evaluating strategic decisions and choices, such as the decision to enter an alliance, the partnering choices, the choice of structure for the alliance, and the evolutionary trajectory of the alliance over time.

The next sub sections elaborate on the particular aspects of strategic behaviour, which are considered in this research.

2.2.1 PORTER'S GENERIC STRATEGIES

According to Porter (1985) organizations have three basic strategic options available for gaining competitive advantage, irrespective of their industry, products and services, environmental circumstances and resources. These are: c*ost leadership, differentiation* and *focus*. Focus is divided into two variants, cost focus and differentiation focus.

- Cost leadership strategies are aimed at achieving cost leadership by supplying products and services at the lowest possible cost to as many customers as possible.
- Differentiation strategies provide a differentiated set of products and services that is difficult for competitors to replicate.
- Focus strategies involve achieving Cost Leadership or Differentiation within niche markets in ways that are not available to more broadly-focused players.

Porter (1980) further describes that if the company engages in each generic strategy but fails to achieve any of them, the company is then "stuck in the middle." The company that is 'stuck in the middle' has low profitability. The generic strategies are shown in figure 8 below.

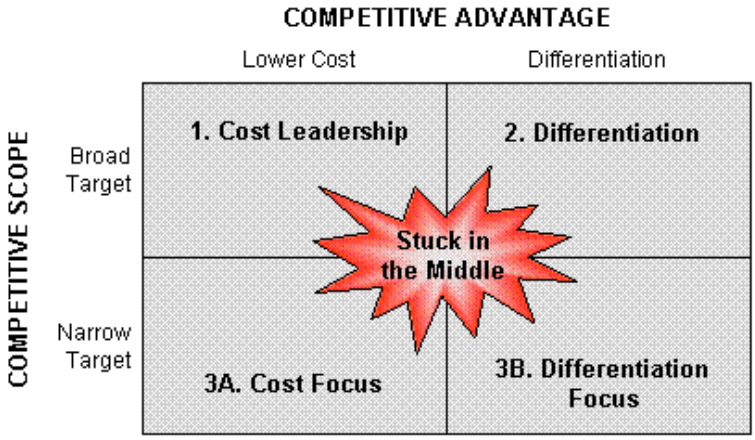

Figure 8: Porter's generic strategies
(Source: http://www.12manage.com/methods_porter_competitive_advantage.html)

2.2.2 ALLIANCE STRATEGIES

Hoffmann (2007) distinguished three alliance strategies, namely *shaping*, *adapting*, and *stabilizing strategy*. Shaping strategy refers to actively shaping the environmental development according to firm strategy; adapting strategy refers to reactively adapting to the changing environmentand stabilizing strategy refers tostabilizing the environment in order to avoid organizational change.

Hoffmann theorizes that the focal firm opts for a particular alliance strategy based on the *shaping potential* of the firm and the *strategic uncertainty* it faces, as illustrated in Figure 9.

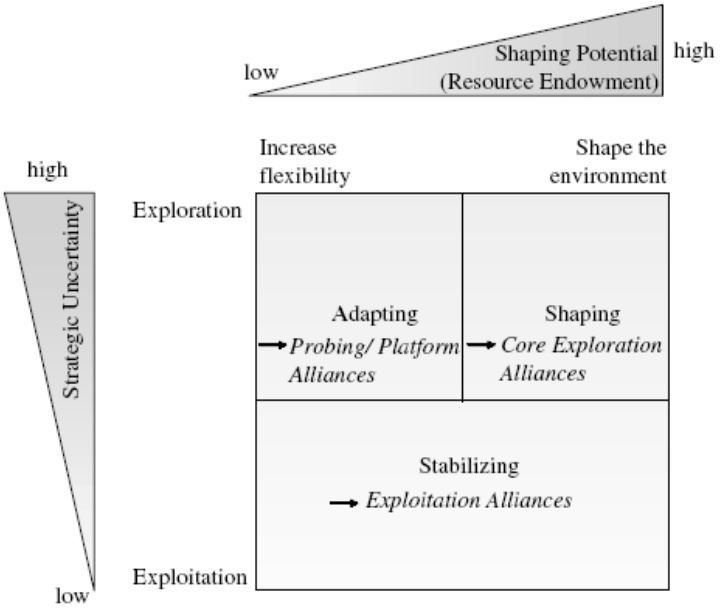

Figure 9: Type of alliance strategies (Adopted from Hoffman 2007, pg. 832)

The *shaping potential* or resource endowment of the focal firm is produced by three types of resources: (1) technical capital, characterizing the firm's technological competence to develop new products or technologies; (2) commercial capital, representing the firm's capability to commercialize the developed products or technologies; and (3) social capital, symbolizing the firm's position within the alliance portfolio and the benefits coming from the relationships with the alliance partners.

In his paper, Gulati (1998) mentioned that a firm with abundant ssocial capital can attract better partners and has access to information about a greater number of alliances. According to the strength of these resources, the focal firm chooses an overall alliance strategy in a particular business. For example, high technological and commercial competence and social capital of the focal firm indicate high shaping potential, which means that the focal firm will prefer to opt for a shaping strategy (Hoffmann, 2007).

Strategic uncertainty is defined by Hoffmann (2007) as the perceived uncertainty resulting from unclear environmental developments (e.g. regulative uncertainty, technological uncertainty, market uncertainty, and competitive uncertainty) in relevant environmental sectors, weighted with the perceived relative importance of the individual sectors. Strategic uncertainty can influence the strategic decisions of the focal firm. For example when there is high strategic uncertainty, the focal firm might opt for exploration strategies through alliances in order to shape the environment according to the firm's business strategy.

Hoffmann further explains that the configuration of alliance portfolio depends on alliance strategies. He distinguished four essential configuration parameters of alliance portfolio:

1. Number of alliances, which determines the total amount (quantity or volume) of information and resources to which the focal firm has access.
2. Dispersion (breadth) of alliances, which determines the spread or diversity of information and resources to which the focal firm has access with its alliances. This means that the focal firm has ties with firms from a variety of industry sectors.
3. Redundancy of alliances, which refers to the overlapping of alliances, which causes that alliances provide the same information and resources to the focal firm. Redundancy is directly influenced by the density of the focal firm's network. The denser the network of the focal firm, the higher the redundancy. Redundancy reduces dependency on partners and increases reliability of information.
4. Linkage strength (intensity) of alliances, which determines the quality of information and resources to which the focal firm has access as well as the flexibility or stability of the position of the focal firm within its network.

In the table 3 below, Hoffmann's theoretical insights on how the type of alliance strategy determines the configuration of the alliance portfolio, has been provided. For example, if the firm's pursues an adapting strategy, the configuration of the alliances portfolio is characterized by a large number of alliances (many), high dispersion, low redundancy and a weak linkage strength, which shows a low stability of alliances.

Table 3: Configuration of alliance portfolio based on type of alliance strategy (Adopted from Hoffmann, 2007: pg. 836)

Configuration parameters of Alliance portfolio	***Adapting Strategy***	***Shaping Strategy***	***Stabilizing Strategy***
Number of alliances	Many	Rather few	Few
Dispersion of alliances	High	Rather low	Low
Redundancy of alliances	Low	Rather high	High
Linkage strength of alliances	Weak	Rather strong	Strong
Stability of alliances	Low	Average	High

2.2.3 BUSINESS ECOSYSTEM STRATEGIES

According to business ecosystems theory (Moore, 1993), alliances are developed over time in an evolutionary way and co-evolving with each other to reach a bigger success.

In their research which introduced a research framework for investigating the relation between network structure, firm strategy, and the pattern of innovation diffusion, den Hartigh& van Asseldonk (2004) defined a business ecosystem as a network of suppliers and customers around a core technology, who depend on each other for their success and survival. According to them, a firm's (business ecosystem) strategy is the strategy the firm chooses with respect to the business ecosystem and distinguished three generic types of business ecosystem strategies, namely a *shaper strategy*, an *adapter strategy (*smart follower strategy) and *reserving the right to play strategy*.

- A firm pursuing a 'shaper strategy' actually tries to develop or maintain its own business ecosystem, with itself and its technology in the core. Within the shaper strategy, the main actors can be identified as either 'keystones' or as 'dominators'. Keystones maximally explore new business opportunities and enable continuous renewal of the ecosystem by practicing system governance. Dominators, on the other hand, maximally exploit the business opportunities by practicing strict management and partner coordination.
- Firms pursuing an 'adapter or smart follower strategy' join the dominant technology by acquiring licenses for developing products based on the dominant technology. This means that these firms focus on developing either complementary to or compatible with the dominant products or technologies. By pursuing such an adapter strategy the firms can still enjoy network effects created by the dominant technology.
- 'Reserving the right to play' is the strategy to wait before entering the market and to keep options open in order to reach a strong position later on (similar to wait-and-see strategy). The actors following this strategy are called late entrants (Schilling, 2008).

In their paper, Coyne and Subramaniam (1996) defined strategy as a handful of decisions that drive or shape a firm's actions. According to them, this handful of decisions also consists of selecting the strategic posture of the firm. They further distinguish three strategic postures which may be adopted by a firm:

1) *Adapting*: Adapting refers to analyzing the external environment and committing to a set of actions that conform to that environment. This posture is adopted by firms who seize known opportunities and respond to known threats.

2) *Shaping*: Shaping refers to attempting to change the external environment for example by altering the basic structure of the industry. When there is high uncertainty about the direction of an industry, bold shaping posture is adopted by a firm.
3) *Reserving the right to play*: This posture refers to doing the minimum required in order to become a strong market player later on.

Iansiti & Levien (2004) uses another classification of strategies based on the type of business ecosystem species: *dominator*, *keystone* and *niche player*. They describe that keystones are the central and well-connected actors in the business ecosystem, which provide the technological platforms to others who depend on this platform; whereas dominators are the actors who affect the diversity of the business ecosystem by eliminating other species. Niche players are actors who contribute to the diversity of the business ecosystem because they are the most numerous ones. Niche players choose the strategy to develop capabilities to differentiate themselves from other firms in the network and try to maintain niche markets for their success and survival. This is called 'niche leveraging' and is an equivalent of the adapter strategy or 'smart follower strategy', mentioned by den Hartigh & van Asseldonk (2004).

2.2.4 STANDARD SUPPORT STRATEGIES

In his framework for factors leading towards standard dominance, van de Kaa (2009) presented a range of strategic factors that are adopted in a market in order to win a standards battle. These factors are firm-level factors based in the institutional economics literature and are termed as 'standard support strategies'. Institutional theorists have proposed that firms can have an impact on the outcome of a standards battle. In particular the strategic behaviour of a firm may increase the possibility for reaching dominance. By pursuing a standard support strategy, a firm can not only promote its own product or technology, but may also prevent the adoption of competing products/technologies. These standard support strategies include: pricing strategy, appropriability strategy, timing of entry, marketing communications, pre-emption of scarce assets, distribution strategy and commitment.

- *Pricing strategy* refers to the strategically pricing of the standard's implementation in order to create market share. Sometimes firms deliberately choose for low pricing in order to make their standard more attractive and to build a huge installed base of users in a short time, which can lead towards achieving standard dominance.
- *Appropriability strategy* refers to the strategic actions undertaken by firms to ensure that their standard is protected from imitation by rivals, for example by using licensing policies. An open appropriability strategy is more likely to lead towards gaining dominance.
- *Timing of entry* refers to the moment at which a firm introduces its standard in the market. A firm can choose to enter the market in an early stage or at a later stage when the market is more mature. In order to introduce its standard in the market, can choose between three main strategies: a *niche market strategy*, *a mass market strategy* and a *wait-and-see strategy* (Ortt, Zegveld and Shah, 2007).
- *Marketing communications* include pre-announcements for the introduction of a new standard into the market or advertising or public relations subjected towards the end-users (customers) at later stages in order to gain market share quickly.

- *Pre-emption of scarce assets* refers to achieving competitive advantage by preempting scarce assets from other players in the market and using this advantage in order to reach dominance. Assets can be manufacturers of the products in which the standards are used.
- *Distribution strategy* refers to the strategy used by a firm to increase the strength of its distribution system in order to speed up the acceptance of the new product or technology.
- *Commitment* refers to the sustained attention and support from all the standard supporters (main actors who support the standard) in order to achieve dominance. Sometimes firms are not fully committed to one standard, because they also commit themselves to other standards at the same time. This can negatively influence the firm's market share position.

2.3FIRM PERFORMANCE

To analyze the firm performance, the relevant performance criteria for the specific focal firm and the specific technology platform have to be defined and measured. According to den Hartigh& van Asseldonk (2004), the generally accepted performance criteria are:

- Technology dominance or standardization, which refers to the relative market share of the technology platform.
- Technological performance, which refers to the quality of the technology.
- Innovation performance: the total number of new products or services introduced and/or the turnover from new products and services.
- Financial performance: turnover and (gross, net) profitability measures and/or Returns on Equity (ROE), Return on Assets (ROA).

For the purpose of the study, the focus is on technology dominance or standardization and financial performance. Technology dominance or standardization refers to the standard dominance achieved by a new technology in the operating market, which is usually marked by a market share of 50% or more (Schilling, 2010).Market share refers to the portion of a product's unit sales in the overall market, compared to those of other alternatives. Winners can be distinguished from losers by the market shares they achieve. Return on total assets (ROA) is calculated by dividing the operating income, i.e., earnings before interest and taxes, by total assets of the firm.

As stated by Gulati (1999), a focal firm's alliance portfolio provides it with access to network resources and potentially enhances its performance. Lavie (2007) showed that the focal firm can enrich its own set of resources or may develop new resources and capabilities by having access to network resources that are possessed by partners in its alliance portfolio. This can enhance the performance of the focal firm.

In his research, Hoffmann (2007) showed that the financial performance (i.e. profitability) of a focal firm's business is positively affected by the quality of the technological and commercial competences and the social capital. Ozcan & Eisenhardt (2009) described that alliance pportfolios with a mixture of strong ties - enabling rich and efficient information and resources exchange -, and weak ties – enabling more flexibility and exploration-, are more likely to improve firm performance. Such portfolios are termed as 'high-performing portfolios'. On the other hand, Powell *et al..*, (1996) showed that portfolios that are centrally embedded within their broader industry network also

provide qualitative information and resources and flexibility benefits that may improve firm performance.

2.4 POSSIBLE RELATIONSHIPS BETWEEN A FIRM'S STRATEGIC BEHAVIOUR, NETWORK POSITION AND PERFORMANCE

Now that the aspects of strategic behaviour, network position and performance of a firm have been investigated by reviewing existing literature, it is time to summarize possible relationships between these concepts from the reviewed literature in this chapter.

Relationship between network position and performance

- Many scholars have investigated how the number of alliances, network density and structural holes influence the firms' new product development, revenue growth, market share, or profitability (Ahuja, 2000; Tsai, 2001; Zaheer and Bell, 2005; Venkatraman *et al.*., 2008).According to Zaheer & Bell (2005) firms may positively influence their performance with increased access to information and resources, and a better maintenance of possible threats and opportunities by bridging structural holes effectively.

Relationship between strategic behaviour and performance

- According to Hoffman (2007) alliance strategies influence firm performance.
- According to van de Kaa (2009) standard support strategies help firms promoting their own technology and preventing the adoption of competing technologies. Standard support strategies can result in gaining market dominance and winning a standards battle.
- In their paper about studying the relation between network structure, firm strategy and the pattern of innovation diffusion, den Hartigh & van Asseldonk (2004) explained that by selecting the right business ecosystem strategy, a firm in a business ecosystem can influence its own performance.

Relationship between strategic behaviour and network position

- Hofmann(2007) showed that the alliance strategy influences the configuration of the alliance portfolio, which is measured by the configuration parameters 'number', 'dispersion', 'redundancy' and 'Linkage intensity' of alliances. The parameters number and dispersion are equivalent to then network characteristics 'size' and 'diversity' and 'redundancy' is related to the characteristic 'density', since redundancy is directly influenced by the density of the focal firm's network.
- According to den Hartigh & van Asseldonk (2004), the business ecosystem strategy may have an impact on the 'network structure'. This network structure can be measured along dimensions like network size, connectivity, concentration and entropy. These dimensions seem to be equivalent to the network characteristics: network size density, diversity and generic structure of the network.

Relationship between strategic behaviour, network position and performance

- With their research model, Venkatraman *et al.* (2008) showed that a firm's performance in not only influenced by environmental characteristics, such as market scope, and firm characteristics, such as product scope, but also by its network position to obtain resources for strategic action. This means that the firm's business strategy interacts with its network position to impact the firm's performance.

All the above mentioned proposed relationships from prior literature will be used further in the next phases of the research to explore whether these relationships can also be obtained from the case studies. From the overview of retrieved possible relationships between the aspects of strategic behaviour, network position and performance, it can be concluded that possible relations of the aspect 'Porter's generic strategies' to other aspects of network position and performance have not been obtained from the literature study. Also, from the preliminary analysis of the two cases that have been selected for this research (Table 22- See Appendix 4), it can be concluded that they do not contain information about Porter's strategies. Hence, Porter's generic strategies will not be considered further in this research.

2.5 CONCLUSION

In this chapter a literature review has been performed to gain better understanding in the core concepts of interest. The core concepts strategic behaviour, network position and firm performance have been explored by reviewing prior literature. Due to the demarcation of the research in section 1.8, only particular aspects of strategic behaviour, network position and performance have been explored. Also possible relationships between these aspects, which have been proposed by previous scholars, have been presented as well. However, after presenting an overview of the proposed relationships between the aspects from prior literature, it seemed that Porter's generic strategies were not relevant for this case study research. Also considered here is the fact that Porter's generic strategies seem to be unidentified from the preliminary analysis of cases selected for this case study research (Table 22). Hence Porter's generic strategies have been left out during data collection and data analysis.

The theoretical views from prior literature regarding the aspects of strategic behaviour, network position and performance of a firm; and the proposed relationships from extant literature will serve as a frame of reference during practical exploration of the research, where the case studies will be conducted, and during the cross case analysis. This means that during the analysis of the cases, only the aspects that have been considered and described in this chapter will be explored The practical exploration of the research is presented in the next chapter and the cross case analysis in chapter four.

3. PRACTICAL EXPLORATION

This chapter provides a practical exploration of the research topic, which includes an in-depth analysis of two selected case studies. The purpose of this chapter is to retrieve empirical findings from these case studies in order to confront them with theories from existing literature on strategic behaviour, network positions and performance (See Chapter two). In the first section of this chapter, an overview of the case study method that has been used for this research has been presented. Both selected case studies are then conducted in the next two sections. The chapter ends with a short overall conclusion.

3.1CASE STUDY METHOD

For the purpose of this research, a case study research method has been followed. The case study research method is defined by researcher Robert Yin as an empirical inquiry that investigates a 'case' (contemporary phenomenon) within its 'real-life' context in-depth; where boundaries between the phenomenon and its context are not clearly evident; and in which multiple sources of evidence are used (Yin, 2003). The case study method is applicable since this research addresses an exploratory question with many variables of interest, namely strategic behaviour, network positions and firm performance.

3.1.1 SELECTION OF CASES

Case studies can be either a single- or multiple-case design. According to Yin (2003) a single-case design is ideal is a researcher wants to study unique or extreme cases; want to confirm or challenge a theory or want to look at cases where the researcher did not have access to before. On the other hand, multiple case studies can be used to either, predict similar results (a "literal replication") or predict contrasting results but for predictable reasons (a "theoretical replication"). Multiple-case designs involve using more than one case to gather data and drawing conclusions from the empirical findings, and may also enhance the validity of a study. In this research, a multiple case design has been chosen and in particular two cases have been selected.

Yin (2003) further described that selecting the case(s) is probably the most critical step in doing case study research. Prior to the selection of the case(s), a formal *case study screening* procedure has to be conducted. Yin also states that the case selection or screening goal is to ensure that after having started the actual case study, the selected case proves to be viable for the intended research.

Screening criteria for selecting the cases

The selection of cases was based on the next criteria to meet the research objective(s):

- *Similarity*: This refers to selecting cases that differ from each other content-wise, but are still comparable in some way. For example the cases should be about high tech firms involved in technology standard battles with their business ecosystems.
- *Preliminary evidence* that the cases comprise of the characteristics that match with the objective of the research. This refers to looking for cases that contain the characteristics or variables of interest – strategic behaviour, network position and firm performance - and will satisfy the purpose of the research and answer the research question.

- *Richness of the available data*. In other words looking for cases that contain sufficient data that can be analyzed in order to get significant outcomes/results from which further propositions/hypotheses can be formulated.

After the selection criteria had been defined, a preliminary investigation/analysis of the available case reports (Table 1) took place. The results from the preliminary analysis have been presented in Tables 19-23, which can be found in the Appendices 1-5 respectively. Finally two cases have been selected based on the extent to which they complied with the selection criteria.

The two cases that have been selected include: (1) the technology standards battle between Apple iPod and Microsoft Zune; and (2) the technology standards battle between the SACD and DVD-A. Both cases are about high tech firms with their networks of inter-organizational relationships, which are engaged in technology standards battles with competitors during the technological life cycle of a high tech product category. Besides, these cases illuminate best with the research question, since they contain sufficient information about the core concepts of interest for this research (strategic behaviour, network positions, and firm performance).

These two cases were conducted by MOT students and submitted in November 2010 as reports for the assignment for the course MOT9592 (Standards Battles, Technology Patterns, and Business Ecosystems) for the MSc programme Management of Technology (MOT) at the Faculty of Technology, Policy and Management (TPM), TU Delft. The objective of the assignment for the course MOT9592 was to study how the networks of stakeholders, supporting competing standards, changes over time during the technology life cycle and how this impacts the dominance of the competing standards. The assignment consisted of three parts: Technology Patterns (TP), Standards battles (SB), and Business Ecosystems (BE). For the TP part, a pattern of development and diffusion for the product/technology in which the standard is implemented had to be found and included definitions, working principle, functionality of the product/technology as well as the hallmarks or dates for the invention, market introduction, large-scale industrial production and sales take-off of the product. For the SB part, a standards battle had to be analyzed and included an extensive literature study to find factors for dominance, a case description to get a historical overview of the standards battle, and a case analysis to be determine if, why and how the (dominant) standard had achieved dominance. And finally for the BE part, the business ecosystem of the standard had to be analyzed over time. Here, based on the technology development time scale, the period and a number of moments in time for which data had to be collected, had to be defined first. Then for each moment in time, the main actors in the business ecosystem, their connections and strategies had to be identified, as well as measuring the performance and analyzing the dynamics of the business ecosystem. Besides three separate reports for each part, one final report had been submitted per student, in which all three parts where well integrated.

3.1.2 SOURCES OF EVIDENCE

Yin (2003) described that a researcher should try to collect enough data in order to have confirmatory evidence, which means evidence from two or more different sources (multiple sources of evidence). He explained that the evidence from multiple cases is often more convincing, and makes the overall study more robust. He further mentioned six major sources of evidence, most commonly used in doing case studies, such as:

- Documents: letters, memoranda, agenda, administrative documents (progress reports, proposals, internal records), and newspaper clippings or articles in newsletters.
- Archival records: service records, organizational records(charts and budgets over time), survey data, personal records(calendars, diaries, telephone listings)
- Interviews: open-ended interviews, but also focused, structured interviews or surveys
- Direct observations: can be formal(ask one to make observations of meetings, factory work, classrooms, etc) or casual (such as a fieldtrip)
- Participant observation: assuming a role within the case study situation and getting an inside view of the events actually by participating.
- Physical artefacts or cultural artefacts: technological devices, tools or instruments

There are three main principles of data collection: (1) *use multiple sources of evid*ence; (2) *create a case study database* and (3) *maintain a chain of evidence* (Yin, 2003).

1. Multiple sources of evidence (i.e. 'data triangulation') add to the validity of a research/study Yin (2003). Therefore, in conducting the case studies for this research, multiple sources of evidence have been used, such as documents and archival records. Besides the reports (of the selected cases), various additional sources like scientific articles/journals, financial reports (of the involved companies) and multiple (reliable) website sources have been used. Also, sources which were mentioned in the reports were validated and re-used again where needed in order to complete the cases for an in depth case description and analysis.

2. A database for the case study has been created and contains:
   - Scientific books/journals/articles on case study approach and case study examples
   - Case study documents: the two reports of the two selected cases (provided by dr. Erik den Hartigh); mails and data sources used for one of the cases (provided by one of the students); financial reports of companies (provided by dr. Erik den Hartigh)
   - Case study notes (with hallmarks, timelines, and other data like sketches, tables) which have been taken manually during the data collection period as well as during case analysis
   - Charts, Graphs, Figures and Tables (collected from reports and also created with computer software like Office & Visio).

3. In order to maintain a chain of evidence, the research question and case study approach have been pointed out and linked. Besides, adequate citing of the case study data base has been conducted throughout the report (through endnotes and reference lists for each case study).

3.1.3 CASE STUDY STRUCTURE

The two case studies have been conducted by analyzing case reports compiled in November 2010 for the course MOT9592 at TU Delft in by the respective students Sandra Treviño Barbosa[1](first case study) and David van der Kleij[2](second case study).

[1] Treviño Barbosa, S.I. (2010). MP3 players: Technology pattern, standards battle and business ecosystem. *Report submitted for the course MOT9592, TPM, TU Delft.*

[2]van der Kleij, D. (2010). DVD Audio versus Super Audio CD: Technology pattern, standards battle and business ecosystem. *Report submitted for the course MOT9592, TPM, TU Delft*.

For the complete case study description and analysis, data from the two reports, to be precise 'text parts' and 'figures', have been used and adopted. The text parts are especially used for the case description. Behind every text part that has been used, proper references to the student(s) are made. Figures that have been adopted from the reports include figures to illustrate: the 'Pattern of development and diffusion' and the 'business ecosystem during certain data moments in time'. However, in the second case study the pattern overview has been generated by the researcher and is not adopted from van der Kleij's report. All the figures that have been adopted contain captions with reference to the reports and the exact page where the figure can be found.
Furthermore, additional data sources have been used to get more information for a more in-depth case description and case analysis. In order to make clear which sources have been used additionally, they have only been placed as footnotes in this chapter and are not included in the complete list of References of this thesis.

Case study structure
At first each case study has been treated as a single case. The case studies have been conducted in separate sections following a similar case structure/procedure. The conclusions from each part are then used as information contributing to the whole research. The case study structure is as follows.

1. *Case description*: Each case study starts with a case description, which includes:
   - A background of the product/technology, which includes definitions of the product/technology, networks and films involved
   - The technology life cycle, which provides an overview of the pattern of development and diffusion of the technology.

2. *Case analysis*: This refers to the within-case analysis, which is divided into two parts:
   - Part 1 includes an analysis of the overall aspects of network positions, strategies, and performance of the firms involved in the standards battle during specific data period(s); and
   - Part 2 contains an analysis based on specifically chosen data moments in time (chosen from the specific data period(s) as mentioned in part 1) in order to find which aspects of network positions, strategic behaviour, and firm performance might have influenced the outcome of the battle. After the case analysis all findings are summarized in a table that has been created by the researcher to present an overview of all aspects that have been found from the case evidence.

3. *Validity check*: The validity check comprises of a horizontal and vertical check of all table entries in order to find out if the analysis has been done correctly and if there are any irregularities.
   - The horizontal check was to analyze the change in aspects of strategic behaviour, network position and performance over time in order to find a certain pattern of evolution of the various aspects.
   - The vertical check was to analyze all the aspects for each data moment in order to find relationships between the various aspects.

4. *Conclusion*: Each case study ends with a concluding section, where all that has been discussed before has been summarized first, followed by some concluding remarks.

3.2 CASE STUDY 1: MP3 PLAYERS

3.2.1 CASE DESCRIPTION

This case study details the technology standards battle for dominance in the portable audio player market between the two specific configurations of portable MP3 players: Apple iPod and Microsoft Zune.

Background

The high tech product category/technology

A MP3 player can be defined as a portable device that enables the end-user to store, organize and reproduce digital audio files. The audio file formats that are supported by MP3 players are: MP3 (MPEG Audio Layer III), WMA (Windows Media Audio), WAV (Waveform Audio), MIDI (Musical Instrument Digital Interface) and AAC (Advanced Audio Coding). There are several configurations of MP3 players varying in storage size, additional functionality, size and price. The main types of MP3 players are: (1) *Flash Memory Players*, which are MP3 players embedded in a USB flash memory with the controls and a simple LCD display in the outside of the USB stick and are used mostly by exercisers; (2) *Hard-drive and mini hard-drive players*; (3) *MP3 CD players and Minidisc MP3 players*, which refers to the MP3 players that are similar to the normal portable CD players, however they are able to reproduce MP3 and other formats of digital audio files; and (4) *Hybrid players*, which refers to the MP3 players that are already included in other consumer electronics such as smartphones, personal digital assistants or DVD players. (Treviño Barbosa, 2010).

This case study is about two specific configurations of MP3 players, namely Apple iPod and Microsoft Zune. Apple iPod can be defined as a portable digital media player developed by Apple Inc. that can be used with both Macs and PCs. Apple introduced several versions of the device, including iPod, iPod mini, iPod Special Edition, iPod photo, and iPod shuffle. Microsoft Zune is a portable digital media player from Microsoft which was launched five years after the iPod's introduction in 2001.

Main actors (promoters of both technologies)

The technology standards battle between the Apple iPod and Microsoft Zune started in 2006, when Microsoft released their first portable MP3 player, Microsoft Zune, as a competitor to the iPod, which had been introduced in November 2001 by Apple. The technology life cycle has been evaluated and all portable MP3 players that were released from invention till market stabilization, including Apple iPod and Microsoft Zune, are mentioned. In the case analysis, however, only this particular technology standards battle has been investigated. The focus is on the business ecosystems around both core technologies iPod and Zune with respectively Apple and Microsoft as the main promoting members. This means that the overall strategies that have been used by Apple and Microsoft during the technology life cycle for the iPod and Zune respectively have been evaluated. Also performance measures for both firms are provided. However, Apple's Business ecosystem has been investigated only and therefore only Apple's network positions within the business ecosystem around its specific core technology (iPod) have been evaluated.

Technology life cycle

Ortt and Schoormans (2004) described the development and diffusion of a product category by a pattern which can be distinguished into three main phases: invention, market introduction (commercialization) and industrial production and large-scale diffusion. Invention is defined as the first demonstration of the working principle of the new high-tech product category. Commercialization refers to the first sales of the product/technology and large-scale industrial production means that in the market adaptation phase products are made-to-order or in very small batches. The large scale industrial production marks the beginning of the market stabilization phase, where diffusion may take off, and the product technology in a specific configuration may become the dominant standard, which means achieving a market share of over 50% (Suarez, 2004). Ortt and Schoormans' (2004) pattern has been applied for the analysis of the development and diffusion of the portable MP3 players.

Invention

In 1989, the MP3 format was invented in Germany. Due to the great success of the MP3 audio files that were distributed over the Internet the first portable MP3 player called MPMan F10, with a storage capacity of only 32 MB, got released by Eiger Labs in March 1998 (Millard, 2005). Thus, the invention of the first portable MP3 player can be traced back to March 1998. The MPMan F10 was also introduced to the market in the same year for $250, which marked the beginning of the *market adaptation phase*.

Market adaptation phase

Shortly after the MPMan F10, Diamond Multimedia released its Rio PMP300, which also had a storage capacity of 32 MB of MP3 files, but became a bigger market success, because it featured a bigger LCD screen which could show the song name and a Smart Media slot for the user to increase the storage capacity (Smith, 2008). In 1999, another MP3 player manufacturer, Creative Labs introduced their first MP3 player called Nomad at a price of $429; the only new feature included in this device was the docking station which helped the user to transfer music from the computer without the use of wires. Remote Solutions launched their Jukebox PJB-100 as the first MP3 player to use internal hard-drive instead of flash memory. This new way for storing the MP3 files using a laptop hard drive permitted this device to store up to 4.8 GB of music equivalent to 1,200 songs. However, the introduction price was around $800, and the device was large and heavy. In 2000, Creative Labs released their second MP3 player, Nomad Jukebox, which featured 6 GB of storage capacity by using the internal hard-drive technology which made it large and heavy compared to the flash-memory MP3 players available in the market. Nevertheless, it was introduced at a price of $500 which was much less than its predecessors using hard-drive or Microdrive technologies, such as I2Go's eGo player, which was priced at $2000. Due to the high price-performance ratio, this device was the most sold MP3 player on Amazon in the year of introduction (Menta, 2004).

In November 2001, Apple introduced their first iPod with 5 GB of storage capacity, equivalent to 1,000 songs. The iPod offered a great technological superiority over its predecessors using a 1.8" hard-drive technology, instead of 2.5", making it smaller and ergonomic. The controls were composed by a scroll-wheel and 4 buttons; the screen was bigger than any other MP3 player in the market and the new FireWire® technology for music transfer permitted to copy 1,000 songs in only 10 minutes. The price was $399. Besides, the device was compatible with Mac OS and it offered the

synchronization capabilities with iTunes, Apple's music management software. iTunes allows the user to organize all the music by artists and albums; it also allows the creation of music playlists which can be synchronized automatically with the iPod when this is connected to the computer. In 2002 Apple released the 2nd generation iPod, the first solid state touch-wheel as control, and compatible with Mac OS and Windows OS. The prices for iPods with 5, 10 and 20 GB storage capacity were $299, $399 and $499 respectively.

Market stabilization phase

In April 2003, Apple launched their iTunes music store which enables users to purchase digital songs for 99 cents (per song), download and add it to their libraries. The iTunes Store sold over one million songs in the first week and by December of the same year they had reached 25 million. The 3rd generation iPod was also launched in 2003 supporting 40 GB and including the new dock connector. In this year the sales of MP3 players in the United States reached 12.5 million, a rise of almost three times compared to 2000, therefore it can be said that the large scale diffusion took off in 2003 and this year also marks the beginning of the *market stabilization phase*. In 2005, Apple released the 5th generation iPod which included color screen and video playback as well as 30 and 60 GB storage capacity. The prices were $299 and $399 respectively. Compared to the 1st and 2nd generation iPod, the price-performance ratio of the 5th generation iPod was very attractive for users.

In 2006, Microsoft released their first portable MP3 player, Microsoft Zune for $249. The Zune included 30 GB of storage, wireless functionality to share multimedia files from one Zune to another and a 3-inch LCD color screen which can work in portrait or landscape mode to visualize images and video. Microsoft Zune also had an online music download service, Zune Marketplace, which charged users 99 cents per song, just like the pricing model of Apple's iTunes Store[3]. The release of Microsoft Zune started the standards battle in the MP3 player market for dominance between Apple iPod and Microsoft Zune. In 2007 Apple released the iPod Touch which features a full color multi-touch screen, Wi-Fi connectivity, available from 8 to 32 GB and offering 22 hours of music playback. This device is fully customizable which means that the user can download innumerable applications from the iTunes Store and synchronize them with iPod Touch including games, e-mail, calendar, calculators, etc. In 2009, Microsoft introduced the Zune HD which features up to 32 GB of storage capacity; 3.3-inch OLED multi-touch screen, reproduced HD video files and uses flash memory as the iPod Touch. Zune HD was technologically superior to the iPod Touch, but could not dethrone iPod from its dominant position.

The pattern of development and diffusion of the MP3 player that has been recognized from the available data has been illustrated in Figure 10. It can be seen that the innovation phase lasted only a few months, the adaptation phase lasted five years and the market stabilization phase started in 2003 and it has not reached its end.

[3]http://www.macworld.com/article/53137/2006/09/zune.html

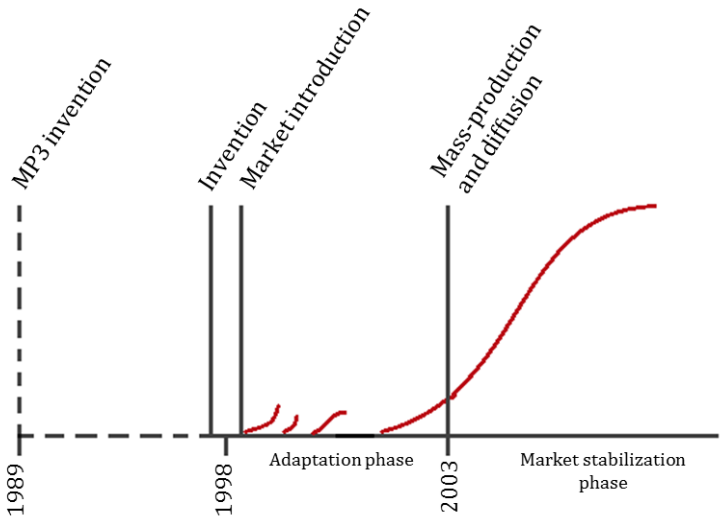

Figure 10: Pattern of development and diffusion of MP3 players (Adopted from Treviño Barbosa, 2010, pg.7)

3.2.2 CASE ANALYSIS – PART 1 OVERALL STRATEGIES, NETWORK POSITIONS AND PERFORMANCE

In the case analysis the overall strategies of the promoters of the iPod and the Zune, respectively Apple and Microsoft, are examined from 2001 till 2007. This is because of the fact that the standard battle between Apple iPod and Microsoft Zune was fought during those years. Moreover performance measures of both product categories in terms of technology standard dominance (or market share) and sales figures have been compared as well. Since the analysis only covered the network positions of Apple during the data period 2001-2007, overall network positions of Apple have been elaborated only.

Network positions of Apple during 2001-2007

In 2001 Apple did not have a big network of actors, and their relationships were strategically formed by Apple's CEO Steve Jobs. Apple created a partnership with PortalPlayer for the design and development of the iPod. Apple also signed deals with Sony, which provided the battery; Wolfson, which provided the codec and Digital-to-Analog converter technologies; Toshiba, which provided the disk drive; Texas Instruments, which provided the Firewire port; and Linear Technology which provided the power management Other important business relation was with Inventec Appliance, an original equipment manufacturer (OEM) located in Taiwan which assembled the iPod. Figure 11a shows Apple's business ecosystem in 2001. Apple is the core firm in red, alliances and partnerships are in blue, and distribution and production partners are in green.

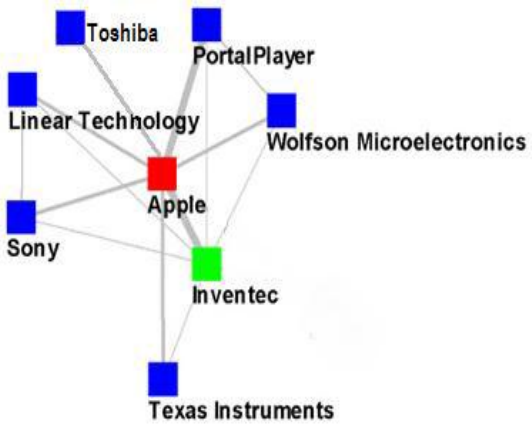

Figure 11a: Apple's Business ecosystem in 2001(Adopted from Treviño Barbosa, 2010, pg. 13)

From 2002 to 2004, an incredible number of accessories for the iPod started to be introduced to the market; and several accessory companies, such as Belkin, Kensington, Logitec, Griffin, Targus and Xtreme Accessories, changed their strategies and products to be compatible with Apple iPod. Apple signed deals with the five major record labels to sell their music catalogs in the iTunes Store around 2003. By 2004 two new industries were added to the iPod network, namely the accessory industry (which are the producers of complementary products for the iPod) and music industry (including record labels). Compared to 2001, the networks size was large and still growing with high diversity, since Apple formed contractual alliances with its supply chain partners (design, production and distribution partners) and with the companies from the music industry; and informal alliances with the companies from the accessory industry. Figure 11b shows Apple's business ecosystem and its connectivity in 2004. Apple is in red, alliances and partnerships are in blue, production partner is in dark purple, the companies from the accessory industry (producers of complementary products) are in pink, signed deals with the music industry (record labels) are in green, and competitors are in yellow.

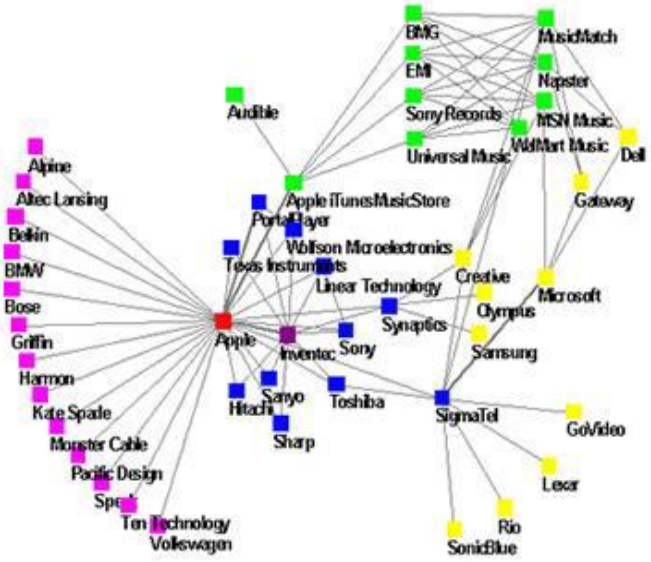

Figure 11b: Apple's Business ecosystem in 2004(Adopted from Treviño Barbosa, 2010, pg. 14)

By 2007 the iPod network had grown immensely. It looked similar to the network in 2004, however large and still growing, since more and more companies joined the business ecosystem. The film industry had also joined the iPod network to sell their movies and TV shows as media content for the iPod through the iTunes Store. Apple also formed a 'coopetive alliance' with Nike.

Strategies

Apple's iPod consisted of various significant components, like the digital-to-analog (DAC) converters and off-shell components, including a Toshiba's drive for storage, which were exclusively made for Apple only. The contracts signed with Toshiba to make the storage drives exclusive for iPod show that Apple achieved *pre-emption of scarce assets*, meaning that those assets could not be bought or used by competitors. Apple preserved their design and manufacturing processes very confidential while signing nondisclosure agreements with its partners, such as Toshiba. Apple also limited interoperability with third-party devices and online music stores for the iPod and iTunes Store. These signs show that the closed *appropriability strategy* also played an important role. Furthermore, Apple entered the market of portable MP3 players when it was already mature enough for mass production and diffusion, this *timing of entry* enabled Apple to take advantage of the high demand while offering an evident technological superiority over the current competitors. By the time Microsoft entered the market, Apple already gained a big installed base and a collection of complementary goods.

Both Apple and Microsoft launched online music stores to provide media content for their MP3 players. The iTunes Store, launched by Apple in 2003, is superior to Microsoft's Zune Marketplace in design, features and implementation, most importantly because of the fact that it has been longer on the market. Besides, there are more than 75,000 applications which can be downloaded to the iPod, including AAA-franchises from well-known game developers, while the Zune Marketplace only offers a handful of add-on programs. Important here is the fact that Apple uses the iTunes Store as a strategy to attract more consumers; they do not make significant profits from content but the service permits the emergence of more complementary goods and increases iPod's network value. From 2004, Apple started to launch different versions and colors of the iPod such as Mini, Shuffle, Nano and Touch.

Apple's *pricing strategy* aimed at maintaining the prices of the different iPod versions close to each other. Moreover, the price difference between the different storage capacities was minor compared to the total price. These strategies were used to attract more consumers and persuade them to buy the iPod with the largest storage capacity, which at the same time also was the most expensive one. Microsoft Zune was introduced much cheaper than the 30 GB iPod, but Apple's installed base was already very large and Microsoft's aims of using pricing strategies to attract consumers were unsuccessful. Furthermore, the iPod prices were cut off just before the Zune HD was released, convincing a great number of people to buy the iPod Touch instead.

Furthermore, the *marketing communications* also accelerated total iPod sales. The iPod has been always marketed as a fashionable product by getting U2, a very famous band, and other artists to promote it. Moreover, the iPod has also been marketed in movies, books and TV shows, since Apple paid to mention the name as a generic term for portable MP3 players. Another marketing strategy was co-branding, which refers to teaming up with other famous brands like Nike. Apple also successfully extended the iPod brand into a large number of products like iPod mini, iPod shuffle, iPod Nano and iPod Touch. These intense marketing strategies made the iPod become popular among all kinds of people and also it produced social effects; for instance, people who owned an iPod were perceived as having more status than others in certain social contexts. Finally, the *distribution strategy* was also important for the success of the iPod, because, at the time Zune came to the market, iPod was already using its Apple store locations all over the world to distribute the iPod, while Zune was only for sale in the U.S.

<u>Performance</u>

Apple's iPod sales were 125,000 units in the first two months after the market introduction in November 2001. In August 2004, Apple reached 82% market share of the hard-drive based music players with their several versions of iPod, after the 64% obtained in the previous year. Creative Labs, was the second in the market with only 3.7% market share. Likewise, Apple entered the market of flash memory based music players in 2005 with the iPod Nano and it obtained 46.3% in only half a year, with SanDisk as second place with only 10.8%. After this, Apple's market share remained above 50% in both hard-drive and flash memory based music players. In 2006, when the first model of Zune was released, Microsoft managed to make an impact in the market and took 10.2% market share. However, Apple was still leading. Apple iPod hit a milestone on April 9, 2007 when the 100 millionth iPod was sold. Despite the innovations and later models of the Zune, its market share dropped to 2% by 2009. By 2010 Apple had sold more than 10 billion songs through the iTunes Store which was launched in 2003; meaning that their average is around 1.4 billion songs per year. In contrast, Zune Marketplace was only available in the U.S. until October 2010 and it only contains around 6 million

songs and a handful of applications; which led to low sales. The performance of Apple's network concerning the MP3 player market is higher to that of Microsoft in market share, complementary goods, number of innovations and reputation. Apple had a better performance in the launching of innovations concerning the iPod, thus every year after 2004 they released new versions of the iPod in order to cover more market segments. Finally, the reputation of iPod as a good MP3 player had been built up from 2001 and it was impossible for Zune to break the entry barriers.

3.2.3 CASE ANALYSIS – PART 2APPLE INC.'S NETWORK POSITIONS, STRATEGIES, AND PERFORMANCE DURING 2001, 2004 & 2007

The case analysis now focuses on investigating the aspects of network position, strategic behaviour (strategies), and performance of Apple during specific data moments chosen from the period 2001-2007. The three data moments are: (1) the year 2001, which refers to the year that saw the introduction of the iPod; (2) the year 2004, when large scale diffusion of iPods took place and when Apple reached 82% of the market share of the hard-drive based music players with their several versions of iPod; and (3) the year 2007, when the battle between Zune (released in November 2006) and iPod was being fought.

Network position of Apple

2001

As mentioned before and seen in figure 11a, Apple did not have a big network of actors in 2001. Apple created a partnership with PortalPlayer for the design and development of the iPod, signed deals with Sony, which provided the battery; Wolfson, which provided the codec and Digital-to-Analog converter technologies; Toshiba, which provided the disk drive; Texas Instruments, which provided the Firewire port; and Linear Technology which provided the power management. OEM Inventec Appliance, located in Taiwan assembled the iPod. About the network structure can be concluded that there is low density and low interconnectivity between the partners. The generic structure is core-periphery, with Apple as the core. All the connections were concentrated around Apple. The networks size is small, there are only few partners. Moreover, there is also low diversity, since Apple had its supply chain partners (design, production and distribution partners) only.

2004

In 2004, Apple had a bigger business ecosystem than in 2001. Two new industries were added to the iPod network, namely the accessory industry and music industry (including record labels). Apple signed deals with the five major record labels to sell their music catalogs in the iTunes Store around 2003.About the network can be concluded that there is high density and high interconnectivity between the partners, especially between the companies within the music industry. The generic structure was somehow difficult to analyze. However, it can be said that the structure was not core-periphery anymore, since the connections were not concentrated around Apple, but more spread. However, Apple was still the main actor. The networks size is large and growing. Moreover, there is high diversity, since Apple formed contractual alliances with its supply chain partners (design, production and distribution partners) and with the companies from the music industry; and informal alliances with the companies from the accessory industry.

2007

The network in 2007 looks similar to that in 2004, however with a higher density and higher interconnectivity between partners. The network size was also large and still growing, since more and more companies joined the business ecosystem. In particular, the film industry joined in order to sell their movies and TV shows as media content for the iPod through the iTunes Store. This brings us to the high diversity aspect. Besides the supply chain partners, music industry partners (record labels), accessory industry partners and film industry partners, Apple also formed a 'coopetive alliance' with Nike. Running shoes from Nike would be wirelessly connected to an iPod, which would then record the running information. Apple created a joint venture with Intel and Micron to secure a great portion of their outcomes on a new flash memory, because they needed this technology for the new iPod models which would be based in flash memory, such as the iPod Touch, which released in 2007. Partners of Apple meanwhile also got more partners or became interconnected, for example the assembling partners in Taiwan increased with Hon Hai Precision Ind. and ASUSTeK Computer along with their old partner Inventec Appliance.

Apple's Strategies as central actor

2001

When Apple introduced the iPod in 2001, several MP3 players were already on the market and the mass production of most of them had started. Apple used a *'wait-and-see' strategy* and introduced the iPod when they were absolutely sure that the digital music industry was having success. Moreover, Apple introduced the iPod in the mass-market, acquiring more sales than the precedent MP3 player producers for niche markets. Besides, the price tag was aimed at €399, which was lower compared to the other MP3 players available at that time. Apple promoted the small size, power, and ease of use of its iPod. Apple CEO Steve Jobs promoted the iPod during its introduction in October 2001 as follows: "With iPod, Apple has invented a whole new category of digital music player that lets you put your entire music collection in your pocket and listen to it wherever you go", and "With iPod, listening to music will never be the same again."

Apple signed an exclusive contract with Toshiba for storage drives in order to pre-empt competitors from getting the same drives. This refers to the standard support strategy *pre-emption of scarce assets*. From the business ecosystems perspective, it can be concluded that Apple used a *shaper strategy* in order to maintain order between the alliances and to extract as much as value from its network. Apple acted as a dominator, Apple acted as a dominator, because they maximally exploited the business opportunities by practicing strict management and partner coordination.

As can be recognized by using Hoffman's theory, Apple used *shaping strategy* and created 'core exploration alliances' with the companies which would help them in the design and development of a new configuration of an already existing technology, such as Toshiba, PortalPlayer, Texas Instruments, Wolfson Microelectronics, Linear Technology and Sony. These alliances were dominated by Apple because they kept all the information about the designs as well as the management of the relationships between the supply-chain partners. This refers to the *appropriability strategy* Apple pursued in order to protect information. The iPods were distributed through Apple stores, as well as through Apple's reseller partners and were also sold online[4].

[4]http://news.cnet.com/2100-1040-275054.html#ixzz1MxV7zccA

2004

In 2004, Apple still used shaper strategy, but this time they worked in increasing these alliances to offer new complementary products for the iPod. Apple now acted as a *keystone* and exercised power indirectly. Apple focused on letting all these new partners in the network as well as let more connections appear between other network partners. A lot of companies joined the business ecosystem without formal contracts or deals, for instance all the accessory producers. Apple also signed contracts with the record labels to start selling their media content in the iTunes Store, which was introduced in 2003 in the U.S market. In June 2004, Apple released the iTunes Music Store in three European markets: France, Germany, and the United Kingdom[5]. Apple introduced the FairPlay technology, which ensures that the music bought through the iTunes Store can only be played in the iPod. The introduction of the iTunes Store and the lack of interoperability with other online music stores and MP3 players were strategies to ensure the market standard' and make it easier to achieve market dominance. The iTunes Store can be seen as the smart distribution strategy used by Apple. Besides, Apple used a smart *pricing strategy* to attract more customers; there were only small margins between the different versions of iPods. Apple maintained the 99cts pricing model (or one-price-fits-all model) for the media content sold through the iTunes Store since it launched it in 2003[6]. Songs were sold for only $0.99 through the iTunes Store, whereas the iPod itself was sold at $399 for example. *Marketing communications* also influenced the fast adoption of iPod, because the iPod was promoted intensely by artists and in movies, TV shows and ads.

2007

From 2004 to 2007, Apple changed to a *stabilizing strategy* to have more control in their business ecosystem and finally achieve market dominance and later become a monopoly. In this phase Apple formed 'exploitation alliances' to extract as much value from the business ecosystem as possible. Apple again used *shaper strategy* and acted as a dominator, especially with the music industry (record labels and studios companies). Since 2006, some record labels had been pushing Apple to change the 99ct pricing model, since they wanted more profits[7]. However, the companies in the music industry were fully controlled by Apple: if they wanted to keep selling their media content in the iTunes Store they should let Apple decide on the prices and conditions. Apple thus exercised strict governance and high authority.

The *marketing strategy* that was used by Apple is co-Branding. Apples teamed up with the high quality brand Nike and introduced the Nike running shoes, which used the iPod and iTunes to play paced music, while tracking the runner's speed and distance. Distribution strategy led towards winning the standards battle from Zune, because the Zune was only available in the U.S, whereas the iPod was distributed by Apple stores all over the world.

<u>Apple's Performance</u>

By the end of 2001, Apple recorded 125.000 sold iPods. According to Businessweek[8], Apple gained a market share of 2.5% in the overall US market for MP3 players with the iPod. In 2004, Apple gained a market share of 82% with the iPod in the market for hard-drive based MP3 players only. Amongst all hard drive-based as well as flash-based MP3 players, Apple gained a market share of 41.9%[9].

[5]http://www.ilounge.com/index.php/articles/comments/instant-expert-a-brief-history-of-ipod/
[6]http://www.technewsworld.com/story/49727.html
[7]http://www.technewsworld.com/story/49727.html
[8]http://www.businessweek.com/technology/content/aug2002/tc20020827_7649.htm
[9]http://www.macobserver.com/tmo/article/iPod_Claims_82_HD-Based_Retail_Market_Share_42_All_Players_UPDATE/

According to Apple's Annual report for the fiscal year 2004, Apple sold a total of 4.4 million iPods in the fiscal year. The net sales of iPods rose US$961 million or 279% during fiscal 2004 compared to 2003[10]. By the end of 2004, approximately 8.2 million iPods have been sold worldwide[11]. In January 2007, Apple gained a market share of 72.7% and reported quarterly revenue of US$7.1 billion, of which 48% from iPod sales. The 100 millionth iPod was sold in April 2007 and on 22 October 2007, Apple reported quarterly revenue of US$6.22 billion, of which 26% came from iPod sales[12].

All the findings obtained from the case study analysis (Part 2) have been placed into Table 4 below. The aspects of strategic behaviour and network position and the financial measures, which have been obtained from the case analysis, are summarized and placed into the table. A table entry with "--"means that the certain aspect could not be obtained from the case study, because it was either missing or difficult to analyze.

Table 4: Overview of data obtained from the analysis of the Apple iPod case

Overview of aspects of strategic behaviour, network position and performance from Case study 1			
Focal firm: Apple Product/technology: iPod	**Data moment in time**		
Aspects	***2001 Market adaptation phase (Creating the market phase)***	***2004 Market stabilization phase (Post dominance phase)***	***2007 Market stabilization phase (Decisive battle phase)***
Aspects of strategic behaviour			
Standard support strategy			
Pricing strategy	The first iPod 5GB storage capacity / 1,000 songs was priced at $399, which was cheaper than current alternatives	Small margins between the different iPod versions/generations to attract more customers; 99cts pricing model for the media content at the iTunes Store	Apple maintained the 99cts pricing model for the media content at the iTunes Store
Appropriability strategy	Apple's nondisclosure agreements for information secrecy	Lack of interoperability with other online music stores and MP3 players	--
Timing of entry	Wait-and-see strategy; mass market	--	--
Marketing Communications	Apple promoted the small size, power, and ease of use of its iPod.	Promotion of iPod by celebrities/artists (e.g. U2) and in movies, TV shows and ads	co-Branding (teaming up with Nike)
Pre-emption of scarce assets	Exclusive contract with Toshiba for storage drives	--	--
Distribution strategy	Distribution of iPod by Apple stores and Apple's reseller partners (retailers) and also online	Apple authorized and unauthorized retailers; iTunes Music Store service expanded to Europe.	Distribution of iPod by Apple stores and retailers all over the world and also online.
Commitment	--	--	--
Hoffmann's alliance strategy			
Shaping strategy	Apple formed 'core exploration alliances'	Again exploration strategies: Apple increased alliances in	--

[10]http://www.macobserver.com/tmo/article/Apple_Annual_Report_iPod_Strong_Education_Sales_a_Major_Concern_UPDATED/
[11]http://www.macworld.com/article/53499/2006/10/ipodtimeline.html
[12]http://en.wikipedia.org/wiki/IPod

Overview of aspects of strategic behaviour, network position and performance from Case study 1			
Focal firm: Apple Product/technology: iPod	**Data moment in time**		
Aspects	***2001 Market adaptation phase (Creating the market phase)***	***2004 Market stabilization phase (Post dominance phase)***	***2007 Market stabilization phase (Decisive battle phase)***
		order to offer new complementary products of the iPod.	
Adapting strategy	--	--	--
Stabilizing strategy	--	--	Apple formed 'exploitation alliances' to extract as much value as possible from the business ecosystem
Business ecosystems strategy			
Shaper strategy – *dominator*	Apple formed alliances with companies for the design and development of the iPod in order to maintain order between the alliances and to extract value from the network.	--	Apple acted as a dominator: record labels and studios companies were fully controlled by Apple: if they wanted to keep selling their content in the iTunes Store they should let Apple decide on the prices and conditions.
Shaper strategy – *keystone*	--	Apple let new partners join the network without formal deals, and let more connections appear between other network partners. Apple exercised power indirectly.	--
Adapting strategy	--	--	--
Reserving the right to play	--	--	--
Aspects of Network position			
Size	Small; stable	Large; growing	Large; still growing
Diversity	Low; stable	High; fast growing	High; still growing
Generic structure	Core-periphery; Apple: core	--	--
Density	Low density; Low interconnectivity	High density; High interconnectivity	Higher density; Higher interconnectivity
Presence of structural holes	--	--	--
Alliance degree	--	--	--
Aspects of Firm Performance			
Market share	2.5%; 125.000 units sold	82% (hard-drive); 41.9%(overall); 4.4 million units sold (Fiscal Year 2004); 8.2 million units sold (end of 2004)	72.7% (Jan 2007)
Financial performance	--	Exact value missing (Net sales of iPods rose US$961 million compared to 2003)	US$ 1.6 billion (26% of US$6.22 billion)

3.2.4 VALIDITY CHECK

In order to ensure if the analysis is based on correct and useful data and to find out if there are any irregularities; all the entries in table 4 above have been validated through a horizontal and a vertical validity check. The horizontal check refers to the process of validating the table entries per row. In other words, looking at the how the aspects of strategic behaviour, network positions and firm performance evolved over time in order to find a certain pattern of evolution. On the other hand, vertical check refers to the process of validating all table entries of each column; in this case this refers to looking at all the aspects of strategic behaviour, network position and firm performance found per year in order to find relationships between the various aspects.

Horizontal check

For the horizontal check of data entries of table 4, it is important to recall that the year 2001 indicates the year when Apple iPod was introduced into the market and which started the market adaptation phase; year 2004 refers to the year belonging to the market stabilization phase, when large scale diffusion of iPods took place and when Apple reached dominance with 82% of the market share of the hard-drive based music players; and 2007 refers to the year when the battle between Microsoft Zune and Apple iPod was being fought. Conclusions from the horizontal check are as follows:

Aspects of strategic behaviour:

Standard support strategies:

- Pricing strategy played a role during all three stages. In 2001, the iPod was launched and to compete with the existing alternatives Apple introduced it at a lower price. Then in 2004, Apple maintained the prices of the different iPod versions close to each other, which attracted more consumers and persuaded them to buy the iPod with the largest storage capacity, which was also the most expensive one. This not only resulted in a larger customer base, but also in high revenues from record number of units sold during that year. Another pricing strategy was the 99cts pricing model that Apple maintained since the introduction of the iTunes Store. This can be recognized as the 'razor blade model', where songs could be seen as the cheap 'blades' and the iPod itself as the expensive 'razor'. In fact Apple decided for the media content providers that songs should be sold for only $0.99 through the iTunes Store, whereas the iPod itself was sold at $399. In 2007, Apple still maintained this 99cts pricing strategy for the media content at iTunes Store. Thus from the horizontal check it can be said that the strategy of Apple did not change from 2004 to 2007, which is really strange since a standards battle was started since Microsoft Zune got released in 2006. Microsoft Zune (30GB storage capacity) was introduced at a price of $249, whereas the 30 GB iPod was priced at $299 then. Also the online download services of both products used the same pricing model of 99cts per song. However, Apple's installed base was already very large and Microsoft's aims of using pricing strategies to attract consumers were unsuccessful. Therefore it can be concluded that pricing strategy in 2007(which is also when the decisive battle took place) did not play a significant role in this battle.
- Appropriability strategy in 2001 refers to Apple's strategic decision/action to preserve their design and manufacturing processes very confidential, while signing nondisclosure agreements with its partners. In the next stage, in 2004, Apple also limited interoperability with third-party devices and online music stores for the iPod and iTunes Store. In the last stage, 2007, no new

data has been found about any appropriability strategy pursued by Apple. From the horizontal check the conclusion can be drawn that Apple used a closed appropriability strategy during 2001 and 2004

- Timing of entry strategy refers to the moment at which Apple introduced its standard into the market. Apple chose to enter the market for portable MP3 players at a later stage, when the market was already mature enough for mass production and diffusion. Apple took advantage of the high demand for cheaper, smaller and easy to use players and offered technological superiority over the current competitors at that time. By the time Microsoft entered the market, Apple had already gained a big installed base and a collection of complementary goods. So Apple's wait-and-see strategy worked well, as well as the strategy to introduce the iPod to the mass market. The horizontal check reflects that timing of entry strategy has only been pursued by Apple in 2001 and not in 2004 and 2007, which is correct.
- Marketing strategies have been applied during all three data moments. In the year of introduction Apple promoted the small size, power, and ease of use of its iPod. In 2004, Apple got the iPod intensively promoted by celebrities and artists (e.g. by offering Special Edition iPods with signature of the U2 Band) and in movies, TV shows and commercials. In 2007, besides the promotion of iPod through artists, movies, TV shows and ads, another marketing strategy played an important role, which was co-Branding, which refers to teaming up with other high quality famous brands like Nike to offer a specific product, the Nike running shoes. From this horizontal check it can be concluded that it is completely correct and logical that Apple used marketing strategies during the various stages of the technology life cycle(in this case 2001, 2004, 2007) in order to create awareness about its product and gain market share quickly till reaching dominance.
- Just like appropriability strategy, the pre-emption of scarce assets strategy is also pursued in 2001 only, which is correct because 2001 was the introduction year of the iPod. Apple signed an exclusive contract with Toshiba to get storage drives from Toshiba for the development of the iPod and thereby pre-empted rivals from using the same storage drives for their products.
- Distribution strategies have been used during 2001, 2004 and 2007. In 2001, Apple distributed the iPod online, through Apple Store and also through retailers of Apple products (Apple retailers). In 2004, besides the distribution through retailers and Apple stores and online providers), the smart distribution strategy of Apple to extend the Apple iTunes Store to Europe accelerated downloads of media content as well as purchases of iPods. What made the iPod win the battle from Zune was the distribution strategy in 2007 to provide the iPod worldwide through Apple Stores and (online) retailers all over the world, while the Zune could be purchased in the U.S. only. The horizontal check validates that distribution strategy played an important role during all three data moments and especially in 2007, the phase where the decisive battle took place.

Hoffmann's alliance strategies:

- In 2001 and 2004, Apple opted for a shaping strategy and then chose a stabilizing strategy in 2007. In 2001, there was strategic uncertainty (Hoffmann, 2007), therefore Apple opted for exploration strategies through alliances and formed 'core exploration alliances' in order to design and develop the iPod (shaping strategy). The alliances were dominated by Apple and had to keep all the information about the designs as well as the management of the relationships between the supply-chain partners only. In 2004, Apple still maintained the shaping strategy, but focused on increasing alliances in order to offer new complementary products of the iPod, such as

accessories(from accessory industry) and media content(from record labels and music studios). However, in 2007 the strategy changed from shaping to stabilizing, since Apple opted for creating 'core exploitation alliances' to stabilize the environment in order to avoid organizational change and to extract as much value as possible from the iPod business ecosystem.

Business ecosystem strategies:

- During all three data moments Apple opted for the shaper strategy in order to maintain order between the alliances and to extract as much as value from its network; however Apple's behaviour (as either dominator or keystone) changed over time. In 2001, Apple acted as a dominator, because they maximally exploited the business opportunities by practicing strict management and partner coordination. In 2004, Apple acted as a keystone by putting itself and its technology in the core and allowing (1) new partners to join the business ecosystem without formal deals, and (2) more connections to appear between other network partners. In 2007, Apple again acted as a dominator by completely dominating record labels and studios companies by stating that if they wanted to keep selling their content in the iTunes Store they should let Apple decide on the prices and conditions.

Aspects of network position: The table entries have been compared with the entries from table 3: 'Overview of Networks characteristics during the Technology Life cycle' by den Hartigh *et al.* (2010).

- Size: In 2001 the network size was *small and stable*, which according to table 3 is applicable to the 'R&D build up' phase (innovation phase). However, in this case the year 2001 belongs to the 'creating the market' phase and the correct size should be 'medium and growing'. Year 2004 can be recognized as belonging to the market stabilization phase, where Apple iPod reached dominance, when using to the definition of dominance by Suarez (2004). The correct size should be 'large, first growing, later stable', but the evidence from the case analysis showed a network size of *'large; growing'*. The differences for 2001 and 2004 are not that divergent and can be explained by thinking of what has been perceived by the author during the case analysis as 'small', 'medium' or 'large' and 'stable' or 'growing'. Also, in this case it can be seen that Apple's network had really grown quickly from 2001 to 2004, because two industries joined and many companies within all the involved industries joined as well. Therefore stating that the size is large and growing can be seen as logical and correct. The resulted size in 2007 from the case analysis matches the size from the theoretical evidence for the 'decisive battle' phase. The correct size should be just like in 2004 'large, first growing, later stable'. However, since the battle was being fought in 2007, it can be concluded that the 'decisive battle' phase took place in the market stabilization phase and not in the market adaptation phase.
- For Diversity and Density the same pattern can be seen: the data for year 2001 matches with data for 'R&D build up' phase from table 3, whereas data for 2007 matches with data for 'Decisive battle' phase. For 2004 the theoretical evidence suggests that there should be a 'declining' trend; however that was not found from the evidence from the case analysis. Even here it can be concluded that perception might have influenced the results from the case analysis. Moreover, when looking at the evolution over time, diversity and density went from 'low' in 2001 to 'high' in 2004 to 'higher' in 2007, which seems to be a logical trajectory when recalling what the data moments imply.
- Evolution over time of the 'generic structure' also shows irregularities. Evidence from case analysis does not match with evidence from theoretical evidence.

- It was quite difficult to analyze the 'presence of structural holes' and 'alliance degree' for each data moment, so the analysis of these characteristics over time could not take place as well.

Aspects of firm performance:

- Market share rose from 2.5% in 2001, to 82% in 2004 and during the decisive battle in 2007 iPod got a market share of 72.7%. From the horizontal check it can be concluded that when first introduced in 2001, it is obvious that Apple iPod was only able to get a market share of 2.5%. In the market stabilization phase (2004), iPod reached peak market share of 82%, because of the large scale diffusion during that time. When eventually the Zune got released in 2006, the decisive battle phase started and Zune was able to take away part of the market share from iPod. However Apple iPod remained the leader in 2007 with a market share of 72.7%.
- Financial performance measures were only found for 2007 and therefore the horizontal check could not validate if the analysis has been performed correctly. The only conclusion that can be drawn is that nothing can be said about how the firm (Apple) performed *financially over time from 2001 to 2004* with respect to the iPod since exact figures were missing. For 2007, however it is known that Apple got 26% of its total revenue alone from selling iPods, which equals to US$ 1.6 billion.

Overall conclusions from the horizontal check:

In this case study the most important standard support strategies that were applied during all three years were pricing strategy, marketing communications and distribution strategy. Apple further pursued shaping strategy in 2001 as alliance strategy and followed that for 2004 as well, but changed to stabilizing strategy in 2007. As business ecosystem strategy, Apple used shaper strategy during all three data moments, but showed the ability to change its strategy and role combination from shaper-dominator in 2001, to shaper-keystone in 2004, to shaper-dominator again in 2007, which also contributed to the success of the iPod. Aspects of network positions showed irregularities in the sense that they did not completely match with the characteristics described by den Hartigh *et al.*'s (2009) and presented in table 3. It was quite difficult to analyze the 'presence of structural holes' and 'alliance degree' for each data moment, so the analysis of these characteristics over time was not conducted. Since the battle between Apple iPod and Microsoft Zune was being fought in 2007, it can be concluded that the 'decisive battle' phase took place in the market stabilization phase and not in the market adaptation phase. Market share went from 2.5% in 2001, to 82% in 2004 to 72.7% in 2007. Nothing can be said about how Apple performed financially over time from 2001 to 2007 with respect to the iPod since exact figures for the year 2001 and 2004 were missing.

Vertical check

For the vertical check each column of Table 4 has been observed, which means that per data moment (2001, 2004, 2007) all aspects of strategic behaviour, network position and performance are reviewed. Again, it is important to recall that in 2001 and 2004 respectively the commercialization and large scale diffusion of the iPod took place and that the battle between Zune and iPod was being fought in 2007.

2001:

Aspects of strategic behaviour:

- The year 2001 indicates the launch of Apple iPod and as can be seen from the table strategies that were pursued by Apple were: all standard support strategies, except commitment; shaping strategy; shaper strategy (dominator). It is quite logical that in order to commercialize a product, the standard support strategies played an important role in gaining market share. In this case the combination of appropriability strategy, preemption of scarce assets, and timing of entry, distribution strategy and marketing strategy resulted in gaining market share quickly. Also prior to the commercialization of a firm, the firm must have opted for exploration strategies in order to form alliances for the development and design of its product. Therefore the conclusion can be drawn that it is correct that shaping/shaper strategy has been pursued by Apple.
- In this case it can be concluded that the shaping and shaper strategy are alike, since the strategic action of the firm is to shape the environment according to its business strategy. However, there are some irregularities. The evidence from the case analysis showed that Apple opted for a shaper strategy; however Apple pursued a 'wait-and-see' strategy before entering the market (see 'timing of entry'). According to den Hartigh& van Asseldonk (2004), 'wait-and-see strategy' is equivalent to the business ecosystem strategy 'reserving the right to play'. This means that for 2001 it can be concluded that the pursued strategies by Apple: timing of entry and shaper strategy, are inconsistent.

Aspects of network positions:

- Vertical check of the network characteristics size, diversity, density showed that all the characteristics in 2001 belong to the 'R&D build up' phase within the innovation phase. However, it can be reasoned that 2001 is the whole year and not exactly the time from where the iPod was released (November 2001), and therefore the network might have been observed from the beginning of the year 2001 and thus matched the characteristics for the 'R&D build up' phase.
- No data has been found for the 'presence of structural holes' and 'alliance degree'.

Aspects of firm performance:

- For 2001, the performance is only measured in terms of market share. By the end of 2001, Apple was able to gain an overall market share of 2.5% in the overall US market for MP3 players with its iPod; 125.000 iPods were sold.
- There is no data about the financial performance of Apple (in terms of revenues/profits) in 2001 resulting from the net sales of iPods.

2004:

Aspects of strategic behaviour:

- In 2004 the most important standard support strategies were pricing strategy, appropriability strategy, distribution strategy and marketing communications. Appropriability, pricing and distribution strategy especially refer to the iTunes Store. This pattern is correct, since large scale diffusion of iPod took place in 2004 and those strategies are of importance to gain market share. What was also important was the shaper strategy of Apple and especially to exercise the role of a keystone in the business ecosystem. For this year it can also be concluded that shaper strategy and shaping strategy are alike.

Aspects of network positions:

- In 2004 large scale diffusion of iPod took place, which means that Apple iPod was in the market stabilization phase. All the network characteristics found from the case analysis deviate from the theory.

Aspects of firm performance:

- In 2004, Apple gained a market share of 82% with the iPod in the market for hard-drive based MP3 players and a market share of 41.9% for hard drive-based as well as flash-based MP3 players. Apple sold a total of 4.4 million iPods in that year alone. By the end of 2004, a total of approximately 8.2 million iPods have been sold worldwide.
- About the financial performance can be said that the net sales of iPods rose US$961 million or 279% during fiscal 2004 compared to 2003, but the exact value of the total net sales could not be found or measured.

2007:

Aspects of strategic behaviour:

- In 2007 pricing strategy, marketing communications and distribution strategy of Apple were important, of which distribution strategy resulted in beating Microsoft Zune, since iPods could be purchased worldwide and Zunes only in the US.
- When comparing the alliance strategy and business ecosystem that have been pursued by Apple, the following irregularity has been found for year 2007. Apple opted for a shaper strategy and acted again as dominator (business ecosystem strategy) by forcing media content providers (record labels and studios companies) to comply with prices and conditions set by Apple. However, by using Hoffmann's theory it had been concluded that Apple opted for a stabilizing strategy as alliance strategy and created 'exploitation alliances' with the media content providers to extract as much value from the business ecosystem as possible. Since shaper strategy is not the same as stabilizing strategy, it can be concluded that business ecosystem strategies and alliance strategies are not alike.

Aspects of network positions:

- 2007 also belongs to the market stabilization phase, but data for the network characteristics size, diversity and density from case analysis in table 4 matched with data from theory (table 3) for the 'decisive battle' phase. Since the decisive battle took place in 2007, the results can be considered as correct. Nevertheless, data for the generic structure is also deviant.

Aspects of firm performance:

- As can be seen in the table, Apple gained a market share of 72.7% in 2007. However, this is the figure for January 2007. Other market share figures for 2007 have not been found. Nevertheless, it can be said that iPod had lost 10% of market share to Zune, but throughout 2007 it remained the leading product.
- Financial performance of Apple coming from iPod sales has been measured for 2007, since Apple reported quarterly revenue of US$6.22 billion on 22 October 2007, of which 26% came from iPod sales.

Overall conclusions from the vertical check:

For 2001 it can be concluded that appropriability strategy, preemption of scarce assets, and timing of entry, distribution strategy and marketing strategy resulted in gaining market share quickly. The shaping and shaper strategy are alike, since the strategic action of the firm is to shape the environment according to its business strategy. The pursued strategies by Apple timing of entry and shaper strategy are inconsistent. Furthermore, the network characteristics size, diversity, density in 2001 matched with the characteristics for 'R&D build up' phase within the innovation phase. The 'generic structure' also showed irregularities. No data has been found for the 'presence of structural holes' and 'alliance degree'. As for the aspects of firm performance, it can be concluded that for 2001 the performance is only measured in terms of market share.

For 2004 it can be concluded that the standard support strategies pricing strategy, appropriability strategy, distribution strategy and marketing communications were of importance for gaining market share. Apple pursued a shaper strategy and exercised the role of a keystone in the business ecosystem. For this year it can also be concluded that shaper strategy and shaping strategy are alike. As can be seen from the evidence from the case analysis, strategies and aspects of network positions are somehow related. Apple's network grew quickly from 2001 to 2004, because two industries joined and many companies within all the involved industries joined as well. This happened due to the behaviour of Apple as a keystone within the business ecosystem, since Apple allowed numerous companies to join the network. Furthermore strategies and performance are also related: due to the pricing strategy, appropriability strategy, distribution strategy and marketing communications pursued during 2004, Apple was able to gain a market share of 82%.

For 2007 the following conclusions can be drawn. From the most important standard support strategies pricing strategy, marketing communications and distribution strategy, the smart distribution strategy of Apple of making the iPod available worldwide, resulted in beating Microsoft Zune, which could only be purchased in the US. Business ecosystem strategies and alliance strategies are not alike, since Apple pursued shaper strategy but also stabilizing strategy in 2007, which are not comparable to each other. Both aspects of performance, market share and financial performance have been found.

An overview of the overall findings from the horizontal and vertical validity check is provided in Table 5 below.

Table 5: Overview of the findings from the Validity check of the Apple iPod case analysis

Validity Check of the Apple iPod case analysis			
Horizontal Check	**Vertical check**		
	2001 (market adaptation phase)	**2004 (market stabilization phase)**	**2007 (market stabilization phase)**
• The most important standard support strategies over time were pricing strategy, marketing communications, and distribution strategy.	• Appropriability strategy, pre-emption of scarce assets, timing of entry, distribution strategy and marketing communications resulted in gaining market share quickly.	• Pricing strategy, appropriability strategy, distribution strategy and marketing communications caused the peak market share in 2004.	• Pricing strategy, marketing communications and distribution strategy were pursued by Apple, of which the smart distribution strategy resulted in beating Microsoft Zune.
	• Appropriability strategy, pre-emption of scarce assets, timing of entry and distribution strategy influenced network characteristics size, diversity and density.	• Appropriability strategy, distribution strategy and marketing communications influenced network characteristics size, diversity, and density.	• Distributions strategy and marketing communications influenced the network characteristics size, diversity and density.
• As alliance strategy, Apple pursued shaping strategy in 2001 and 2004, but changed to a stabilizing strategy in 2007.	• Apple formed 'core exploration alliances' in order to design and develop the iPod (shaping strategy).	• Apple maintained shaping strategy, but focused on increasing alliances to offer new complementary products of the iPod.	• Apple formed 'core exploitation alliances' to extract as much value as possible from the business ecosystem.
	• Shaping and shaper strategy are alike.	• Shaping and shaper strategy are alike.	• Shaper strategy and stabilizing strategy are not alike.
	• Timing of entry and shaper strategy are inconsistent.		
• Apple's business ecosystem strategy within the business ecosystem did not change over time; the role changed from dominator in 2001 to keystone in 2004 to dominator again in 2007.	• Apple's shaper-dominator strategy influenced its network position in the business ecosystem.	• Apple's shaper-keystone strategy resulted in an increase of network size, diversity and density.	
• Network characteristics size, diversity, density and generic structure from the case analysis did not completely match with the network characteristics from den Hartigh *et al.*'s (2009) theory.	• The network characteristics size, diversity, density in 2001 matched with the characteristics for 'R&D build up' phase, instead of with those for 'creating the market' phase.	• All the network characteristics deviate from the theory.	• The network characteristics size and density actually matched with the characteristics for the 'decisive battle' phase according to the theory.

Validity Check of the Apple iPod case analysis			
Horizontal Check	**Vertical check**		
	2001 (market adaptation phase)	**2004 (market stabilization phase)**	**2007 (market stabilization phase)**
• No results have been found for the 'presence of structural holes' and 'alliance degree'. • The battle between Apple iPod and Microsoft Zune started in the market stabilization phase, therefore the year 2007 belongs to the 'the decisive battle' phase.			• The year 2007 might be considered as belonging to the 'decisive battle' phase.
• Market share went from 2.5% in 2001, to 82% in 2004 to 72.7% in 2007. • Financial performance could not be measured, due to lack of available data for the years 2001 and 2004.	• Market share is the performance indicator and was 2.5%.	• Market share of 82%.	• Market share of 72.7%. • Financial performance 26% of US$6.22 billion came from iPod sales.

3.2.5 CONCLUSION

This case study detailed about the technology standards battle between two specific configurations of MP3 players, namely Apple iPod and Microsoft Zune. Apple iPod is portable digital media player developed by Apple Inc. and several versions of the device are available, such as the iPod classic, iPod mini, iPod Special Edition, iPod photo, and iPod shuffle. Microsoft Zune is a portable digital media player from Microsoft, which was launched five years after the iPod's introduction in 2001.

After reviewing the overall strategies and performance measures of both product categories/technologies during 2001-2007., the focus went on Apple Inc. as focal firm and its core technology, Apple iPod. For that case analysis three specific data moments in time were chosen, namely 2001, 2004 and 2007.

The year 2001 indicates the launch of Apple iPod, year 2004 refers to the year when large scale diffusion of iPods took place and when Apple reached 82% of the market share of the hard-drive based music players; and in 2007 the battle between Zune and iPod was being fought. All findings from the case analysis were tabulated in table 4, after which a horizontal and vertical validity check took place. The results from the validity check are presented in table 5.

Concluding remarks on this case study are as follows.

- Strategies and performance seem to be related. Firstly, because pricing strategy, appropriability strategy, distribution strategy and marketing communications pursued in 2004 led towards the peak market share of 82%. Secondly in 2007 distribution strategy was the significant strategy that made Apple iPod the clear winner of the technology standards battle between Apple iPod and Microsoft Zune.

- Strategies and network position also seem to be somehow related to each other. Appropriability strategy, pre-emption of scare assets, timing of entry and distribution strategy pursued in 2001 by Apple resulted in the specific network size, density and diversity. In 2004, appropriability strategy, distribution strategy and marketing communications influenced the size, diversity, and density of the network. And finally in 2007, distribution strategy and marketing communications also influenced the network size, diversity and density. For example Apple teamed up with Nike to produce the 'running shoes' and also the distribution network had grown immensely, since iPods were distributed worldwide.

- Although they were comparable in 2001 and 2004, business ecosystem strategies and alliance strategies were not alike in 2007. Therefore, we are inclined to consider that perhaps business ecosystem strategies and alliance strategies have to be treated as two separate dimensions of strategies.

- Apple's pursued exploration strategies (shaping strategy) as alliance strategy in 2001 and 2004. These alliance strategies seemed to influence the size, diversity, density of the network during those years. This means that there might be a possible link between alliance strategies and the network characteristics size, diversity and density.

- Apple acted as a main actor during every data moment in time, but used different business ecosystem strategies to manage its iPod network. It changed its role from dominator in 2001 to keystone in 2004 to dominator again in 2007. Based on the type of strategy and behaviour (role) of Apple, the network characteristics also changed. Therefore one may be inclined to conclude that business ecosystem strategies and aspects of network positions are possibly related.

- While the initial idea was use market share and financial performance as indicators for aspects of performance, the findings of this case analysis showed market share being the only performance indicator. Data about the financial performance could only be found for the year 2007. Since measures for 2001 and 2004 were not available, it has not been possible to observe how the financial performance evolved over time.

3.3 CASE STUDY 2: SACD VS. DVD-A

3.3.1 CASE DESCRIPTION

This case study detailed the technology standards battle between the audio formats Super Audio CD (SACD) from Sony and DVD Audio (DVD-A) from the DVD Forum for dominance in the Hi-fi digital audio market.

Background

The high tech product category/technology

Super Audio CD (SACD) is defined as an optical music carrier high-resolution, developed by Sony and Philips to provide improved sound quality, in the form of higher fidelity multi-channel (surround) sound, and backward compatibility with CD as well[13]. DVD Audio (DVD-A) is defined as a high-fidelity audio storage medium with varying numbers of channels, sampling frequencies, word lengths and other features such as video elements, designed by the DVD Forum for improved sound quality, while maintaining backward compatibility with the CD format[14]. Where the CD format offers 16 bit resolution at a sampling frequency of 44.1 kHz (44100 samples per second), the SACD and DVD-A format both offer high resolution audio. According to the AES high resolution audio technical committee, every carrier which offers more than two channels (each 44.1 or 48 kHz) and resolution corresponding to 16 bit can be defined as high resolution (Reefman and Nuijten, 2001). The SACD audio format stores 1-bit words at a sampling frequency of 64 times 44.1 kHz and is based on the sound recording and reproduction technology called Direct Stream Digital (DSD). Therefore it is also known as the Bitstream or DSD format. The DSD's simplified signal path, in combination with its ultra-high sampling rate, results in a better reproduction of the original source material. Furthermore, it can hold much more digital information than a regular CD (Reefman and Nuijten, 2001). SACDs can have a studio-mixed, high-resolution stereo / surround signal, with a maximum of six independent channels. There are three types of SACDs: single layer disc, dual layer disc and hybrid disc. The single layer disc contains a high resolution layer which offers high definition audio. The dual layer disc contains two high resolution layers, which provide more audio storage capacity. A customized player, a SACD player, is needed to play the single and dual layer discs in order to obtain high resolution audio. Nevertheless, there are also hybrid discs which are playable on the standard CD players, but with a quality similar to the normal CD audio. These hybrid discs have one high definition audio layer and one standard Red Book CD-compatible layer, which make them backwards compatible with the standard digital CD players[15] [16]. On the other hand, the DVD-A format covers a wide variety of sampling rates (44.1/48 to 176/192 kHz) and word lengths (16-24 bit) and is based on the same technology that was used to create the CD and the DVD-Video, the Pulse Code Modulation (PCM) digital audio technology, but improved. The greater storage capacity and high sampling rates offer high quality audio experience to the customers. Compared to the CD, DVD-A discs can hold up seven times more information, because of the use of the Meridian Lossless Packing (MLP) system. In

[13] Geutskens, Y. (2009). SA-CD FAQ. Retrieved on April 10, 2011; Available at: http://sa-cd.net/faq#general1

[14] Shapiro, L. (2001). Surround Sound: The High-End: SACD and DVD-Audio. Retrieved on April 10, 2011; Available at: http://www.extremetech.com/article2/0,2845,1180143,00.asp

[15] http://www.crutchfield.com/S-7C1sdQ79q8y/learn/learningcenter/home/cd_dvdsacd.html

[16] Elen, R.(2001). Battle of the Discs. Retrieved on April 10, 2011; Available at: http://www.ambisonic.net/sacdvdada.html

order to obtain the high resolution audio from a DVD-A disc, a special player – DVD-A player- is needed. Most DVD-A discs may have added video and graphics content and can be played on the standard DVD players. This feature indicates the backwards compatibility of the DVD-A discs with the conventional DVD players[17] [18].

Main actors (promoters of both technologies)

Sony and Philips, who had previously cooperated together for the invention of the conventional CD, jointly invented the SACD format in 1998. Sony group is the overall umbrella under which all Sony activities belong to. Under the Sony Group is the Sony Corporation, which is the electronically business unit. This is further segmented in eight categories: Consumer products and devices (CPD), network products and services (NPS), B2B & Disc manufacturing (B2B & disc), pictures, music and Sony Ericsson. Another company of relevance is the Sony Music Entertainment, a record company of the Sony group and which is a wholly owned subsidiary of the Sony Corporation (van der Kleij, 2010).

The DVD-A format is developed by the DVD Forum, an international association established in 1995 and consisting of hardware manufacturers, software firms, content providers and other users of Digital Versatile Discs (DVD).The DVD Forum is responsible for setting the new standards in agreement with all members of the executive body of the DVD Forum, the Steering committee. The companies within the DVD Forum were forced to cooperate with each other in order to get support from the ICT industry. Seen the internet revolution, it was significant for the companies to have support of the ICT industry. This resulted in an uneasy alliance were several companies had to cooperate to establish one standard. Sony and Philips are also part of the DVD forum[19].

The battle between SACD and DVD-A started from mid 2000, with the official launch of the DVD-A format. SACD was already introduced in 1999. The technology life cycle dimension, followed by the analysis of this particular standards battle, will focus on the business ecosystems around both core technologies SACD and DVD-A with respectively Sony and the DVD Forum as the main promoting members. This means that the strategies that have been used by Sony and by the DVD Forum to promote the SACD and DVD-A respectively; and the network positions of these main actors within the business ecosystem around the specific core technologies and their performance will be evaluated in the next sections.

Technology life cycle

Ortt and Schoormans' (2004) pattern has been applied for the analysis of the development and diffusion of SACD and DVD-A. However, in order to trace back all those hallmarks in the pattern of development and diffusion of the high tech product category/technology, a clear definition of the high tech product category/technology is necessary. Therefore the following definition has been proposed: "Both SACD and DVD-A are high-resolution audio formats based on different technologies and intended to succeed the Compact Disc (CD) by offering better sound quality". Based on this definition the hallmarks will be traced back by not only considering the SACDs and DVD-A discs and titles, but also the hardware products like SACD player and DVD-A player.

Invention

[17] http://www.crutchfield.com/S-7C1sdQ79q8y/learn/learningcenter/home/cd_dvdsacd.html
[18] Elen, R.(2001). Battle of the Discs. Retrieved on April 10, 2011; Available at: http://www.ambisonic.net/sacdvdada.html
[19] About DVD Forum; Avalaiable at: http://www.dvdforum.org/about-mission.htm

The SACD format was jointly developed by Sony and Philips, but it is still unclear what exactly is invented by which of the two firms. However, Sony owns the trademarks and Philips is the licensor of the disc format and the trademark[20]. In order to overcome the limitations of the Compact Disc (CD), Sony and Phillips started R&D practices in 1991 to look for a new generation audio format that could replace the CD (Janssen en Reefman, 2003). In April 1998, Sony released version 0.9 of the SACD Specification[21], which can be seen as the first specification of the product category and therefore marks the invention of the SACD format. The final version was introduced in March 1999 (Konstantinides, 2003).

On the other hand, the DVD-A Specification was developed by the Working Group 4 (WG-4) of the DVD Forum with additional input from the music industry. They received 15 key requirements from the international music industry, represented by the International Steering Committee (ISC) (Konstantinides, 2003). A draft standard of the DVD-A format was released in January 1998, followed by version 0.9 in July 1998. The final DVD-Audio 1.0 specification got released in March 1999, after getting approval in February 1999[22]. This version however lacked the copy protection feature.
By using the proposed definition of the product category, the first release of a high quality audio disc specification can be considered as the invention. Since SACD was the first released high quality audio format, the invention date of the SACD, April 1998, is considered as the invention hallmark.

Market adaptation phase
In May 1999, Sony presented several innovations of the SACD, like the hybrid disc recording techniques, at the AES (Audio Engineering Society) convention. At this convention, the increased audio quality is demonstrated for the first time to the public (Janssen en Reefman, 2003). In addition, Sony released the first SACD player in Japan with a price tag of $5,000 in the same month[23]. Both events marked the market introduction of the SACD and the start of the market adaptation phase. At the end of 1999, the SACD player was distributed in limited quantities in the USA. Moreover, studios such as DMP, Mobile Fidelity Labs, Pioneer, Sony, and Telarc released about 40 SACD titles at the end of the same year[24]. The first SACD players and SACD discs were stereo-only. Since the first SACD players were quite expensive, the SACD technology attracted mainly audiophiles only. The prices of the SACD players were varying from as cheap as $1,500 to a price range of $3,500-$5,000. In the spring of 2000, Sony and Philips introduced multi-channel audio as an enhancement to the SACD format. Multi-channel SACD recordings were released, along with the first multi-channel SACD players.[25].

On the other hand, release of the first DVD-A discs was scheduled to October 1999, due to a delay in selection of copy protection features like encryption and watermarking, and facing difficulties from the Secure Digital Music Initiative (SDMI). This scheduled release was even more delayed until mid 2000, due to technical concerns like deficiencies in production facilities and hardware, but also lack of support from music labels. Nonetheless, Pioneer released the first DVD-Audio player (without

[20] Geutskens, Y. (2009). SA-CD FAQ. Retrieved on April 10, 2011; Available at: http://sa-cd.net/faq#general1
[21] Taylor, J. What about DVD-Audio or Music DVD? Retrieved on April 10, 2011; Available at:http://dvddemystified.com/dvdfaq.html#1.12
[22] Idem to 16.
[23] Idem to 17.
[24] http://geekscomputer.blogspot.com/2011/01/what-about-dvd-audio-or-music-dvds.html
[25] http://www.timefordvd.com/tutorial/SACDOverview.shtml

copy protection support) in Japan at the end of 1999, with SACD support included, which means that the DVD-A player could play both types of discs (SACD and DVD-A)[26]. The DVD-A format was finally launched in the summer of 2000. Since the launch, only a handful of DVD-Audio titles were released by record labels. Silverline / 5.1 Entertainment was the first record label that released DVD-Audio titles[27]. The eventual release of the DVD-A format in 2000 marked the beginning of the technology standards battle between both audio formats SACD and DVD-A.

Market stabilization phase

According to Ortt and Schoormans (2004), the market stabilization phase refers to the phase where large scale industrial production and diffusion (sales take off) of the product takes place, but also when the product becomes a standard.

The date of large sale industrial production can be set around the beginning of 2000, when the SACD titles were being released. By the end of 2001, the total number of SACD titles surpassed 500. To roll out SACD into the mass market, Philips and Crest Digital partnered in May 2002 and jointly developed and installed a SACD hybrid disc production line in the USA, with a production capacity of 3 million discs per year[28]. As of June 2002, over 650 SACD music titles, including nearly over multi-channel SACD music titles, were available worldwide[29], as more music companies joined the SACD network, including, EMI, Virgin, UMG and Zomba, as well as other smaller audiophile labels such as Telarc, DMP, and Chesky[30].

In January 2003, Sony Digital Audio Disc Corporation (DADC) announced a major investment in SACD replication facilities at its European headquarters in Salzburg, Austria, with a production capacity of 500.000 discs monthly. At that time, more than 2.5 million SACD players had already been purchased by households worldwide and over 1,000 SACD titles were already published[31], most of which appeared to be high profile hybrid SACD titles from Pink Floyd, the Rolling Stones and Bob Dylan[32]. For that year the SACD sales were tracked and showed that 1.3 million SACD discs had been sold during 2003. This means that the sales of SACD products can be considered to have taken off from somewhere between 2002 and 2003, more specifically around May/June 2002, when a total of 650 titles had been published already.

In July 2000, Matsushita (under the Panasonic and Technics labels) first released full-fledged DVD-A players in July 2000 for $700 to $1200. From fall 2000 to early 2001, many companies like Pioneer, JVC, Yamaha, and others released DVD-Audio players. Around 50 DVD-A titles were available by the end of 2000 and almost 200 by the end of 2001[33]. Furthermore, DVD-A unit shipments in 2001 reached 0.3 Million copies and $6 Million in dollar value[34]. From the previous data it can be concluded that the large scale industrial production of DVD-A can be traced back to fall 2000, when more and more DVD-A players and titles started to release.

According to the RIAA 2003 Unit Shipment report, 0.4 million DVD-A discs were sold in 2003, which was similar to a 0.8% rise in DVD-A unit shipments and a 5.3% decline in the dollar value of units

[26] http://dvddemystified.com/dvdfaq.html#1.12
[27] http://www.timefordvd.com/tutorial/DVD-AudioTutorial.shtml
[28] http://www.newscenter.philips.com/main/standard/about/news/press/archive/2002/article-2217.wpd
[29] http://www.timefordvd.com/tutorial/SACDOverview.shtml
[30] http://www.practical-home-theater-guide.com/sacd-music.html
[31] http://www.sa-cd.net/shownews.php?news=6
[32] http://www.tfproject.org/tfp/tilted-technology/54370-sacd-dvd-sales.html#ixzz1J4vaJOBu
[33] http://dvddemystified.com/dvdfaq.html#1.12
[34] http://www.wiredstate.com/forum/viewtopic.php?f=65&t=3073&start=20

compared to the previous year. According to a RIAA 2003 consumer phone survey over 2,900 consumers across the United States, 2.7 % of the consumers purchased music in DVD-A format[35], which showed that in 2003 DVD-A was the second favorite audio format after the most favorite CD audio format. From these facts, it can be assumed that the sales of DVD-A products, just like SACD, also took off between 2002 and 2003.

Both technologies made an important step in 2005. The standardization of Direct Stream Transfer in ISO/IEC 14496-3:2001/Amd 6:2005 in 2005 opens the possibility of SACD markets to grow in the future. Other than that DVD-A also make an important step in 2005 to overcome the copy protection issues by the invention of supporting tools which allow data to be decrypted or converted to 6 channel .wav files directly without have to go through digital to analog conversion phase (Achman, Cikili, van Leeuwen and Warnar, 2010). As of 2005, a total of almost 3000 SACD titles have been offered by nearly 250 record labels. As for DVD-A, more than 110 labels offered DVD-A titles by 2005. The total number of DVD-A titles offered had been determined as half of the total number of SACD titles that year[36].

In May 2006, more than 13 million SACD compatible players were in circulation worldwide. During that time Sony announced the introduction of the new Unified Cutting Master Format (UCMF), which is developed by Sony and Phillips, and would not only simplify and speed up the production of SACDs, but also significantly decrease costs associated with the mastering process. The development of the UCMF is another indication of Sony's strong on-going commitment to SACD[37]. According to Sony, the total estimated cumulative quantity of SACD hardware (SACD players and PlayStation 3) delivered to market is around 20 million as for June 2007. More precisely, close to 200 different models from 43 manufactures are available in the market[38].

Since 2009, Sony Records no longer released new SACD titles, but the format had the support of various record labels[39]. As of August 2009, 443 labels have released one or more SACDs[40]. Until October 2009 more than 6,000 SACD titles had been released, of which 50% appeared to be classical music[41]. Despite relatively wide consumer availability to SACD players, however, high definition audio formats continued to attract few major record labels. SACD at the moment has about 7,021 titles[42] available.

In this standards battle, neither SACD nor DVD-A were able to achieve market dominance. Instead, SACD and DVD-A got their own niche markets, consisting of audiophiles who enjoy high quality audio. A main reason is the internet revolution which took off in 2000 and resulted in the availability of (lower quality) MP3 and downloadable music (from the Internet) at a lower price. The mass market had decided to choose lower quality music over the higher quality SACD and DVD-A.

[35]http://www.wiredstate.com/forum/viewtopic.php?f=65&t=3073&start=20
[36]http://www.stereophile.com/asweseeit/305awsi/index.html
[37]Super Audio CD Software Production Moves Into Network Age.[May 2006]. Avaiable at:http://www.sa-cd.net/shownews/41
[38]SA-CD.net, *FAQ.*Retrieved on April 12, 2011. Available at: http://sa-cd.net/faq#playback13
[39]Guttenberg, S. (2009).Betamax to Blu-ray: Sony format winners, losers. Retrieved on April 10, 2011. Available at: http://news.cnet.com/8301-13645_3-10204536-47.html
[40]SA-CD.net, *FAQ.*Retrieved on April 12, 2011. Available at: http://sa-cd.net/faq#playback13
[41]http://en.wikipedia.org/wiki/Super_Audio_CD
[42] SA-CD.net, *Titles*. Retrieved on April 12, 2011. Available at: http://www.sa-cd.net/titles

Based on the analysis of the development and diffusion of SACD and DVD-A, the pattern that has been identified is illustrated in figure 12 below.

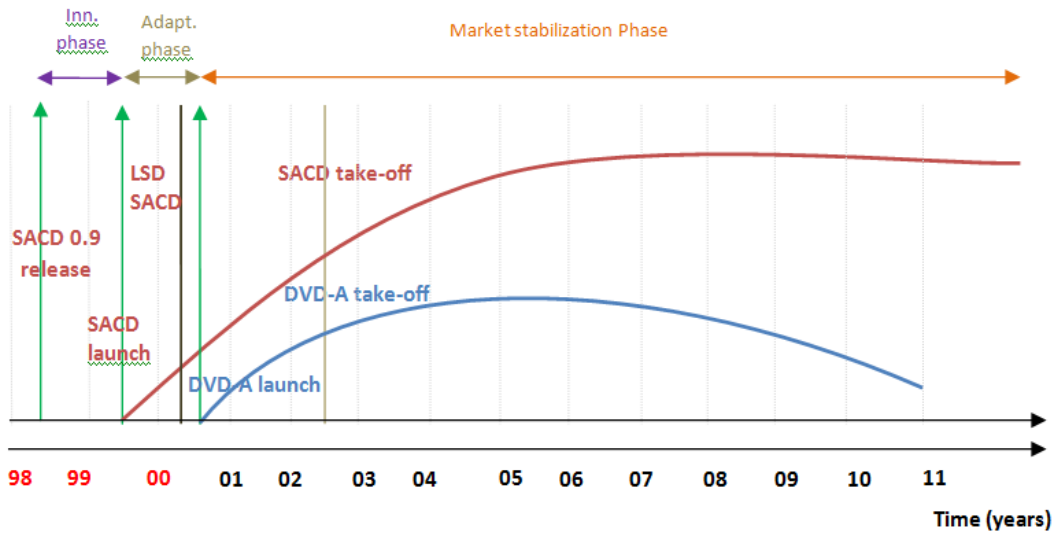

Figure 12: Pattern overview SACD and DVD-A (Source: author)

3.3.2 CASE ANALYSIS – PART 1 OVERALL STRATEGIES, NETWORK POSITIONS AND PERFORMANCE

In the case analysis the network positions of Sony and DVD Forum within the business ecosystems around both core technologies are explored for two data periods, namely 1998-2000 and 2003-2006. The first data period is chosen, because that period refers to the innovation phase and market adaptation phase, from invention in 1998 till large scale diffusion of the SACD in 2000 and commercialization of the DVD-A format in mid 2000 (See Figure 12). The second period 2003 - 2005 refers to the market stabilization phase, where the standards battle between SACD and DVD-A took place. The year 2003 was one year after sales of both SACD and DVD-A took off and 2006 witnessed the still ongoing support of Sony for SACD with the introduction of UMCF.
Furthermore, the overall strategies of the promoters of both SACD and DVD-A format, respectively Sony and DVD Forum, are examined. Moreover performance measures of both formats in terms of technology standard dominance (or market share) and sales figures are given.

Network positions

As mentioned, the network positions of Sony and DVD Forum within the business ecosystems around both core technologies are explored for two data periods, namely 1998-2000 and 2003-2006.

SACD

First data moment: 1998-2000

As mentioned before, Sony and Phillips already cooperated for development of the CD and continued their cooperation for the development of the SACD. They spent almost seven years of development of the SACD and their relationship can be recognized as a strong R&D tie. Small recording companies were given the opportunity to produce SACD discs. Dawn Frank, an experienced SACD production

engineer established 'Super Audio Productions' (SAP) in 2000, which focuses its core business on the blend of SACD related services, including DSD recording, DSD conversion, re-modulation, editing and mastering services. This relationship is thus pure of licensing nature[43].

In the period between 1998 and 2000, Sony was the central firm within the SACD Business ecosystem during 1998-2000 with a strong R&D tie with Phillips. Besides its own recording company, Sony Music attracted SAP in 2000 to for SACD related services. Sony also attracted hardware manufacturers like Pioneer and for replication it used two disc replication facilities of its own company for disc replication Sony Disc Manufacturing (SDM), Shizuoka/Japan and Terra Haute/USA. Also remarkable is the connection of Sony with DVD Forum, since Sony was also part of the DVD Forum. Sony got its revenues from selling the SACD players along with the sales of albums (SACD titles), from Sony Music. Philips and Sony hold the intellectual property rights of the SACD player and the SACD discs. They offer packages to other hardware and disc manufactures, which have to pay a basic royalty rate, per licensed product. The SACD Business ecosystem during 1998-2000 has been illustrated in figure 13a.

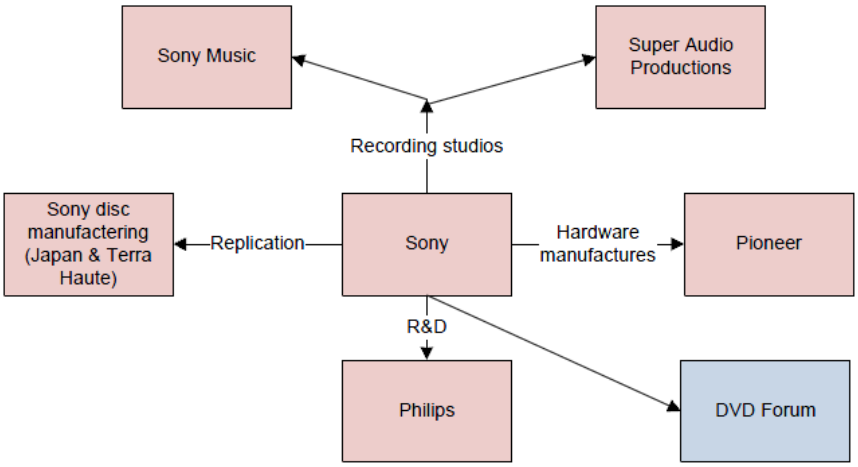

Figure 13a: SACD Business ecosystem during 1998-2000(Adopted from van de Kleij, 2010; pg.13)

Second data moment: 2003-2006

Because of the free licensing scheme of the SACDs offered by Sony, many recording studios joined Sony Music and SAP during 2003-2006 in record the SACDs. To record the discs, the recording studios use professional equipment, which are provided by professional technology providers like EMM Labs, Genex, Tascam and Sonic Studios. In 2003, Philips asked professional technology providers to include DSD capabilities in their products. Then in 2006 Sony announced a new Unified Cutting Format (UCMF), developed by Sony and Phillips to speed up the production of the SACD. UCMF decreases the production time, and shows its practicality for the SACD replication companies. Besides Sony's replication factories in Japan and Terra Haute, now replication companies like Crest national, Sonopress, and Viva magnetics were also attracted to produce SACD discs. The number of hardware companies also increased significantly. To summarize, the SACD business ecosystem during this period consisted of Sony and Phillips (still R&D tie), recording studios (companies), replication companies, professional technology providers and hardware manufacturers. The SACD Business ecosystem during 2003-2006 has been illustrated in figure 13b below.

[43]Frank, D. Super Audio CD production.Company with a low connection to Sony. Available at: Www.superaudioproduction.com/about_us.html

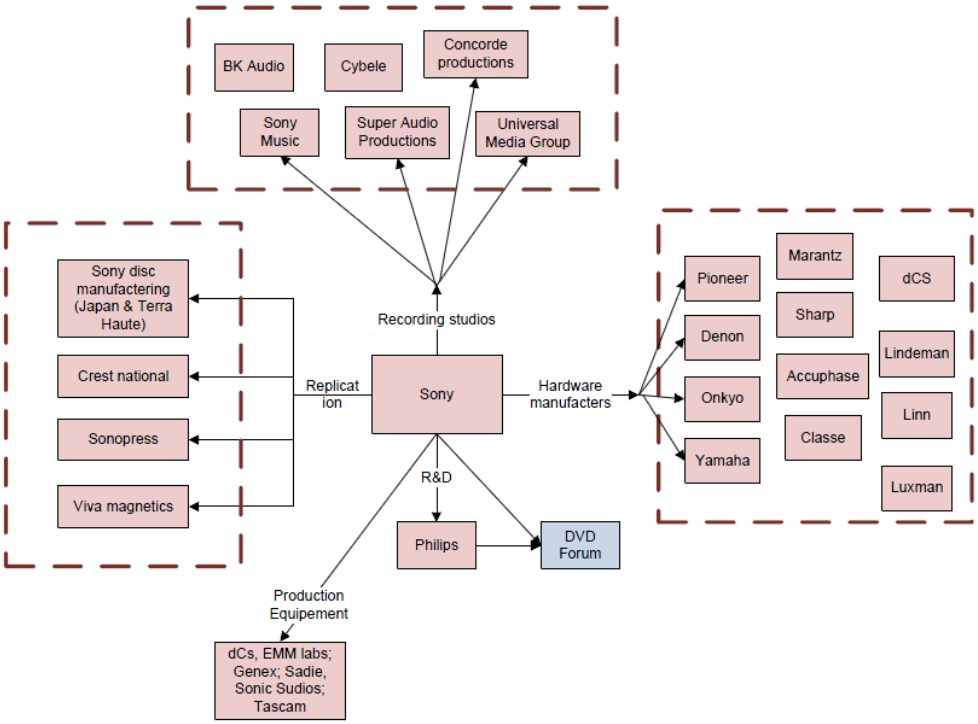

Figure 13b: SACD Business ecosystem during 2003-2006(Adopted from van de Kleij, 2010; pg.15)

DVD-A

First data moment: 1998-2000

For every new product/technology or standard developed, promoted by the DVD Forum, a specific working group has to be established first. For the development, promotion and improvement of the DVD-A format a group named 'Working Group 4' (WG-4) was established. WG-4 consisted of record companies and hardware manufactures.

During this period, the record companies included Time Warner Music and the three recording associations which represent the worldwide music recording industry, namely (1) Recording Industry Association of America (RIAA), which creates, manufacture approximately 85% of all legitimate recorded music produced and sold in the US; (2) International Federation of the Phonographic Industry (IFPI), and (3) Recording Industry Association of Japan (RIAJ).

The WG-4 first had to discuss the new format with these three recording associations.

The hardware companies consisted of Philips, Sony, Matsushita Electric, Hitachi, Mitsubishi Electric, Pioneer, Thomson, JVC, IBM and Toshiba. The intellectual property of the DVD is assigned to DVD FLLC, a unit which promulgates licenses for DVD related products or the use of the logo. The hardware manufacturers get their sources of revenue of their players, and if necessary have to pay Sony and Philips if the player is also capable playing the SACD format (van der Kleij, 2010). The DVD-A business ecosystem during 1998-2000 has been illustrated in figure 14a below.

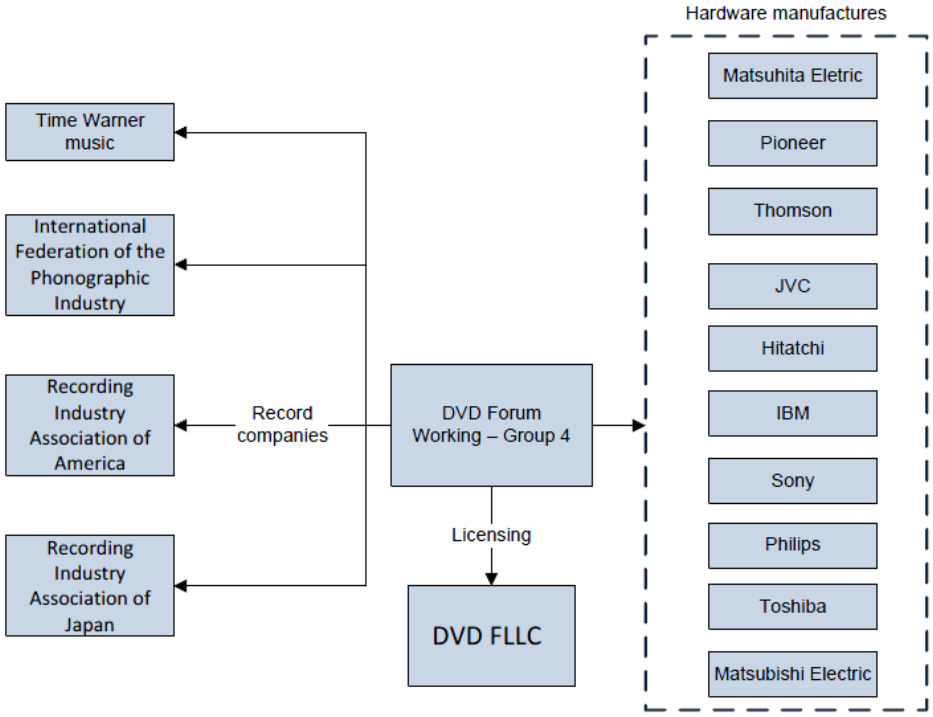

Figure 14a: DVD-A Business ecosystem during 1998-2000(Adopted from van de Kleij, 2010; pg.14)

Second data moment: 2003-2006

The DVD forum grew to a total of 220 companies, including the hardware manufacturers, recording companies and the license company. To be precise, the number of hardware manufacturers increased significantly, the DVD FLLC and record companies remained the same. The DVD-A business ecosystem during 1998-2000 has been illustrated in figure 14b below.

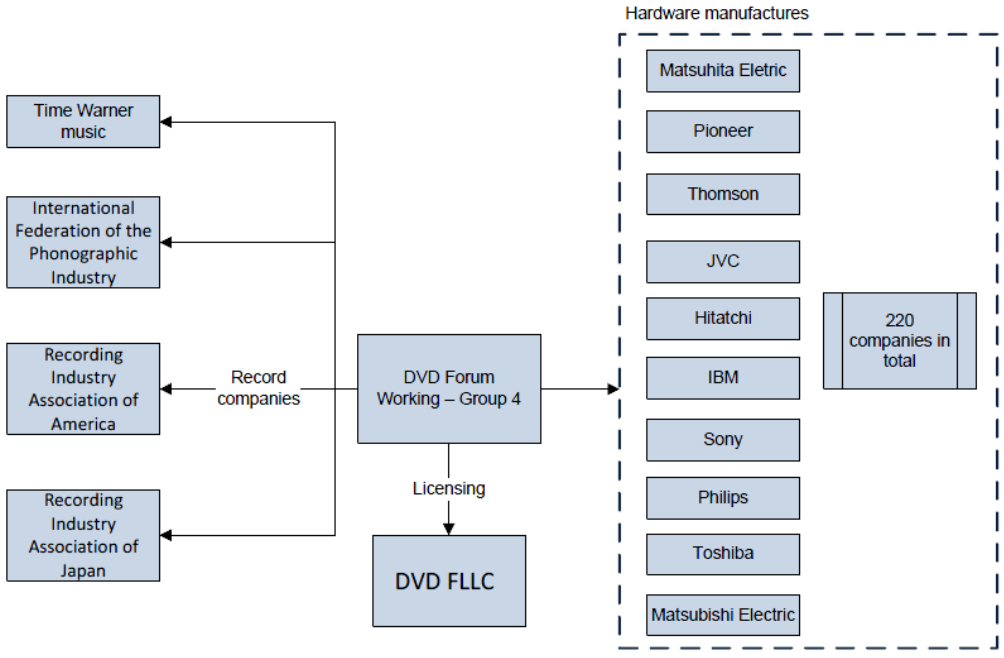

Figure 14b: DVD-A Business ecosystem during 2003-2006(Adopted from van de Kleij, 2010; pg.16)

Strategies

Looking at the commercialization of the first audio discs, it can be seen that the first SACD discs were introduced in May 1999, whereas the first DVD-A in mid 2000. Moreover, when looking at the availability of the first SACD and DVD-A players, it can be said that the *timing of entry* of Sony's first SACD player in May 1999 was seven months earlier than the first DVD-A player introduced by Pioneer in December 1999. This means that the SACD was the early entrant and the DVD-A the late entrant. Since an SACD player is required to enjoy high resolution audio delivered by SACD discs, the early entry ensured a lock in of audiophiles. Sony and the DVD Forum both aimed at attaining the mass market with their products. In order to attain that, the DVD forum negotiated with the three largest record associations (companies). Sony, on the other hand gave away free licenses. It managed to gain an installed base by the time DVD-A was launched, but was serving a niche market instead.

Both Sony and Philips have always focused on radical innovation and developing completely new technologies. This strategy is also seen in the development of SACD where only part of the technology used was earlier developed for the DVD. The encoding technology DSD was specifically developed for the SACD and presented as a radical improvement to store high quality music on a disc. They are convinced this technology is better than any existing technology for writing music to a disc and therefore support the SACD and did not switch towards the DVD-A. The DVD Forum on the other hand was only established to set a standard for DVD-related formats and to exploit the format. They don't focus on developing new technologies, fundamental innovations, but more on supporting the existing DVD format (Achman, Cikili, van Leeuwen and Warnar, 2010).

Sony and Phillips had already cooperated for the CD technology and since they also jointly worked on the SACD technology, there were limited cost resulting from the learning effects from previous cooperation. Also, the same distribution network that both companies already had in place for the distribution of the CDs could be used for distributing the SACD giving Sony and Philips a head start with the launch of the product (Achman, Cikili, van Leeuwen and Warnar, 2010). Furthermore, existing replication facilities and wholly owned record companies (Sony Music) have been used to quickly produce SACD discs (van der Kleij, 2010). A good distribution strategy ensures a producer to reach its customer with the new product. Sony had persuaded companies owning an existing CD license to expand it to a SACD license, without additional costs[44]. By doing so, recording companies would easily choose to produce the new format, since no switching costs are involved. Moreover, extra momentum in titles available could be ensured. Secondly, Sony looked for alliances with other record companies to ensure high profile releases on SACD, like the Rolling Stones catalogue released in 2004, whereas DVD forum had to negotiate with the major record companies first. These two facts are probably responsible the extra momentum in sales.

The introduction price of the SACD player was around 5000 dollar with respect to 2000 dollar for the first DVD-A player from pioneer. Since Pioneer's DVD-A player could play all formats, including SACD, the prices of the SACD players rapidly declined within a year to 750 dollars. Despite the major price difference at introduction, this seems to be of no influence on the number of titles available within a year after market introduction (for both parties).

[44]Philips, Sony Announce Licensing Plans for DSD, Super Audio CD. 1998, 17 February; Available at: http://www.sony.net/SonyInfo/News/Press_Archive/199802/980217/index.html.

Sony and Phillips were both part of the SACS as well as the DVD-A business ecosystem, however, they were more committed to their own SACD format than to DVD-A. They even tried to persuade the hardware manufacturers of the DVD Forum to include compatibility with SACD in developed DVD-A players. The strong commitment can also be traced back to the several announcements for advanced (1) recording and playback technologies to ensure superior audio and compatibility with CD format or (2) fast production of SACDs. For example the announcement in 2003 to install a new hybrid SACD line at its manufacturing facility in Terre Haute/USA; or the announcement of the introduction of UMCF in 2006. These announcements showed the strong ongoing support of Sony and Phillips to SACD[45].

Performance

In this case, the market share is represented by means of number of titles available. Around 40 SACD titles were available by the end of 1999 and by the end of 2001, the total number of SACD titles surpassed 500. Around 50 DVD-A titles were available by the end of 2000 and almost 200 by the end of 2001[46]. Furthermore, DVD-A unit shipments in 2001 reached 0.3 Million copies and $6 Million in dollar value[47]. As of June 2002, over 650 SACD music titles, including nearly over multi-channel SACD music titles were available.

According to the RIAA 2003 Unit Shipment report, 0.4 million DVD-A discs were sold in 2003, which was similar to a 0.8% rise in DVD-A unit shipments and a 5.3% decline in the dollar value of units compared to the previous year. According to a RIAA 2003 consumer phone survey over 2,900 consumers across the United States, 2.7 % of the consumers purchased music in DVD-A format[48], which showed that in 2003 DVD-A was the second favorite audio format after the most favorite CD audio format. As for SACD, more than 2.5 million SACD players had been purchased by households worldwide and over 1,000 SACD titles had been published, mainly high profile hybrid SACD titles, until January 2003. In 2003, the SACD sales were tracked for the first time in history and showed that 1.3 million SACD discs had been sold during the year[49].

Sales figures of the DVD-A (from shipments in the US) were five times higher in 2004 with respect to the SACD (with a market share of 2.7% versus 0.5%), mainly because of the fact that DVD-A discs offered extra content like music videos and interviews. The overall sales in 2004 included 2.2 million for SACD versus 0.4 million for the DVD-A.

According to the titles available in 2005 the SACD started to gain advantage in market share. As of 2005, a total of almost 3000 SACD titles have been offered by nearly 250 record labels. Since the overall US shipments were 300,000 units in January–June 2004, as claimed by the RIAA, it can be concluded that only 100 units of each title were offered to retail customers in that period. As for DVD-A, more than 110 labels offered DVD-A titles by 2005. The total number of DVD-A titles offered had been determined as half of the total number of SACD titles that year[50].

In 2009, the maximum number of titles was reached by SACD, whereas there were only few DVD-A titles. However, none of the technologies was able to gain dominance and had their own niche markets.

[45] http://www.sa-cd.net/shownews/3
[46] http://dvddemystified.com/dvdfaq.html#1.12
[47] http://www.wiredstate.com/forum/viewtopic.php?f=65&t=3073&start=20
[48] http://www.wiredstate.com/forum/viewtopic.php?f=65&t=3073&start=20
[49] http://www.tfproject.org/tfp/tilted-technology/54370-sacd-dvd-sales.html#ixzz1J4vaJOBu
[50] http://www.stereophile.com/asweseeit/305awsi/index.html

3.3.3 CASE ANALYSIS – PART 2SONY'S NETWORK POSITIONS, STRATEGIES, AND PERFORMANCE DURING 1999 AND 2003

In the first part of the case analysis two data moments were chosen: 1998-2000 and 2003-2006 and for those two data moments the network positions, strategies, and performance measures of Sony and DVD Forum have been evaluated. In this part, the focus will be on Sony and SACD only and for the elaborated analysis of the strategies, network positions and performance of Sony, two important data moments in time are chosen: (1) the year 1999, when SACD was introduced to the market and which started the marker adaptation phase, and (2) the year 2003 within the market stabilization phase, when SACD sales were tracked for the first time in history and showed that SACD succeeded in outselling DVD-A by 3.25 times[51].

Network position of Sony

1999

The year 1999 represents the year when the commercialization of the SACD took place and which started the market adaptation phase. The SACD Business ecosystem during 1999 is similar to the one illustrated in figure 14a. When looking at the structure of the network, it can be seen that Sony is the core firm (with its SACD technology as core technology). The generic network structure is core-periphery. There is also low density and low interconnectivity between the actors.

When looking at the network, it can be concluded that there are four types of actors involved. These are actors the development and production of the SACD:

- Philips as R&D tie. Sony and Phillips cooperated for the development of the CD as well as for the SACD and their type of connection is of R&D nature. Strong connection, since Philips and Sony together hold the intellectual property rights of the SACD player and the SACD discs.
- Hardware manufacturers, to deliver the SACD hardware. The type of connection is low and in the form of licensing. Packages are offered to the hardware manufacturers and they have to pay a basic royalty rate, per licensed product.
- Sony's own record company (or studio), Sony Music and other small record companies, like Super Audio Productions (SAP) for SACD related services.
- Sony's own company for disc replication: Sony Disc Manufacturing (SDM) at two manufacturing facilities: Shizuoka/Japan and Terra Haute/USA.

There is medium diversity and the network size is also medium, since not many companies are involved. However, the size is expected to grow fast since Sony had been offering SACD licenses without additional costs to holder of CD licenses, in order to attract more partners and by doing so to reach the mass market.

2003

The year 2003 is within the market stabilization phase, which started in mid 2000 with the large scale diffusion of SACDs. The SACD Business ecosystem during 2003 has been illustrated in figure 14b.
As can be concluded, Sony is still the core firm (with its SACD technology as core technology). The generic network structure is again core-periphery. However, the density is high now, because of the

[51] http://www.tfproject.org/tfp/tilted-technology/54370-sacd-dvd-sales.html#ixzz1J4vaJOBu

increased number of actors that joined the network between 1999 and 2003 and because of the new actors that were joining in 2003, due to the free licensing scheme of the SACDs offered by Sony.

The diversity also increased because besides the four types of actors (as during 1999) a new group of actors joined the network: professional technology providers like EMM Labs, Genex, Tascam and Sonic Studios. The actors are not only connected to Sony, but also to the record companies, who need professional equipment from these providers in order to record the SACDs. Therefore it can also be said that the interconnectivity increased in 2003.

Since this new group of actors joined, the network size also became bigger. Furthermore the network size also grew, because new replication companies like Crest national, Sonopress, and Viva magnetics were also attracted to produce SACD discs. Moreover, the number of hardware companies also increased significantly.

Sony's Strategies as central actor

1999

As has been shown in the pattern overview (See figure 13), the SACD was invented in 1999. The year 1999 represents the market adaptation phase and more specifically the creating the market phase. Strategies that might have played a role in 1999 are evaluated next.

Sony (and Phillips) introduced the SACD format in March 1999 and invented the first SACD player in May 1999, which means seven months before the introduction of the first DVD-A player by Pioneer. Being the *first mover* on the market, the SACD had the advantage to quickly achieve a lock in of audiophiles. This means that the *timing of entry* played a role here. Sony also aimed at reaching the mass market with its product.

The first SACD players were introduced with a $5000 price tag in 1999 and since those were quite expensive, the SACD technology attracted mainly audiophiles only. At the end of 1999, SACD players were distributed in limited quantities in the USA, with the cheapest unit priced at $1,500 and other SACD players priced in the $3,500-$5,000 range. Because of the high price tag of SACD players, SACD technology was *marketed* exclusively to audiophiles in 1999[52].

Sony (and Philips) used the same distribution network that they already had for the distribution of the CDs for the distribution of SACD. Also, Sony used its own record company and existing replication factories to produce SACD discs. Moreover, Sony's partners like the record companies holding a CD license, could change convert their license into a SACD license without additional costs, which ensured more offerings of SACD titles. After all, there were no switching costs involved (from CD tot SACD) this way. By giving away free licenses, Sony tried to gain momentum in SACD titles being offered and wanted to reach the mass market. All these strategies can be recognized as smart *distribution strategies* pursued by Sony. Sony followed a *shaper strategy* and developed a business ecosystem around its own proprietary SACD technology with itself and SACD in the core. To be precise, Sony had the role of a keystone, since it provided a common technology platform and tried to improve the business ecosystem as a whole by being an important hub in the network.

[52]http://www.timefordvd.com/tutorial/SACDOverview.shtml

2003

The SACD sales took off between 2002 and 2003. In 2003 many 'high-profile hybrid SACD titles' were released. 'High-profile' refers to the fact that big name albums were released and 'hybrid' refers to the fact that the SACD discs were of hybrid type which means that they were backwards compatible with the conventional CD players. Together with the advantages like backwards compatibility and high profile albums, Sony used *aggressive marketing* (the high profile hybrid titles were marketed in the CD bins of many record stores) and PR and succeeded in outselling DVD-A by 3.25 times in 2003[53]. The free licensing of SACD technology again played an important role in attracting more and more record companies and replication companies, which refers to the *distribution strategy* pursued. Record companies using the SACD format were not keen to switch over to the DVD-A format.

Although Sony was also part of the DVD Forum and involved as manufacturer of DVD-hardware, SACD had the full attention of Sony. Sony's *commitment* to SACD was evident in 2003, when Sony Disc Manufacturing (SDM) announced a new hybrid SACD line - that would produce 15,000 hybrid SACD discs per day- at its replication facility in Terra Haute/USA[54]. Sony at this stage again followed *shaper strategy* and acted like a keystone, since it and its technology were still placed in the core. The SACD network in 2003 showed a significant increase in actors compared to 2000, which emphasizes the importance for Sony to improve the business ecosystem as a whole.

Performance

The market share, as mentioned before, is estimated by the amount of SACD titles made available, so not in percentages. Studios such as DMP, Mobile Fidelity Labs, Pioneer, Sony, and Telarc released about 40 SACD titles at the end of 1999 and as of January 2003 over 1,000 SACD titles had been published (mainly high profile hybrid SACD titles).
SACD sales for the year 1999 were not available, since SACD sales got tracked for the first time in history in 2003 and showed that 1.3 million SACD discs had been sold during the year.

All the findings obtained from the case study analysis (Part 2) have been placed into table 6 below. The aspects of strategic behaviour and network position and the financial measures, which have been obtained from the case analysis, are summarized and placed into the table. A table entry with "--"means that the certain aspect could not be obtained from the case study, because it was either missing or difficult to analyze. In this case study only two data moments in time have been chosen. Therefore data obtained for these two data moments have been placed into the table. However, to maintain the same structure for both case studies, this table has the same format as Table 4. Therefore the fourth column ("200?") is included, but all the table entries are left blank.

[53]http://www.tfproject.org/tfp/tilted-technology/54370-sacd-dvd-sales.html#ixzz1J4vaJOBu
[54]http://www.sa-cd.net/shownews/3

Table 6: Overview of data obtained from the analysis of the Sony SACD case

Overview of aspects of strategic behaviour, network position and performance from Case study 2			
Focal firm: Sony **Product/technology: SACD**	**Data moment in time**		
Aspects	***1999*** ***Market adaptation phase*** ***(Creating the market phase)***	***2003*** ***Market stabilization phase*** ***(Post dominance phase)***	***200?***
Aspects of strategic behaviour			
Standard support strategy			
Pricing strategy	The first SACD players were expensive (€5000)	Sony offered cheaper SACD players	
Appropriability strategy	--		
Timing of entry	First mover; Mass market strategy		
Marketing Communications	Because of the high price tag of SACD players, SACD technology was marketed exclusively to audiophiles	Sony used aggressive marketing (the high profile hybrid titles were marketed in the CD bins of many record stores) and PR	
Pre-emption of scarce assets	--	--	
Distribution strategy	Same distribution network as for the distribution of CDs; Sony used its own record company; Sony gave away free licenses to its partners to ensure more offerings of SACD titles.	Sony offered free licensing of SACD technology to reach the mass market. Sony attracted more record companies and replication companies	
Commitment	--	By announcing a new hybrid Super Audio CD (SACD) line at its manufacturing facility in Terre Haute Sony showed its dedication to expand the awareness for and broadening the acceptance of SACD technology.	
Hofmann's Alliance strategy			
Shaping strategy	--	--	
Adapting strategy	--	--	
Stabilizing strategy	--	--	
Business ecosystem strategy			
Shaper strategy – *dominator*	--	--	
Shaper strategy – *keystone*	Sony and its SACD technology were in the core; Sony tried to improve the business ecosystem as a whole by being an important hub in the network	Sony and its SACD technology were still in the core	
Adapting strategy	--	--	
Reserving the right to play	--	--	
Aspects of Network position			
Size	Medium; fast growing	Large; still growing	
Diversity	Low; growing	High; stable	
Generic structure	Core-periphery; Sony: core	Core-periphery; Sony still core	

Overview of aspects of strategic behaviour, network position and performance from Case study 2			
Focal firm: Sony Product/technology: SACD	**Data moment in time**		
Aspects	***1999 Market adaptation phase (Creating the market phase)***	***2003 Market stabilization phase (Post dominance phase)***	***200?***
Density	Low density; Low interconnectivity	High density; High interconnectivity	
Presence of structural holes	--	--	
Alliance degree	--	--	
Aspects of Firm Performance			
Market share	±50 SACD titles	>> 1,000 SACD titles	
Financial performance	--	--	

3.3.4 VALIDITY CHECK

In order to ensure is the analysis is based on correct and useful data and to find out if there are any irregularities all the entries in table 6 above have been validated through a horizontal and a vertical validity check. The main goal of the horizontal check is to find certain patterns of evolution of the aspects of strategic behaviour, network position and firm performance and the aim of the vertical check is to find relationships between the various aspects for every data moment in time.

Horizontal check

Before the horizontal check of data entries of table 6, it is important to affirm that the year 2000 marked the large-scale diffusion of SACD and start of the market stabilization phase, while DVD-A got launched in the market, which started the standards battle between both technologies; whereas year 2003 marked the time when SACD sales were tracked for the first time in history and showed that SACD succeeded to outsell DVD-A. Conclusions from the horizontal check are as follows:

Aspects of strategic behaviour:

Standard support strategies:

- Pricing strategy of Sony changed from 1999 to 2003. Sony introduced the first SACD players in 1999 at a price of €5000 whereas the introduction price of the first DVD-A player in 1999 was almost 1/3 of the price of a SACD player. By the end of 1999 SACD players were released at lower prices ranging from $1500 to 5000. From 2000 on Sony started offering cheaper SACD players to compete with DVD-A.
- Timing of entry: Sony was seven months earlier with the SACD than the DVD Forum with the DVD-A and aimed at reaching the mass market with its product. Since timing of entry is a strategy to introduce the new product, it is quite logical that this strategy is used once only (so in the first data moment only, 1999).
- Marketing strategies: Even though there is no explicit mentioning in the literature about which kind of marketing attempts were pursued by Sony in 1999, data has been found that back to that time the SACD was exclusively being marketed to audiophiles, because of the high price tag of the first SACD players. In 2003, on the other hand, Sony used aggressive marketing strategies to gain momentum in the sales of SACD products. The high profile hybrid titles, which were produced in 2003, were marketed in the CD bins of many record stores.

- Distribution strategies played an important role in both years. In 1999, the same distribution network that already been used for the distribution of the CDs, were used for the distribution of SACD. Also, Sony's own record company and existing replication factories were used to produce SACD discs. More importantly, Sony provided free licenses to its partners like the record companies holding a CD license to attract more partners in order to ensure more offerings of SACD titles. In 2003, Sony really wanted to reach the mass market with its technology and again offered free licenses to record companies and was able to attract more record companies and replication companies as well.
- In 1999, Sony did not show any clear sign of commitment to the SACD technology, but in 2003 the commitment was evident, since Sony showed its dedication to expand the awareness for and broadening the acceptance of SACD technology by announcing a new hybrid Super Audio CD (SACD) line at its manufacturing facility in Terre Haute.

Business ecosystem strategies:

- During both data moments Sony opted for the shaper strategy in order to maintain order between the alliances and to extract as much as value from its network. Also, its role as keystone did not change over time. Sony maintained its role as keystone by putting itself and its technology in the core and allowed more partners to join the business ecosystem in order to reach the mass market.

Aspects of network position: Like in the first case study, the table entries of table 6 have been compared with the entries of table 3 'Overview of Networks characteristics during the Technology Life cycle' (den Hartigh *et al.*, 2009)

- Size: Year 1999 marked the market introduction as well as the start of the market adaptation phase ('creating the market' phase), where the size of the network should be *Medium; fast growing* according to the Table 'Overview of Networks characteristics during the Technology Life cycle'. As can be seen from table 6, the characteristics found do match with the characteristics according to the theory. The characteristics found for year 2003 *large; still growing* can be recognized as belonging to the 'decisive battle' phase (market adaptation phase) and not to the market stabilization phase. However, it can be concluded that since in this case the battle between SACD and DVD-A started in the market stabilization phase, these results can be considered as consistent. The year 2003 can thus be seen as belonging to the 'the decisive battle' phase.
- Diversity: the data for year 1999 matches with data for 'Technological feasibility' phase, whereas data for 2003 matches with data for the Market stabilization phase.
- Generic structure of the network did not change from 1999 to 2003. It remained *core-periphery*, however according to the theoretical evidence the generic structure should be 'chain-structure' and core-periphery refers to the 'R&D build up' phase. This means that over time the generic structure of the network did not change. The fact that the structure did not change, could be due to the fact that Sony's business ecosystem strategy also remained constant over time.
- Density: the data for year 1999 matches with data for 'R&D build up' phase, whereas data for 2003 matches with data for the 'decisive battle' phase.
- No results have been found for the 'presence of structural holes' and 'alliance degree'.

Aspects of firm performance:

- The performance had to be evaluated in terms of the technological dominance of standardization (market share) and financial performance. However, the latter could not be evaluated, due to lack of available data. Also the market share has been estimated by the amount of SACD titles made available, so not in percentages. In 1999 about 40 SACD titles were made available and in 2003 more than 1,000 SACD titles (mainly high profile hybrid SACD titles), which amounts to an increase with 20 times.

Overall conclusions from the horizontal check:

From the horizontal validity check the following conclusions were drawn. Hoffmann's alliance strategies were not recognized in this case study. Also most important standard support strategies were pricing strategy, marketing communications, distribution strategy and commitment. About the Business ecosystem strategy that had been pursued can be concluded that Sony pursued shaper strategy and the role of keystone during both data moments, which means that this strategy did not change over time. Horizontal check of the aspects of network positions showed irregularities, because the network characteristics found from the case analysis did not completely match with the network characteristics from theory. The battle between SACD and DVD-A started in the market stabilization phase, therefore the year 2003 belongs to the 'the decisive battle' phase. The fact that the generic structure of the network remained the same during both years can be related to the fact that the business ecosystem strategy that has been pursued by Sony remained the same. In this case market share has been estimated by the amount of SACD titles made available, so not in percentages. The market share in 2003 increased 20 times more than that in 2000. Financial performance could not be measured, due to lack of available data.

Vertical check

For the vertical check each column of Table 6 has been observed, which means that per data moment (1999 and 2003) all aspects of strategic behaviour, network position and performance were reviewed. Again, it is important to recall that in 1999 the commercialization of the SACD took place, whereas the year 2003 marked the year when Sony succeeded to outsell DVD-A discs with its SACDs.

1999:

Aspects of strategic behaviour:

- As can be seen from table 6, the strategies that were pursued by Sony in 1999 were pricing strategy, marketing communications, timing of entry, distribution strategy and shaper strategy, from which timing of entry and distribution strategy can be considered the most significant one to accelerate market share and to attract network partners. The SACD technology was released seven months before the DVD-A and was therefore able to achieve an installed base. The same distribution network that already been used for the distribution of the CDs by Sony and Phillips, were used for the distribution of SACD. Also, Sony's own record company and existing replication factories were used to produce SACD discs. More importantly, Sony provided free licenses to its partners like the record companies holding a CD license to attract more partners in order to ensure more offerings of SACD titles.

Aspects of network positions:

- Vertical check of the network characteristics respectively diversity and density in 1999 showed that they belonged to respectively the 'technological feasibility phase' and the 'R&D build up'

phase, instead of belonging to the actual 'creating the market' phase. However, it can be reasoned that the launch of the SACD format took place in may 1999, but the analysis had been conducted from beginning of 1999, when SACD still belonged to the innovation phase (consisting of 'R&D build up' and 'technological feasibility' phase). Thus the deviating results might have resulted as a consequence of that.

- The generic structure has been found to be core-periphery, which matched the generic structure belonging to the R&D build up phase. However, it can be reasoned that since Sony acted as a keystone by keeping itself and its technology in the core, the structure resembles core-periphery structure.

Aspects of performance:

- Market share has been estimated by the number of SACD titles being offered. In 1999 approximately 40 SACD titles were made available.

2003:

Aspects of strategic behaviour:

- As can be seen from table 6, the strategies that were pursued by Sony in 2003 were pricing strategy distribution strategy, marketing communications, commitment and shaper strategy. In 2003 SACD succeeded in outselling DVD-A and if we look at the strategies, it can be concluded that commitment and marketing communications are related to each other. This because Sony's announcement of new hybrid SACD line at its manufacturing facility in Terre Haute not only showed his commitment to the SACD technology, but can also be considered as a strategy to expand the awareness for and broadening the acceptance of SACD technology.

Aspects of network positions:

- Vertical check of the network characteristics size and density for 2003 showed that they actually matched with the characteristics for the 'decisive battle' phase (according to the theoretical evidence) and not with the characteristics for the market stabilization phase. Diversity, however, matched with market stabilization phase. However, it can be reasoned that these results are not inconsistent, since the standards battle started in 2000 with the launch of the DVD-A format and 2003 might be considered belonging to the 'decisive battle' phase. The generic structure is again core-periphery in 2003, which can be explained with the fact that Sony opted for a shaper strategy and acted like a keystone again by keeping itself and its SACD technology in the core.

Aspects of performance:

- Market share: more than 1000 SACD titles were made available in 2003.

Overall conclusions from the vertical check:

In 1999 the timing of entry, distribution strategy and shaper strategy can be considered the most significant one to accelerate market share and to attract network partners. Vertical check of the network characteristics size, diversity, density and structure showed deviating results. Since Sony acted as a keystone by keeping itself and its technology in the core, the generic structure of the network resembled the core-periphery structure. Market share is the performance indicator and has been measured in terms of number of SACD titles and was about 40 SACD titles at the end of 1999.

In 2003 distribution strategy, marketing communication, commitment and shaper strategy were pursued by Sony, of which commitment and marketing communications seem to be closely related to each other. Vertical check of the network characteristics size and density showed that the characteristics actually matched with the characteristics for the 'decisive battle' phase according to

the evidence from theory. Therefore it can be reasoned 2003 might be considered as belonging to the 'decisive battle' phase. The generic structure was again core-periphery, because in 2003 Sony again used shaper strategy and had the role of a keystone. The market share has been measured in terms of number of SACD titles and was more than 1000 SACD titles in 2003.
An overview of the overall findings from the horizontal and vertical validity check is provided in Table 7 below.

Table 7: Overview of the findings from the Validity check of the SACD Case analysis

Validity Check of the SACD Case analysis		
Horizontal Check	**Vertical check**	
	1999 (market adaptation phase)	**2003 (market stabilization phase)**
• The most important standard support strategies over time were pricing strategy, marketing communications, distribution strategy and commitment. • Sony's business ecosystem strategy and role within the business ecosystem did not change over time.	• Strategies like timing of entry, distribution strategy and shaper strategy can be considered the most significant one to accelerate market share and to attract network partners.	• Distribution strategy, marketing communication, commitment and shaper strategy were pursued by Sony, of which commitment and marketing communications seem to be closely related to each other.
• Network characteristics found from the case analysis did not completely match with the network characteristics from theoretical evidence. • No results have been found for the 'presence of structural holes' and 'alliance degree'. • The battle between SACD and DVD-A started in the market stabilization phase, therefore the year 2003 belongs to the 'the decisive battle' phase. • The fact that the generic structure of the network remained the same during both years can be related to the fact that the business ecosystem strategy that has been pursued by Sony remained the same.	• Network characteristics diversity and density matched with 'technological feasibility phase' and the 'R&D build up' phase, instead of with those for 'creating the market' phase. • Since Sony acted as a keystone by keeping itself and its technology in the core, therefore the generic structure of the network resembled the core-periphery structure.	• The network characteristics size and density actually matched with the characteristics for the 'decisive battle' phase according to the evidence from theory. • The year 2003 might be considered as belonging to the 'decisive battle' phase. • The generic structure was again core-periphery, because in 2003 Sony again used shaper strategy and had the role of a keystone.
• Market share has been estimated by the amount of SACD titles made available and not in percentages. The market share in 2003 increased 20 times more than that in 2000. • Financial performance could not be measured, due to lack of available data.	• Market share is the performance indicator and has been measured in terms of number of SACD titles and was about 40 SACD titles at the end of 1999.	• The market share has been measured in terms of number of SACD titles and was more than 1000 SACD titles in 2003.

3.3.5 CONCLUSION

This case study detailed the technology standards battle between the audio formats Super Audio CD (SACD) from Sony and DVD Audio (DVD-A) from the DVD Forum for dominance in the Hi-fi digital audio market. Super Audio CD (SACD) is defined as an optical music carrier high-resolution, developed by Sony (and Philips) to provide improved sound quality, in the form of higher fidelity multi-channel (surround) sound, and backward compatibility with CD as well. SACD format was first introduced into the market in May 1999. The first SACD players got also released in the same month and year. DVD Audio (DVD-A) is defined as a high-fidelity audio storage medium with varying numbers of channels, sampling frequencies, word lengths and other features such as video elements, designed by the DVD Forum for improved sound quality, while maintaining backward compatibility with the CD format. The first DVD-A player got released seven months after the first SACD player, but the DVD-A format was officially launched in mid 2000. By that time the market stabilization phase had already started, since large scale diffusion of SACD took place at the beginning of the year 2000. With the launch of the DVD-A format, the technology standards battle was also started. The outcome of this battle is that there was no winner. Neither Sony nor DVD Forum was able to achieve market dominance with their technologies. Both technologies were aimed at reaching the mass market, but instead they got their own niche markets, consisting of audiophiles who enjoy high quality music.

After an overview of the technology life cycle, the case analysis was started. At first overall aspects of network position, strategic behaviour and performance for both product categories/technologies and promoting members were evaluated for two data periods, 1998-2000 and 2003-2006. After that case analysis, a second analysis was performed where only Sony as focal firm and its core technology, SACD, were evaluated. For that purpose three specific data moments in time had to be chosen, just like in the previous case study. There were many data moments in time with superficial data; only for two data moments in time (year 1999 and 2003) sufficient data about the aspects of strategic behaviour, network position and performance could be found. Hence those two data moments were selected for the case analysis. The year 1999 referred to the year that witnessed the market introduction of SACD, and also the start of the market adaptation phase, in particular the ‘creating the market’ phase. On the other hand the year 2003 indicated year when the sales of SACD were tracked for the first time and when SACD managed to outsell DVD-A within the market stabilization phase. All findings from the case analysis were tabulated in table 6, after which a horizontal and vertical validity check took place. The horizontal check took place to analyze the change in aspects of strategic behaviour, network position and performance over time in order to find a certain pattern of evolution of the various aspects. The vertical check took place to analyze all the aspects for each data moment in order to find relationships between the various aspects. An overview of all findings from the validity check can be found in table 7.

The main conclusions from the case analysis are as follows.

- According to the Technology life cycle dimension (den Hartigh *et al.*, 2009) a technology standards battle takes place in the market adaptation phase; in particular in the ‘decisive battle’ phase. However, evidence from the case analysis showed that the battle between SACD and DVD-A took place in the market stabilization phase.

- There were many data moments in time with superficial data; only for two data moments (year 1999 and 2003) sufficient data about the aspects of strategic behaviour, network position and performance could be found. Hence those two data moments were selected for the case analysis.
- In this case market share was the only performance indicator. And what was found to be somewhat impeding on the analysis is the fact that market share could only be measured by estimates of the total number of SACD titles made available. Perhaps it would have been better if there was data available about the installed base (total number of users of the SACD technology).
- The two strategies pursued by Sony 'timing of entry' and 'distribution strategy' seem to have accelerated the adoption of SACD by users and record companies. Sony allowed producers of the CD to use SACD technology. Also by this giving away of 'free' licenses, producers of smaller record companies also adapted to the SACD. So it seems as if the combination of the strategies 'timing of entry' and 'distribution strategy' may have influenced the network position (network size, density, diversity) as well as performance (market share/release of SACD titles by record companies). This applies to year 1999.
- Evidence from the case analysis showed that the standard support strategies 'commitment' and 'marketing communications' seem to be alike. In 2003, Sony made its commitment to the SACD technology evident by announcing a new hybrid SACD line at its manufacturing facility in Terre Haute. This announcement can also be seen as a marketing strategy to expand the awareness for and broadening the acceptance of SACD technology. Thus commitment is equal to marketing communications and seems to influence the market share (performance).
- The generic structure of the network seemed to remain the same over time and the business ecosystem strategy that had been pursued by Sony also remained the same. This indicates that there may be a possible relationship between network position (generic structure) and strategic behaviour (business ecosystem strategy: shaper strategy). Perhaps the generic structure remained the same, because of the fact that the business ecosystem did not change as well.

3.4 CONCLUSION

A practical exploration of the research topic has been presented in this chapter, starting with an overview of the case study method that has been applied for this research. Two cases have been selected based on particular selection criteria and after that the case studies have been conducted following a specific case structure. Each case study includes a brief background, a case description, followed by an in-depth analysis and validity check and finally a concluding section.
The two case studies are (1) Apple iPod vs. Microsoft Zune; and (2) SACS vs. DVD-A. The first case study detailed about the technology standards battle between two specific configurations of MP3 players, namely Apple iPod and Microsoft Zune, whereas the second case study detailed the technology standards battle between the audio formats Super Audio CD (SACD) from Sony and DVD Audio (DVD-A) from the DVD Forum for dominance in the Hi-fi digital audio market.

Only the results from the within case analysis for each case study have been presented in this chapter. In order to determine whether the research outcomes can be assumed valuable, a cross case analysis is needed. This cross case analysis has been presented in the next chapter.

4. DISCUSSION OF FINDINGS

The purpose of this chapter is to provide an overview of the empirical findings from the case analysis conducted in Chapter 3, followed by a confrontation of those empirical findings with the reviewed theoretical views from extant literature on strategic behaviour, network positions and performance (presented in Chapter two) and finally a discussion of the findings. The chapter therefore first starts with a cross case analysis of the two case studies. This will ultimately result in research outcomes, which are discussed in the following section. In the same section the quality of the research has been discussed as well and finally the chapter ends with an overall conclusion.

4.1CROSS CASE ANALYSIS

Voss *et al.* (2002) defined data analysis as "the process of bringing order, structure and meaning to the mass of collected data". According to Miles and Huberman (1994) data analysis can be defined as consisting of three flows of activity: data reduction, data display and conclusion drawing/verification. The three activities are briefly described below.

1. *Data reduction*: Data can be reduced and transformed through selection, summary, paraphrasing, or through being listed in a larger pattern. This activity usually takes place in the *within case analysis*, where not only detailed 'write-ups' of the case study are presented, but also comparison of findings from the case study to the frame of reference (i.e. theoretical framework) takes place. This activity has already taken place in the previous chapter for each case through the case description, two parts of case analysis and the validity check.
2. *Data display*: This is the activity where the reduced data has to be displayed it in an organized, compressed way so that conclusions can be drawn more easily.
3. *Conclusion drawing/verification*: This is the final analytical activity, where regularities, patterns (differences/similarities), explanations, possible configurations, causal flows, and propositions have to be noted.

The analyzing activities 2 and 3 usually take place through cross-case analysis, which has been conducted in this section. *Cross-case analysis* refers to comparing data in one case with data in the other case. Cross-case analysis is often conducted to organize and analyze (and reduce even more) data retrieved from case studies in order to find patterns and to see if it fits with the existing theory (Miles & Huberman, 1994). According to the authors, cross-case analysis may not only result in similarities and differences which were already found through the within-case analysis, but also in other new patterns or discoveries as well. Through cross-case analysis a researcher should also seek to increase the internal validity of the findings.

For the cross case analysis, especially for the analyzing activity 3, two types of data have been compared to each other:

1. *Theory/Theoretical view*: This refers to the knowledge base or existing theory from extant literature, which has been used as frame of reference during the practical exploration (Chapter 3) and during the cross-case analysis (Current chapter). As has been cited by Voss *et al.* (2002), theory can be defined as "a system of constructs and variables in which construct are related to

each other through propositions and the variables are related to each other through hypotheses"

2. *Practical evidence*: This refers to the empirical evidence (also called empirical findings/data) retrieved from the case studies.

In the previous chapter two case studies have been conducted: (1) Apple iPod vs. Microsoft Zune, and (2) SACS vs. DVD-A. Overviews of the findings from both case studies are presented in section 4.1.1. In the next sub-section all the similarities and differences across the cases, found from the practical evidence are presented first, followed by a confrontation of the empirical findings to the theoretical evidence. What follows then is a discussion on the findings from the cross case comparison. The last sub-section presents conclusions from the cross case analysis.

4.1.1 DATA DISPLAY

Miles and Huberman (1994) suggest that data displays can be constructed by organizing data by case, time or concept to facilitate appropriate analysis. In this research data has been organized by case, which means that each case study has been treated as a single case study, with a specific case study structure/procedure had been applied(See Chapter 3). For each case study data has been structured by:

- *Time*: refers to observing specific data periods and then choosing important data moment in time, belonging to specific phases according to the technology life cycle. In the first case study, three data moments in time were chosen, whereas in the second case study only two were chosen.
- *Concept*: refers to the three concepts being studied in this research, namely strategic behaviour, network position and performance. For every concept, operational measures had been established to be studied. These operational measures have been named 'aspects of strategic behaviour, aspects of network position and aspects of performance.

Based on the outcomes from the within case analysis of both case studies in Chapter 3, the overall findings have been summarized and displayed in an organized and condensed way in Table 8 and 9 in order to draw conclusions easily.

Remarks on Table 8 and 9

Three types of arrows have been used to indicate possible relationships between the various variables of interest within this research and have been assigned to codify data found from case analysis. Within this cross case analysis, these arrows have the following meaning:

- The block arrow pointing right $\Longrightarrow$ indicates that from the case analysis it has been revealed that there *seems* to be a possible influence of the variable on the left side on the variable on the right side. That is the reason for choosing an arrow pointing to the right. Whether this influence can be considered significant or not for this research will be discussed later on.
- The block arrow pointing to both sides (left and right) $\Longleftrightarrow$ indicates that the case analysis showed that both variables on the left and on the right side *seem* to be equivalent to each other, or in other words similar or alike.

- The block arrow pointing to both sides (left and right) with a vertically inclined line ⇎ indicates that from the case analysis the variables on the left and on the right *do not seem* to be equivalent to each other and may be considered as distinctive variables.

An overview of the overall findings from case study 1 is shown in table 8, whereas those from case study 2 are shown in table 9.

Table 8: Overview of the findings from the analysis of Case study 1: Apple iPod vs. Microsoft Zune

<table>
<tr><th colspan="3">Case study 1: Apple iPod vs. Microsoft Zune</th></tr>
<tr><th>2001
(market adaptation phase)</th><th>2004
(market stabilization phase)</th><th>2007
(market stabilization phase)</th></tr>
<tr><td>Strategic behaviour ⇨ Performance
-- App. strategy -- market share
-- Timing of entry
-- Pricing strategy
-- Pre-emption of scarce assets
-- Distribution strategy
-- Marketing comm.</td><td>Strategic behaviour ⇨ Performance
-- App. strategy -- market share
-- Pricing strategy
-- Distribution strategy
-- Marketing comm.</td><td>Strategic behaviour ⇨ Performance
-- Pricing strategy -- market share
-- Distribution strategy
-- Marketing comm.</td></tr>
<tr><td>Strategic behaviour ⇨ Netw. Pos.
-- Timing of entry -- size
-- Distribution strategy -- diversity
-- App. strategy -- density
-- Pre-emption of scarce assets</td><td>Strategic behaviour ⇨ Netw. Pos.
-- Distribution strategy -- size
-- Marketing comm. -- diversity
-- App. Strategy -- density</td><td>Strategic behaviour ⇨ Netw. Pos.
-- Distribution strategy -- size
-- Marketing comm. -- diversity
-- density</td></tr>
<tr><td>Alliance strategy ⇔ BE strategy
-- shaping -- shaper
(core exploration) (dominator)</td><td>Alliance strategy ⇔ BE strategy
-- shaping -- shaper
(core exploration) (keystone)</td><td>Alliance strategy ⇎ BE strategy
-- stabilizing -- shaper
(core exploitation) (dominator)</td></tr>
<tr><td>Timing of entry ⇎ BE strategy
-- Wait-and-see -- reserving the right to play</td><td></td><td></td></tr>
<tr><td>Strategic behaviour ⇨ Netw. Pos.
-- BE strategy -- size
-- diversity
-- density
-- generic structure</td><td>Strategic behaviour ⇨ Netw. Pos.
-- BE strategy -- size
-- diversity
-- density</td><td></td></tr>
<tr><td>Strategic behaviour ⇨ Netw. Pos.
-- Alliance strategy -- size
(shaping/exploration) -- diversity
-- density</td><td>Strategic behaviour ⇨ Netw. Pos.
-- Alliance strategy -- size
(shaping/exploration) -- diversity
-- density</td><td></td></tr>
<tr><td colspan="2">Network characteristics from case analysis ⇎ Expected Network characteristics from theoretical evidence
-- size
-- diversity
-- density
-- generic structure</td><td>Network characteristics match with theoretical evidence for “Decisive battle phase”
-- size
-- diversity
-- density
• Decisive battle phase in the market stabilization phase instead of market adaptation phase.</td></tr>
<tr><td colspan="3">Data about structural holes and alliance degree were not obtained from the case study</td></tr>
<tr><td colspan="3">BE : Business ecosystem
Netw. Pos. : Network position
App. : Appropriability
Marketing comm. : Marketing communications
A ⇨ B : A seems to have an influence on variable B
A ⇔ B : A and B are equivalent/alike
A ⇎ B : A and B are not equivalent</td></tr>
</table>

Table 9: Overview of the findings from the analysis of Case study 2: SACD vs. DVD-A

Case study 2: SACD vs. DVD-A	
1999 **(market adaptation phase)**	**2003** **(market stabilization phase)**
Strategic behaviour ⇨ **Performance** *-- Timing of entry* *-- market share* *-- Distribution strategy*	**Strategic behaviour** ⇨ **Performance** *-- Distribution strategy* *- -market share* *-- Marketing comm.* *-- Commitment*
Strategic behaviour ⇨ **Netw. Pos.** *-- Timing of entry* *-- size* *-- Distribution strategy* *-- diversity* *-- density*	**Strategic behaviour** ⇨ **Netw. Pos.** *-- Distribution strategy* *-- size* *-- diversity* *-- density*
	Marketing comm. ⇔ **Commitment**
Strategic behaviour ⇨ **Netw. Pos.** *-- BE strategy:* *-- generic structure* *shaper(keystone)* *(core-periphery)*	Same as in 1999: Same BE strategy and role ⇨ same generic structure
Network characteristics ⇏ **Expected Network characteristics from theoretical evidence** **from case analysis** *-- size* *-- diversity* *-- density* *-- generic structure*	**Network characteristics match with theoretical evidence for *"Decisive battle phase"*** *-- size* *-- diversity* *-- density* • Decisive battle phase in the market stabilization phase instead of market adaptation phase.
Data about structural holes, alliance degree and alliance strategies were not obtained from the case study.	
BE : Business ecosystem **Netw. Pos. : Network position** **App. : Appropriability** **Marketing comm. : Marketing communications**	**A ⇨ B : A seems to have an influence on variable B** **A ⇔ B : A and B are equivalent/alike** **A ⇏ B : A and B are not equivalent**

4.1.2 VERIFICATION

During this analytical activity differences and similarities between both cases studies have been noted first, after which the empirical findings will be confronted to the existing theories from literature in order to draw conclusions.

Similarities and Differences between both cases

By comparing data from case study 1 to data from case study 2, some similarities and differences between both cases have been extracted. All these similarities and differences are summarized and displayed in Table 10 in respectively blue and green.

Similarities across the cases

The cross case comparison of both cases resulted in a number of similar features/similarities.

First of all, there is evidence that in both cases the pattern of Ortt and Schoormans (2004) has been applied for the analysis of the development and diffusion of a high tech product category/ technology. Also, in both cases technology standards battles between the main actors and their respective products/technologies have been analyzed, with the focus on the main actors and the business ecosystems around the core technologies.

Secondly, the main actors of the competing products/technologies in both cases introduced their products/technologies earlier in the market than their respective competitors. In the first case study Apple released the Apple iPod in 2001, whereas Microsoft released the Zune in 2006; and in the second case study Sony was seven months earlier with the SACD than the DVD Forum with the DVD-A and aimed. In addition, in both cases both main actors aimed at reaching the mass market with their products/technologies.

Thirdly, there is evidence that for the data analysis, two comparable data moments in time were chosen, namely the year of commercialization and the year when the technology standards battle took place. Considering the 'technology life cycle dimension', which is a combination of the models of Suarez (2004) and Ortt and Schoormans (2004) and which has been detailed by den Hartigh *et al.*(2010), there is empirical evidence that in both cases the decisive battle took place in the market stabilization phase and not in market adaptation phase.

Another similarity across both cases is the empirical evidence that standard support strategies, and in particular timing of entry, distribution strategy and marketing communications, seem to have influenced the performance over time. Over time, since the strategy timing of entry can only be pursued during the commercialization of a product/technology, which in both cases refers to the first data moment in time.

The sixth similarity is that in both cases evidence has been found that standard support strategies seem to influence network characteristics (size, diversity, density) over time. Based on the type of standard support strategy that has been pursued, the total number of actors, the type of actors and the linkages between actors in the network seemed to have changed. Same goes for the business ecosystem strategy that seems to have influenced on the generic structure of the network. However, whether these possible influences are valid or not will be discussed later in this chapter.

There is furthermore evidence that unlike the fact that financial performance was also supposed to be measured, market share was found to be the only performance indicator in both cases. Possible reasons are difficulties with the sources of evidence on financial performance of the firms of interest with regards to their respective products/technologies, as well as with the data collection methods.

Another similarity across the cases is the evidence that in both cases neither structural holes nor alliance degree was found. However, this does not mean automatically that these aspects of interest were not available at all. The lack of these aspects may be resulting from: (1) problems with the sources of evidence and data collection method; (2) the way these aspects have been defined in previous theories; and (3) the point of view and perception of the researcher during the data analysis. For example, from the analysis it can be concluded that the network characteristics size, diversity, density and generic structure have been found, but alliance degree and structural holes not. However, the analysis of the characteristics was quite difficult. When starting the case analysis, there were no exact guidelines about how to measure the network characteristics. To be more precise, there were no data about what can be assumed as a 'small', 'medium' or 'large' network etc. Same goes for structural holes and alliance degree. Perhaps it would be best to overcome this difficulty, by looking for the rationale behind measuring these network dimensions (characteristics)

and where needed, to create an inventory for what can be assumed as the standard measurement parameter(in this case network size, density, diversity, structural holes). Then, any researcher can refer back to the inventory, when analyzing network characteristics.
Finally, there is evidence that network characteristics from case analysis only matched with those for the 'decisive battle phase' according to theoretical evidence. For this evidence it can also be considered that perhaps reasons like (1) the researcher's perceptions of the various network dimensions such as size, diversity, density and generic structure, and (2) possible problems with the theory (in this research: theoretical evidence) may have influenced this empirical finding.

Differences across the cases

The cross case comparison of both cases also resulted in a number of differences.
To begin with, there is evidence that in the first case study there was a clear winner of the technology standards battle, whereas the second case study had no winner. In the first case study three data moments in time have been analyzed and in the second case study only two.

Thirdly, in the first case study it took 5 years before the technology standards battle between Apple iPod (released in 2001) and Microsoft Zune had started; in the second case the battle between SACD and DVD-A started shortly after the commercialization of the SACD.

There is also evidence that in both cases different types of standard support strategies seem to have influenced the performance and networks characteristics over time. For example, in the first case the standard support strategies appropriability strategy, pre-emption of scarce assets and pricing also seemed to be significant besides timing of entry, distribution strategy and marketing communications in possibly influencing the performance. On the other hand, in case 2, commitment seemed to be possibly influencing the performance besides timing of entry, distribution strategy and marketing communications.

Next, there is evidence that the business ecosystem strategy/role combinations were different in both cases, but still seem to result in the same core – periphery generic structure. In the first case Apple's role was that of a dominator, whereas Sony had the role of a keystone in the second case. Moreover, when Apple changed its role over time, the change in role seemed to have influenced the size, diversity, density and generic structure of the network as well. On the other hand, Sony exercised the same role in the next data moment in time and hence seemed to have the same generic structure. In this part again it may be assumed that perhaps the researcher's perceptions of the generic structure, and an indigent frame of reference for generic structure influenced this research outcome.

Furthermore, unlike the first case study, Hoffmann's alliance strategies were not found in the second case study. However, the reasons may stem from: (1) lack of data and (2) (biased) perception of the researcher during the data analysis. Lastly, the market share has been measured in percentages in the first case study, whereas due to lack of data the total number of released SACD titles has been taken as a measure for market share.

Table 10: Overview of the similarities and differences between both cases

Similarities and Differences between Case Study 1 & 2		
Similarities	**Differences**	
	Case study 1 ***Apple iPod vs. Microsoft Zune***	***Case study 2*** ***SACD vs. DVD-A***
Same topics involved: • Pattern of development and diffusion of a high tech product category/ technology • technology standards battle • business ecosystems		
Both Apple and Sony were first movers compared to their competitors and aimed at reading the mass market with their products.	A clear winner of the standards battle found: Apple iPod.	No winner: Both SACD and DVD-A have their own niche markets.
2 comparable data moments: • The year of Commercialization • The year when the technology standards battle was happening.	3 data moments in time chosen and analyzed.	Only 2 data moments in time chosen and analyzed.
Decisive battle took place in the market stabilization phase and not in market adaptation phase.	The battle started 5 years after the introduction of Apple's iPod.	The battle started shortly after the introduction of SACD.
Standard support strategies (particularly timing of entry, distribution strategy and marketing communications) seem to have an impact on performance over time in both cases.	Appropriability strategy, pre-emption of scarce assets and pricing also seemed to be significant.	Commitment also seemed to be significant.
Standard support strategies seem to influence network characteristics (size, diversity, density) over time in both cases.	• Commercialization: Besides timing of entry and distribution strategy, pre-emption of scarce assets and appropriability strategy from the standard support strategies seemed to influence the network characteristics (size, diversity, density). • Decisive battle phase: Distribution strategy and marketing communications seemed to have influenced the network characteristics (size, diversity, density).	• Commercialization: From the standard support strategies, only timing of entry and distribution strategy seemed to influence network characteristics (size, diversity, density). • Decisive battle phase: Only distribution strategy seemed to have influenced the network characteristics (size, diversity, density).
Business ecosystem strategies seem to have an impact on the network characteristic 'generic structure' in both cases.	• Commercialization: Business ecosystem strategy shaper-dominator may have resulted in the core – periphery generic structure of the Apple iPod network.	• Commercialization & Decisive battle phase: Business ecosystem strategy shaper-keystone may have resulted in the core – periphery generic structure of the SACD network.
	• Apple's business ecosystem strategy did not change over time, but the role did change.	• Sony's business ecosystem strategy and role did not change over time. As a consequence of

Similarities and Differences between Case Study 1 & 2		
Similarities	**Differences**	
	Case study 1 ***Apple iPod vs. Microsoft Zune***	***Case study 2*** ***SACD vs. DVD-A***
	The change in role seemed to have influenced the network characteristics (size, diversity, density and generic structure)	this, perhaps the generic structure remained the same. • Size, diversity and density seemed to have changed, but not because of the business ecosystem strategy and role.
Market share was the only performance indicator.	Market share in percentages.	Market share in total number of SACD titles released.
Data about structural holes and alliance degree were not found in both cases.	Hoffmann's alliance strategies found. Alliance strategy (shaping strategy) found to influence network characteristics size, diversity and density.	Hoffmann's alliance strategies not found.
Network characteristics from case analysis only matched with those for the 'decisive battle phase' according to theoretical evidence		

Results from Cross Case analysis

After listing all similarities and differences across the cases, the next analytical step was to confront the practical evidence with the existing theory/theoretical view. The idea was to constantly and iteratively compare theory with empirical findings until finding a theory/theoretical view which closely fits the empirical data. As stated by Eisenhardt (1989) "a close fit is important to building good theory because it takes advantage of the new insights possible from the data and yields an empirically valid theory".

When confronting the practical evidence with the theory, the following four outcomes are to be expected:

1. *The empirical findings seem to be <u>in accordance</u> with the existing theories*; where evidence from practical exploration seems to be confirmed by an extant theory. Eisenhardt (1989) states that similar findings may strengthen the confidence of the research, since it enhances the internal validity, generalizability, and theoretical level of theory building from case study research.

2. *The empirical findings seem to be <u>conflicting</u> with the existing theories*: where practical evidence and extant theory seem to be contradictory. According to Eisenhardt (1989) resolving contradictions forces researchers to reframe their perceptions and style of thinking in order to (1) discover the underlying reasons for the contradictions, and (2) to gain a broader insight into the empirical evidence and the conflicting theory from literature. However, if conflicting findings are ignored by the researcher, the internal and external validity of the results may become dubious. Readers may be inclined to think that the results are either incorrect or characteristic to the specific cases within the research only.

3. *The empirical findings may be identified as previously unreported*; which means that one would be inclined to conclude that the empirical findings represent novel insights altogether ("discoveries"), since there seems to be no existing theory.
4. *The empirical findings may seem to be missing;* which means that existing theories do suggest particular phenomena, but the practical evidence that might verify or contradict the existing theories seems to be missing.

An overview of the results from the Cross case analysis can be found in Table 11 below.

Table 11: Overview of the results from Cross Case analysis

Results from Cross case analysis			
	Practical evidence from cross case analysis	***Theory [Source(s)]***	***Outcome***
1	Standard support strategies ⇨ Performance - market share	"A standard support strategy helps firms to promote their own technology and at the same time prevents the adoption of competing technologies. Standard support strategies are adopted in a market to win a standards battle".[van de Kaa, 2009: pg.18]	*In accordance*
2	Business ecosystem strategies ⇨ Performance - market share - shaper strategy (dominator/keystone)	"A firm can influence its own performance by selecting the right strategy (shaper, adapter or reserving the right to play)". [den Hartigh, & van Asseldonk, 2004]	*In accordance*
3	Standard support strategies ⇨ Network Position - size - diversity - density		*Previously unreported*
4	Business ecosystem strategies ⇨ Network Position - shaper strategy (dominator/keystone) - size - generic structure - diversity - density	"Generic research framework": market structure and firm performance, mediated by the business ecosystem strategy the firm follows. [den Hartigh, & van Asseldonk, 2004: pg. 27] "Network structure can be measured along dimensions like network size, connectivity, concentration and entropy." [van Asseldonk, den Hartigh & Berger, 2003]	*In accordance*
5	Alliance strategies ⇨ Network Position - Shaping strategy - size - diversity - density	"Configuration of alliance portfolio based on type of alliance strategy" [Hoffmann, 2007: pg. 836] However, instead of size, diversity and density other configuration parameters have been used (Number, Dispersion, Redundancy, Linkage intensity of alliances)	*In accordance*
6	No indication found of any possible influence of Alliance strategies on performance.	Alliance strategies influence Performance [Hoffmann, 2007]	*Missing*
7	No indication found of any possible influence of network position on performance.	Network position influences Performance [Venkatraman *et al.*, 2008; Zaheer & Bell, 2005; Tsai, 2001; Ahuja, 2000]	*Missing*
8	"Decisive battle phase" in the market stabilization phase.	"Decisive battle phase" in the market adaptation phase: Technology life cycle dimension [den Hartig *et al.*, 2009: pg. 5]	*Conflicting*
9	Only retrieved network characteristics from case analysis for the 'decisive battle' phase match with Expected network characteristics from theory.	Table: "Overview of Networks characteristics during the Technology Life cycle" [den Hartigh *et al.*, 2009: pg. 14]	*Conflicting*

Remarks on Table 11

The main findings from the practical exploration have been listed in the first column. The block arrows pointing right in this column indicate that there *seems* to be a possible influence of the left sided variables on the right sided variable. For each empirical finding it has been noted which theory the finding has been compared to. This is presented in the second column of table 4. References to the sources to those theories have been provided there too. For the empirical finding where no theory seems to be available, the column has been left blank. The third column provides the four previously mentioned possible 'outcomes' from the confrontation of empirical findings with existing theories: (1) in accordance, (2) conflicting, (3) unreported and (4) missing.

4.2 DISCUSSION

4.2.1 FINDINGS FROM CROSS CASE ANALYSIS

As can be seen in table 11, comparing the empirical data to theories produced the following outcomes from the cross case analysis:

1. The empirical finding that *standard support strategies* seem to have a possible impact on *performance* seems to be *in accordance* with theory from the research study conducted by van de Kaa (2009).
   According to van de Kaa (2009) standard support strategies help firms promoting their own technology and preventing the adoption of competing technologies. Standard support strategies can results in gaining market dominance and winning a standards battle. As mentioned before, dominance is defined by Suarez (2004) as achieving a market share of more than 50%.

2. The empirical finding that *business ecosystem strategies* seem to have a possible impact on *performance* seems to be *in accordance* with the theory of den Hartigh & van Asseldonk (2004).
   In their paper the authors proposed a research framework to study the relation between network structure, firm strategy and the pattern of innovation diffusion. They theorized that a firm in a business ecosystem can influence its own performance by selecting the right business ecosystem strategy.

Since the empirical findings 1 and 2 from the cross case analysis seem to be *in accordance* with the existing theories of van de Kaa (2009) and den Hartigh & van Asseldonk (2004), one may be inclined to conclude that there is indeed a possible relationship between strategic behaviour- in particular standard support strategies and business ecosystem strategies- and performance. However, the credibility of this conclusion is questionable. The following questions have to be considered before drawing conclusions:

- "How reliable is the evidence from existing theory?"
- "Is the practical evidence correct?"
- "Are there other factors (internal or external of the research scope) that may have influenced the outcomes of the research"?
- "Are the chosen research strategy, data collection methods and data analysis techniques appropriate for this research?"

- "Was the selection of cases appropriate?"
- When performing the case study, has the researcher taken account of bias?", where 'bias' is any trend in the collection, analysis, interpretation, publication or review of data that can lead to conclusions that are systematically different from the truth.

This leads us to the main conclusion that there are practical difficulties when conducting case study research such as bias, problems with data or with the (used) theories/theoretical perspectives or with the research approach.

To elaborate a bit more on these practical difficulties, let us consider outcome 1, where practical evidence that standard support strategies seem to influence the performance seems to be in accordance with the theory of van de Kaa (2009). It can be said that there may be *biases in the collection, analysis and interpretation of the data*. First of all, the *selection of the cases* was based on selection criteria like (1) similarity between cases, (2) preliminary evidence that the cases comprise of the characteristics that match with the objective of the research, and (3) Richness of the available data. Based on these criteria the two cases were selected. Each case study had been conducted and presented in the form of reports by students and those reports have been used for this research. However, analyzed data (such as the hallmarks of the technology life cycle or the evolution of the business ecosystem/network over time) that have been adopted for this research by those students may be biased, based on how data has been collected, analyzed and inferred by the authors of the report. Take for example the hallmarks and phases of the technology life cycle. Based on the hallmarks, the different phases of the technology life cycle can be distinguished. The three hallmarks are 'invention', 'initial market introduction/commercialization' and 'large-scale production and diffusion'. Invention marks the start of the innovation phase, 'commercialization' marks the beginning of the market adaptation phase and 'large-scale production and diffusion' marks the start of the market stabilization phase(Ortt and Schoormans 2004).From the three hallmarks, the third hallmark is less clear and difficult to be defined. This hallmark may have been incorrectly defined in the case studies, based on the data sources that have been used. The authors have used scientific information available on the Internet (websites of the companies involved and other reliable sources) during data collection and data analysis. However, some of the very *reliable* looking sites can also provide completely *wrong information*.

Another type of bias could have come from the ways the authors of the reports interpreted the data, which means that subjective judgments may have been placed upon the data. This perception or interpretation is considered as biased and has been pointed out as the *'biased viewpoint effect'* by Hutjes & Van Buuren (1992). Therefore it can be said that it is very much possible that biased data may have been used.

Another form of bias may have taken place by the researcher during the case analysis, particularly the decision to select the firms Apple and Sony in respectively the first and second case study as focal firms. To elaborate a bit more on this, the following can be said. In the first case study, Apple has been chosen as the focal firm, because the report for that case study had also focused on Apple's strategies and the iPod business ecosystem over time and also because Apple's iPod was the clear winner of the battle. So therefore Apple was analyzed further in this research. However, perhaps it would have been good to take Microsoft as focal firm and analyze the case from that point of view. Or why not looking at the strategic behaviour, network positions and performance of Apple's partners? Nevertheless, case studies are criticized for being time consuming (Yin, 2003; Eisenhardt, 1989) and this appeared to be true during this research. It took loads of time to analyze the case

studies even though the reports were there, because (1) every source had to be verified first and then also (2) backwards and forwards search took place based on the bibliographies provided in the reports, and (3) additional sources of evidence had to be gathered to get more data. So if other firms would have been chosen as focal firms, it would have meant to start from complete scratch, which means more time consuming. Therefore it can be said that the researcher's *choice of firm as focal firm*s may be considered biased.
Another form of bias occurred during data analysis when deciding on the data moments in time for which all the operational measures would be analyzed. The first data moment in time in both cases referred to the year of commercialization. It is then obvious that 'timing of entry' has been noted by the researcher as a standard support strategy pursued by the respective firms to gain market share quickly. But what if another data moment in time was chosen, like for example one or two years before the year of commercialization? Would 'timing of entry' then be noted as strategy? Most probably not! Therefore it can be said the *(biased) choice of data moments in time* to be reviewed/analyzed seems to have influenced the outcome.
Lastly, like said for the authors of the reports of the case studies, the biased perception or *'biased viewpoint effect' also applies to the researcher*. The way data has been interpreted by the researcher as for example possible strategies pursued by the firms, and if and how those strategies influenced the market share is subjective to the researcher's own opinion and understanding.

When we look at outcome 2, the following can be said. According to den Hartigh & van Asseldonk's (2004) choosing the *right* business strategy influences the performance. From practical evidence it has been found that both firms had pursued the business ecosystems strategy shaper strategy, but with different roles (either keystone or dominator). However, the theory does not tell what the 'right' strategy is. Thus, that shaper strategy seemed to influence firm performance in both cases does not automatically mean that the shaper strategy was the 'right' strategy. Also, from both case studies there is evidence that both Apple and Sony pursued shaper strategy, but during all data moments in time Sony exercised the role of a keystone, whereas Apple changed its role from dominator to keystone to dominator again over time. What is then exactly the role of a keystone or dominator and does the role also influence the performance? These questions should be considered before concluding if the business strategy really seems to influence performance. This shows that there may be *problems with the theory*, which may have influenced the outcome. Therefore more emphasis is needed on keystones or dominators and on the influence of the role of a keystone or dominator on performance when pursuing shaper strategy.

3. The empirical finding that *standard support strategies* seemed to influence *network characteristics size, diversity and density* seems to be <u>*previously unreported*</u>. There seems to be no existing theory confirming or contradicting this evidence, however, this does not automatically mean that the case research resulted in a new theory. A possible reason for no match maybe coming from for example a data problem like using a limited number of scientific literature. This data problem will be further referred to as '*data limitation*'. Perhaps delving deeper into the literature would result in finding similar (or conflicting) literature that could be linked to the empirical evidence for theory development. In addition, not only data limitation is then a critical problem, but also the underlying reason for this data limitation, which refers to the undertaken *research approach* for conducting the case studies. This can be explained as follows. When constructing the research design, only specific selection criteria for literature research

have been used. Based on those criteria, only a number of extant literature has been selected to be reviewed during the literature review phase.

4. The empirical finding that business ecosystems strategy *shaper strategy (keystone/dominator role)* seemed to influence the network characteristics size, density, diversity and generic structure seems to be *in accordance* with theory from the research study conducted by den Hartigh & van Asseldonk (2004).
   In their paper about studying the relation between network structure, firm strategy and the pattern of innovation diffusion, den Hartigh & van Asseldonk (2004) explained that 'network structure' can be measured along dimensions like network size, connectivity, concentration and entropy and for the rationale behind measuring these dimensions, they referred to the paper by van Asseldonk, den Hartigh & Berger (2003), which was presented at the ECCON 2003 annual meeting. This tends to lead us to the conclusion that shaper strategy may have an impact on the size, density, diversity and generic structure of the network. However, if this conclusion is justified by the data, is questionable. In addition, it seems odd that both firms pursued the same business ecosystem strategy (shaper strategy) but exercised different roles and still in both cases the network characteristics were influenced. What is the impact of the role of dominator or keystone then in this context? As mentioned previously, for this research it is actually important to consider what the role of a keystone or a dominator exactly is. In addition, how dominators or keystone influence network characteristics precisely is something that is yet to be explored. This refers to a possible *theory problem*.
   Furthermore, it has to be noted that again the *bias in the interpretation of data by the researcher ('biased viewpoint effect')* might have influenced the data analysis. For example, let us consider how the network characteristics have been analyzed by the researcher. The table "Overview of Networks characteristics during the Technology Life cycle" from the paper by den Hartigh *et al.* (2009) has been used as reference point. Within the tables it has been described what the expected network characteristics should be during each phase of the technology life cycle. However, the researcher judged the network characteristics such as size, diversity, density and generic structure (found from the case) according to its own perception of the network dimensions during the first data moment in time, and analyzed the ones for the other data moments in time by comparing it how it was analyzed for the first data moment. This shows that the outcomes may be biased, based on the perception of the researcher. This also means that there is a theory problem, since clear definitions of all operational measures are needed in order to indicate how they can be measured and analyzed when conducting case studies. Therefore it can be said that basically the biggest practical difficulties here are bias in perception and theory problem, which also seem to be intertwined.

5. From Case study 1 it was found that alliance strategy (i.e. shaping strategy) seemed to influence the network size, diversity and density. This practical evidence is *in accordance* with Hoffmann (2007) theory. Hofmann argued that the alliance strategy influences the configuration of the alliance portfolio. The configuration of the alliance portfolio is measured by the configuration parameters Number of alliances, Dispersion of alliances, Redundancy of alliances and Linkage intensity of alliances. Size and diversity can be assumed to be similar to number and dispersion and redundancy is related to density, since redundancy is directly influenced by the density of the focal firm's network (Hoffmann, 2007). Therefore according to Hoffmann's theory and the

practical evidence from case analysis, it may be concluded that alliance strategy influences network position. However, this evidence has only been found in one case. Drawing conclusions from one single case is not considered justified. What could also be a possible problem is *data limitation*. In this case this refers to data limitation for case study 2, where no such evidence was found. Perhaps using more sources (like reliable web sources, papers or publications about the SACD vs. DVD-A battle etc.) would have produced more data.

In addition, perhaps the *research approach* is also a possible practical difficulty here. Before conducting the research it was decided to go for a multiple case design, where two cases had been selected to be analyzed. Perhaps a more in-depth single case study would have been more fruitful, which in this research means exploring either case study 1 or 2 in more detail. Another option could be to select more cases for the analysis in order to see if similar or dissimilar findings can be found. Finally using other sources of evidence would also yield more data. Perhaps using or other sources of evidence like interviews may have resulted in more valuable evidence from both cases, which would increase the validity of this outcome. This indicates that perhaps the research approach has to be modified to consider alternative ways to accomplish the research objective.

6. Hoffmann (2007) showed that alliance strategies influence performance; however empirical evidence from the case analysis to verify or contradict this theory seemed to be *missing*, most possibly due to lack of data (*data limitation*), biased data selection and analysis *(bias),* and *research approach*. Perhaps using more sources of evidence like interviews would increase the amount and reliability of data to be used, which would further produce valuable and convincing evidence.

7. Although many researchers showed the relationship between network position and firm performance (Venkatraman *et al.*, 2008; Zaheer & Bell, 2005; Tsai, 2001; Ahuja, 2000), empirical findings to confirm or contradict any such relationship is seemed to be *missing*. Again it can be considered that *bias, data limitation,* and *research approach* may have resulted in no empirical evidence.

8. There is practical evidence that in both cases the technology standards battle seemed to happen during the market stabilization phase. However, according to the 'technology life cycle dimension' that has been presented in the conference paper by den Hartigh *et al.*(2009) and has been adopted for this research during data analysis, the "decisive battle phase" takes place during the market adaptation phase (See figure 4).
   This means that the empirical evidence and existing theory are *conflicting*. Nonetheless, instead of being inclined to conclude that the retrieved empirical evidence is incorrect, perhaps it would be a good option to reconsider the theory behind the 'technology life cycle dimension'. The technology life cycle dimension is a combination of Suarez' model (Suarez, 2004) and the model of Ortt and Schoormans (2004) and can be used for analyzing technology standards battles. As can be seen in Figure 4, the phases Ia, Ib, IIa, IIb and III are the five phases distinguished by Suarez (2004); and the phases I, II and III are the three main phases as distinguished by Ortt and Schoormans(2004). Some critiques on this combined model can be posed by the following questions. "Why is the combined model constructed like this?"; "Why should the 'decisive battle' phase happen in the market adaptation phase?"; "Is it not possible that a second battle can start

when a particular product has already achieved dominance in the market?" If we look back at the first case study of Apple iPod vs. Microsoft Zune, shortly after its introduction in 2001 the iPod achieved dominance over the other competing products during that time. Being a late entrant, Microsoft entered the market with the Zune in 2006, five years later than the iPod, and at that time the iPod was already was already the most favorite MP3 player amongst users and appeared to be in the market stabilization phase. This may lead us to the assumption that the 'timing of entry' of the Zune at a later stage resulted in the 'decisive battle' phase being at variance with the theory. Taking all the above into consideration, it can be assumed that there seems to be a theory problem, and that the combined model ('technology life cycle dimension') should be re-evaluated again. To be more precise, certain assumptions should be included; for example when using the 'technology life cycle dimension' to analyze a technology standards battle, it can perhaps be assumed that it is possible that the analyzed situation can be at variance with the 'technology life cycle dimension' depending on particular factors, like the 'timing of entry' of competing products/technologies. As mentioned before, in the first case study the timing of entry of the Zune resulted in a battle in the market stabilization phase.

9. The retrieved network characteristics from case analysis only seem to match with 'Expected network characteristics' from theory (den Hartigh *et al.*, 2009) for the 'decisive battle phase'. Therefore it can be said that the empirical findings and theory are *conflicting*. However, in this case we should again consider problems that might have influenced this outcome. As mentioned before in point 4, it has to be noted here again that perhaps *bias in the interpretation of data by the researcher ('biased viewpoint effect')* may have produced this conflicting outcome. The networks characteristics have only been analyzed based on the researcher's own perception of what a "small", "medium" or "large" network size is; or what can be seen as a network having a "low", "medium" or "high" diversity/density. This again brings us to the *theory problem*. In their paper, den Hartigh *et al.* (2009) mentioned the expected network characteristics during the different phases; however there guidelines for future researchers on how to measure those expected network characteristics are not included. In other words, there are no indications about what can be defined as a "small", "medium" or "large" network size; or as a network having "low", "medium" or "high" diversity/density. This made it difficult for a researcher to analyze the network characteristics, because the analysis is then based on the perception of the researcher regarding these characteristics ('biased viewpoint effect'). This then leads to the fact that empirical evidence seems to be conflicting with theoretical evidence. Thus, it can be concluded that two problems that might have affected the outcomes of the research should be taken into consideration: theory problem and bias (biased viewpoint effect/perception).

During the discussion of the results from the cross case analysis, after confronting the practical evidence to theoretical evidence, some possible problems/practical difficulties have been identified as having influenced the outcome (in accordance, conflicting, previously unreported or missing). Even if the practical evidence seemed to be *in accordance* with the theory, the credibility of that outcome has been judged by possible problems/practical difficulties. These include bias in the collection, analysis, interpretation of data; data limitation; theory problem and research approach.

Table 12 is an extended version of Table 11, because it provides a complete overview of the results from the cross case analysis, but with the practical difficulties for each outcome included.

Table 12: Evaluation of the results from cross case analysis (including possible practical difficulties)

Results Cross case analysis				
	Practical evidence from cross case analysis	***Theory [Source(s)]***	***Outcome***	***Possible problem/ Practical difficulty***
1	Standard support strategies ⇨ Performance - market share	"Standard support strategies are adopted in a market to win a standards battle." [van de Kaa, 2009: pg.18]	*In accordance*	1. Bias in the collection, analysis, interpretation of data: • During data collection: - biased selection of cases, based on selection criteria - biased data from case reports (analyzed hallmarks, network figures/graphs over time for the involved firms), based on (1) reliability of used data sources by the authors of the case reports or by (2) their subjective judgments (perception/ 'biased viewpoint effect') • During data analysis: - (biased) choice of focal firm - (biased) choice of and data moments in time; - biased interpretation of the researcher ('biased viewpoint effect'/ biased perception)
2	Business ecosystem strategies - shaper strategy (dominator/keystone) ⇨ Performance - market share	"A firm can influence its own performance by selecting the right strategy (shaper, adapter or reserving the right to play)" [den Hartigh, & van Asseldonk, 2004]	*In accordance*	1. Theory problem: • Apple (case study 1) & Sony (case study 2) both pursued shaper strategy, exercised different roles (keystone/dominator), but their performance seemed to be influenced. • What a keystone/ dominator is and how either role affects the performance has not been mentioned in the theory.
3	Standard support strategies ⇨ Network Position - size - diversity - density		*Previously unreported*	1. Data limitation: • Use of a limited number of scientific literature 2. Research approach: • selection criteria for literature research

Results Cross case analysis				
	Practical evidence from cross case analysis	***Theory [Source(s)]***	***Outcome***	***Possible problem/ Practical difficulty***
4	Business ecosystem strategies ⇒ Network Position - size → - diversity - shaper strategy (dominator/keystone) → - density - generic structure	"Generic research framework": market structure and firm performance, mediated by the business ecosystem strategy the firm follows. [den Hartigh, & van Asseldonk, 2004: pg. 27] "Network structure can be measured along dimensions like network size, connectivity, concentration and entropy" [van Asseldonk, den Hartigh & Berger, 2003]	*In accordance*	1. Theory problem: • How behaving like a keystone/ dominator may influence network characteristics exactly is not mentioned. • Clear definitions of the network characteristics and how to measure them are not stated. 2. Bias in interpretation of data/perception of researcher: • The researcher's own perception of the network dimensions such as size, diversity, density and generic structure may have influenced the outcome (biased perception/biased viewpoint effect).
5	Alliance strategies ⇒ Network Position - Shaping strategy → - diversity - size → - density	"Configuration of alliance portfolio based on type of alliance strategy" [Hoffmann, 2007: pg. 836] However, instead of size, diversity and density other configuration parameters have been used (Number, Dispersion, Redundancy, Linkage intensity of alliances)	*In accordance*	1. Data limitation: • Evidence from one case is not considered enough to draw conclusions. • Use of a limited number of sources (esp. for the 2nd case study) 2. Research approach: • A more in-depth single case study needed. • Conduct more case studies. • Other sources of evidence needed, such as interviews.
6	No indication found of any possible influence of Alliance strategies on performance.	Alliance strategies influence Performance [Hoffmann, 2007]	*Missing*	1. Bias in the collection and analysis of data: • biased data selection • biased data analysis 2. Data limitation: • Use of only two sources of evidence 3. Research approach: • Other sources of evidence needed, such as interviews.
7	No indication found of any possible influence of network position on performance.	Network position influences Performance [Venkatraman *et al.*, 2008; Zaheer & Bell, 2005; Tsai, 2001; Ahuja, 2000]	*Missing*	
8	"Decisive battle phase" in the market stabilization phase.	"Decisive battle phase" in the market adaptation phase: Technology life cycle dimension	*Conflicting*	1. Theory problem: • Critique on 'technology life cycle dimension' - "Is it not possible that a second battle can start

Results Cross case analysis				
	Practical evidence from cross case analysis	***Theory [Source(s)]***	***Outcome***	***Possible problem/ Practical difficulty***
		[den Hartigh *et al.*,2009: pg. 5]		when a particular product has already achieved dominance in the market?" - 'Technology life cycle dimension') should be re-evaluated again, leading towards certain assumptions about the technology life cycle dimension, like factors influencing the phases.
9	Only retrieved network characteristics from case analysis for the 'decisive battle' phase match with Expected network characteristics from theory.	Table: "Overview of Networks characteristics during the Technology Life cycle" [den Hartigh *et al.*,2009: pg. 14]	*Conflicting*	1. Theory problem: • Difficulty analyzing network characteristics, since clear definitions and how to measure them are not mentioned in the used paper. 2. Bias in interpretation of data: • The researcher's own perception of the network characteristics size, diversity, density and generic structure may have influenced the outcome (biased perception/biased viewpoint effect).

4.2.2 QUALITY OF THE RESEARCH

Now that the findings of the case study research have been discussed, it is important to evaluate the quality of the research. When evaluating the quality of the research, the objectives of the research have to be considered. The research objectives were "to evaluate to which extent the case study approach is suitable to investigate the core concepts and to examine whether there is a relation between strategic behaviour, network position and firm performance", and "to determine and propose the best research design for future researchers who might attempt to conduct a case study research to explore a similar research topic by making use of the same collection of available case reports".

According to Yin (2003) there are four generally employed quality criteria to evaluate the quality of a case study research, namely construct validity, internal validity, reliability and external validity. The first three criteria together determine the internal quality of the research, whereas the external quality is determined by the external validity. These criteria are briefly defined, after which they are evaluated for this research:

1. *Construct validity* deals with the question whether the research questions and research objectives have been fully addressed when designing the case study. It refers to establishing correct operational measures of the concepts being studied. Some techniques to ensure construct validity according to Yin (2003) include using multiple sources of evidence (data source triangulation), and having drafts reports of the case studies reviewed by "key informants".

   In this research the three concepts being studied were strategic behaviour, network position and performance. For each of these concepts operational measures had been established, which have been classified as 'aspects': aspects of strategic behaviour, aspects of network position and aspects of performance. For example, as operational measures or aspects of strategic behaviour 'standard support strategies', 'alliance strategies' and 'business ecosystems strategies' have been utilized. Each of these constructs is sub-divided into various types of strategies. All aspects and sub-divisions are demonstrated in Table 13.

Table 13: Overview of operational measures of concepts being studied

<table>
<tr><th colspan="3">Operational measures</th></tr>
<tr><th>Aspects of Strategic behaviour</th><th>Aspects of Network position</th><th>Aspects of Performance</th></tr>
<tr><td>1. Standard support strategy</td><td>1. Network characteristics</td><td>1. Market share</td></tr>
<tr><td rowspan="2">Pricing strategy
Appropriability strategy
Timing of entry
Marketing communications
Pre-emption of scarce assets
Distribution strategy
Commitment</td><td rowspan="2">Size
Diversity
Generic structure
Density</td><td></td></tr>
<tr><td>2. Financial performance</td></tr>
<tr><td>2. Hoffmann's alliance strategies</td><td>2. Presence of structural holes</td><td rowspan="5"></td></tr>
<tr><td>Shaping strategy
Adapting strategy
Stabilizing strategy</td><td rowspan="2"></td></tr>
<tr><td>3. Business ecosystems strategies</td></tr>
<tr><td>Shaper strategy – dominator
Shaper strategy – keystone
Adapting strategy
Reserving the right to play</td><td>3. Alliance degree</td></tr>
</table>

In order to review the construct validity in this research, it seems relevant to evaluate if the correct operational measures have been established. As mentioned before, the researcher experienced difficulties with recognizing the operational measures 'alliance degree' and 'structural holes' during the within-case analysis. The underlying reason was that only definitions for 'alliance degree' and 'structural holes' were provided from the literature review, but the underlying guidelines/theories for how to measure these operational measures were missing. The network characteristics size, diversity, density and generic structure have been analyzed during the within case analysis, but as stated earlier, the perception of the researcher regarding these various operational measures may have influenced the outcomes of the research. This means that the researcher's own understanding of those operational measures may have affected the results. It can therefore be concluded that the operational measures for the concepts being studies have not been established correctly. Therefore in this research

construct validity seems to not completely ensured. To satisfy construct validity for this research the operational measures (See table 13), in particular the 'network characteristics' have to be explored further. This can take place by delving deeper into the literature and by defining measures for the 'network characteristics'. This will result in establishing the correct operational measures for the concepts being studied.

About multiple sources of evidence the following can be said. Yin (2003) classified six sources of evidence, such as documentation, archival records, interviews, direct observations, participant-observation and physical artefacts. (For more information regarding each source of evidence, see Chapter 3). From these sources of evidence, documents and archival records are used for this research. Besides the reports (of the selected cases), various additional sources like scientific articles/journals, financial reports (of the involved companies) and multiple (reliable) website sources have been used. Also, sources which were mentioned in the reports were validated and re-used again where needed in order to complete the cases for an in depth case description and analysis. So multiple sources of evidence are used, however the data that have been selected and analyzed for this research may have been affected by subjective judgments (of the previous authors/investigators) and can therefore be referred to as biased. According to Miles and Huberman (1994) bias can be reduced by triangulation of data. When conducting a case study triangulation of data can take place by collecting data from different sources, including documents, interviews, questionnaires, and observation (Yin, 2003; Darke *et al.*, 1998; Miles and Huberman, 1994). Therefore it can be concluded that to ensure the construct validity of this research, besides documents and archival records, other sources of evidence are needed. Most appropriate would be *interviews* with key persons, including managers or other important people, of the firms involved in the case studies (such as Apple and Sony). Moreover, some these interviewees, which then be referred to as "key informants", can be asked to review draft versions of the case study report, which would also ensure the construct validity.

2. *Internal validity* is the extent to which a certain causal relationship can be established, whereby certain conditions are shown to lead to other conditions, as distinguished from spurious relationships. A clear research framework and techniques like methodological triangulation (case study, surveys, interviews, etc.); cross case analysis and pattern matching logic are most commonly used to ensure the internal validity.

   In this research a case study approach, cross case analysis and pattern matching logic have been employed. Pattern matching or 'structural corroboration' refers to the process of searching certain symptoms belonging to a specific hypothesis in order to come to a valid and coherent context of interpretation of the situation. Since this research is exploratory of nature, no hypotheses have been formulated in the theoretical framework (Chapter 2). Nevertheless, the process of pattern matching has been used in this research, by comparing the empirical findings from the cross case analysis with the existing theories from literature. It may be considered that the outcomes of this research are influenced (i.e. analyzed and/or presented incorrectly) by problems with the data, theory, research approach and the perception or interpretation of the researcher. About the research approach it can be said that interviews as data collection method may have resulted in more data and would have overcome the data problem as well. In

this research interviews have not been conducted. A way to overcome these difficulties and to enhance the internal validity is continuous reflection on research outcomes during the research.

3. *External validity* or '*generalizability'* establishes a domain to which the findings of a research can be generalized to some broader theory. According to Yin, statistical generalization is not available from case studies, but analytical generalization is possible by techniques a literature review, multiple case study design, and within-case and cross-case analysis.

   In this research a multiple case study design has been used. Two cases have been conducted and analyzed to ensure the external validity. Pattern matching also took place by comparing practical evidence with theoretical evidence from literature. However, qualitative case studies are mainly criticized for their lack of objectivity and generalizability. As can be assumed, the use of these two case studies does not seem to be an adequate basis for generalizations. Most specifically because of the fact, that there have been practical difficulties which have affected the outcomes of the research. In order to satisfy external validity in this research a more in-depth review of literature is needed to analyze theories associated with the research topic.

4. *Reliability* is the extent to which the research process can be repeated by other researchers and whether the same research design will lead to similar findings. Techniques that are commonly used to ensure reliability on the research are: implementation of controls to evaluate the research outcomes and use of case study protocol, pilot cases and standard databases. One of the biggest critiques on case study research is the fact that it is somewhat difficult to demonstrate the reliability of the empirical findings through replication. In order to overcome this difficulty Yin (2003) emphasized that the case study researcher must demonstrate a 'chain of evidence' as each analytic step is conducted to increase the reliability of information in a case study. This may be achieved by creating an annotated bibliography of documents, and by explicit citation of particular pieces of evidence, as one shifts from data collection to within-case analysis to cross-case analysis and to overall findings and conclusions ("cross referencing" documents) (Yin, 2003; Darke *et al.*, 1998).

   In this research, the 'chain of evidence' has been demonstrated by recalling and linking the research objective, research question and case study approach. Besides, adequate citing of the case study database has been conducted through the case study 'write-ups', including endnotes and reference lists for each case study. However, as the findings of the research suggest, there seem to be practical difficulties that might have influenced the research outcomes. Therefore, to enhance the reliability of this research a thorough protocol for successfully undertaking, reporting and completing case study research has to be developed. This protocol should contain practical guidelines for all research procedures and should also emphasize on how to overcome significant practical difficulties associated with the conduct of the case study research.

4.3 CONCLUSION

This chapter detailed the cross-case analysis of the two case studies that have been conducted in this research and contains a comprehensive discussion on the findings from the research. After presenting an overview of the empirical findings from the case analysis (conducted in Chapter 3) in Table 8 and Table 9, all similarities and differences across the cases where displayed in Table 10. The final analytical step included a comparison of the empirical findings to the theories about strategic behaviour, network positions and performance (gathered from Literature Review in Chapter 2) and an overview of the research outcomes has been provided in Table 11.

The confrontation of the empirical findings to the existing theoretical views from prior literature resulted in research outcomes, belonging to four main research outcome categories:

1. The empirical findings seem to be *in accordance* conflicting with the existing theories:
    - The empirical finding that standard support strategies seemed to have a possible impact on performance seems to be in accordance with theory from the research study conducted by van de Kaa (2009).
    - The empirical finding that business ecosystem strategies seemed to have a possible impact on performance seems to be in accordance with the theoretical view of den Hartigh & van Asseldonk (2004).
    - The empirical finding that business ecosystems strategy shaper strategy (keystone/dominator role) seemed to influence the network characteristics size, density, diversity and generic structure seemed to be in accordance with theory from the research study conducted by den Hartigh & van Asseldonk (2004).
    - The empirical finding that alliance strategy (i.e. shaping strategy) seemed to influence the network size, diversity and density seemed to be in accordance with Hoffmann (2007) theory.
2. The empirical findings seem to be *conflicting* with the existing theories:
    - Practical evidence that in both cases the technology standards battle seemed to happen during the market stabilization phase. However, according to the 'technology life cycle dimension' that has been presented in the conference paper by den Hartigh *et al.* (2009).
    - The retrieved network characteristics from case analysis only seem to match with 'Expected network characteristics' from theoretical evidence (den Hartigh *et al.*, 2009) for the 'decisive battle phase'.
3. There was one empirical evidence that was identified as *previously unreported*, namely the evidence that standard support strategies seemed to influence network characteristics size, diversity and density.
4. The empirical findings were neither in accordance nor conflicting with existing theories, but instead *missing*:
    - There was no empirical evidence found that would verify or contradict the existing theory about alliance strategies influencing performance (Hoffmann, 2007).
    - There was no empirical evidence to verify or contradict the existing theory that network position may influence firm performance as researched Venkatraman *et al.* (2008), Zaheer & Bell (2005), Tsai (2001) and Ahuja (2000).

From the discussion of the findings it seemed quite apparent that the credibility of the findings was questionable because of practical difficulties like (1) Bias in the collection, analysis, interpretation of data (2) Data limitation, (3) Theory problem and (4) Research approach. An overview of all research outcomes, including the practical difficulties for each outcome has been presented in Table 12.

After discussing the outcomes from the cross-case analysis, the quality of the research was evaluated by employing the four quality criteria suggested by Yin (2003), namely construct validity, internal validity, external validity and reliability.

- *Construct validity*: In this research construct validity seems not completely satisfied. The reasons include: incorrect or incomplete establishment of the operational measures for the concepts being studied; and the use of only two sources of evidence. To ensure the construct validity delving deeper in the literature and using more sources of evidence, preferably interviews would be good.
- *Internal validity*: In this research, case studies, cross case analysis and pattern matching logic have been used to ensure the internal validity. However, the outcomes of this research seem to be influenced by the perception or interpretation of the researcher or by problems with the data, theory or research approach and therefore the internal validity test in not completely satisfied. Yet, the internal validity of this research can be increased by using other data collection techniques and continuous reflection on research outcomes.
- *External validity*: In this research only two case studies have been used and this does not seem to be an adequate basis for generalizations. Besides, there are also practical difficulties which have affected the outcomes of the research. To satisfy external validity a more in-depth of literature review is needed to analyze theories associated with the research topic.
- *Reliability* is very difficult to be demonstrated in case study research. In this research the researcher tried to demonstrate a 'chain of evidence', but because of the practical difficulties encountered during the research, the reliability is somewhat questionable. To enhance the reliability of this research a thorough protocol for successfully undertaking, reporting and completing case study research has to be developed.

On a concluding note it can be said that after the cross case analysis and discussion of findings it is evident that in order to get credible research outcomes it is important to consider all the above mentioned practical difficulties associated with attempting to successfully conduct case study research. Therefore an in-depth critique on each of the difficulties has to be conducted for this research in order to present convincing and credible research outcomes. This also leads the researcher towards attaining the second objective, which is to determine the best research design. The next chapter therefore elaborates on the practical difficulties encountered by the researcher during the research and also includes recommendation on the research design for future researcher who may attempt to undertake a case study research with a similar research topic.

5. RECOMMENDATIONS ONRESEARCH DESIGN

Case study research is the most commonly used qualitative and effective research method in order to get valuable insights and outcomes (Yin, 1994; Darke *et al.*, 1998; Eisenhardt, 1989). However, it is also considered difficult, since the researcher who undertakes a case study research has to face some challenges or practical difficulties (Darke *et al.*, 1998).
In the previous chapter, during the discussion of findings from the cross case analyses, four types of practical difficulties have been identified for this case study research by the researcher. These practical difficulties seemed to have possibly influenced the outcomes of this research and include: (1) Research approach, (2) Bias in the collection, analysis and interpretation of data, (3) Data limitation, and (4) Theory problem.

The purpose of this chapter is to provide an overview of the practical difficulties that have been identified during the cross case analysis in the previous Chapter; and to propose recommendations on the research design, which includes a systematic plan for future researchers on how to successfully undertake a case study research.

In the next four sections, the four practical difficulties have been explored in detail. For each difficulty definitions and an overview from what has been discussed in the previous chapter, have been provided first, followed by recommendations for overcoming those difficulties. Finally a methodical plan is proposed for future researcher to replicate the case study research but with more viable outcomes. This has been done by introducing a research protocol, proposing a research scenario and generating a “stylesheet” for future researchers. Finally the chapter ends with a conclusion, where everything that has been discussed has been summarized.

5.1RESEARCH APPROACH

In this section each phase (including all followed procedures) of the research approach(as illustrated in Figure 15) is described by referring to recommended procedures according to the literature, as well as through a discussion on how those procedures have been applied in this research. Then the practical issues regarding the research approach, as identified in chapter 4, are elaborated next including some recommendations for further research.

Research approach refers to the way this research has been approached by the researcher from start till conclusion of the research. An overview of the undertaken research approach for this research can be seen in Figure 15.

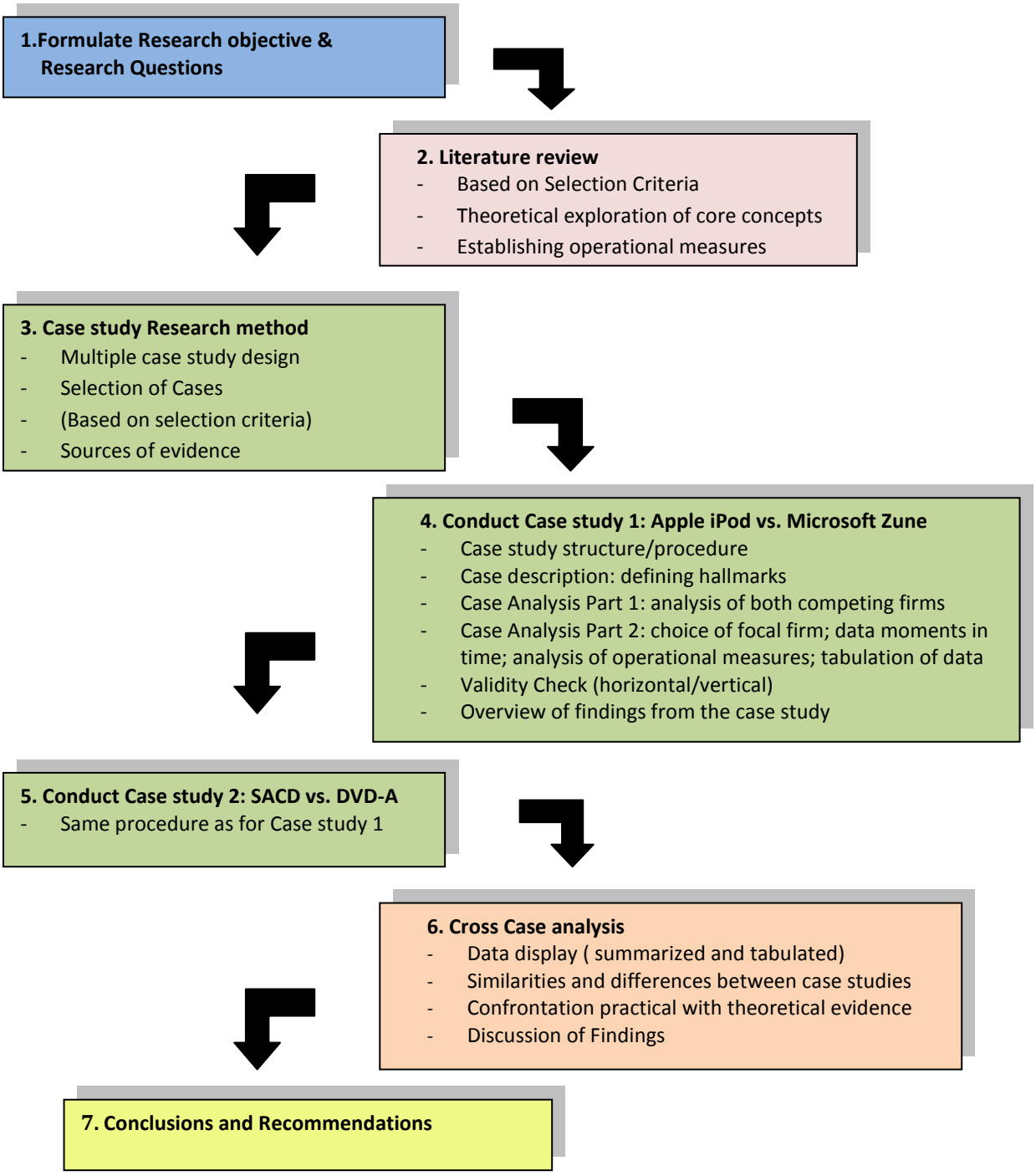

Figure 15: Research approach [author]

As can be seen in Figure 1, this research can be divided into seven phases. More details about each phase are described next.

1. Formulate Research objective & Research Questions

For this research the objective has been twofold: the first objective was "to evaluate to which extent the case study approach is suitable to investigate the core concepts and to examine whether there is a relation between strategic behaviour, network position and firm performance", and the second objective was "to determine and propose the best research design for future researchers who might

attempt to conduct a case study research to explore a similar research topic by making use of the same collection of available case reports".

The main research question was formulated as "*How to determine if and how a focal firm's strategic behaviour and its position within a network of interorganizational relations are related and impact the firm's performance over time?",* whereas various sub-questions have been formulated, focusing on how to investigate the core concepts of interest (strategic behaviour, network position, and performance) and the possible relationships between them.

2. Literature Review

In this research, after formulating the research objective and research questions, a comprehensive *Literature review* was conducted (which is presented in Chapter 2) to provide a solid theoretical foundation for the proposed study.

- For the literature review in this research, firstly a literature research was conducted. The literature research was based on certain selection (or screening) criteria (presented in Chapter 1), such as (1) using only scientific literature (books, high quality journals/papers); (2) up-to-date information; (3) content should contain academic theories on core concepts of interest: strategic behaviour, network position), and firm performance; and (4) Impact factor (IF), which provides a measure of the frequency with which the average article in a journal has been cited in a particular year.
- After the selection, the literature has been analyzed, which resulted in defining the core concepts of interest and establishing operational measures for the concepts (classified as aspects of strategic behaviour, aspects of network position and aspects of performance), for the empirical research.

A theoretical framework consisting of predicted relationships between core concepts and hypotheses is usually developed through the literature review in order to guide the empirical research. However, since in this research the focus was on exploration of the core concepts in order to get a better understanding this, no theoretical framework has been developed.

3. Case study research method

According to Yin (2003) the case study research method is "an empirical inquiry that investigates a contemporary phenomenon within its real-life context; when the boundaries between phenomenon and context are not clearly evident; and in which multiple sources of evidence are used".

- Considering the exploratory nature of the research questions in this research, case study seemed to be the apt research method here. What followed next was deciding on the most appropriate type of case study design for this research. Case studies can be either a single-case design or a multiple-case design (Yin, 2003; Darke *et al.*, 1998; Eisenhardt, 1989). In a multiple-case design more than one case is used to gather data and to draw conclusions from the empirical findings. Also, multiple-case designs allow cross-case analysis and may also enhance the validity of a study. Because of these reasons a multiple case design has been chosen in this research.
- For this research two cases were selected based on selection criteria such as:
    1) Similarity between cases: looking at cases that are comparable.
    2) Preliminary evidence that the cases comprise of the concepts that match with the objective of the research. To satisfy this condition a preliminary investigation into a number of possible cases made available for this research by the first supervisor of this

research project was first conducted. While doing the preliminary investigation the research objective and core concepts of interest were taken into account.

3) Richness of the available data: the cases should contain sufficient data for the analysis.

The selected cases are about high tech firms with their networks of inter-organizational relationships, which are engaged in technology standards battles with competitors during the technological life cycle of a high tech product category *[similarity]*. These cases illuminated best with the research question, since they seemed to contain sufficient information about the concepts of interest for this research (strategic behaviour, network positions, and firm performance) *[Preliminary evidence; richness of available data].*

- In order to collect data for the case study research, documents and archival records were identified as the two appropriate sources of evidence.

All the above mentioned steps have been detailed in Chapter 3.

4. Conducting Case study 1(Apple iPod vs. Microsoft Zune)

After the case study method had been determined, the next phase involved *conducting the first case study* (Apple iPod vs. Microsoft Zune) which started with the case structure/procedure and resulted in a "write-up" consisting of a case description, case analysis, validity check and overall findings from the case study.

- A case study structure/procedure was established to structure the descriptive and analysis part and present the "write-up" of the case study in an interesting and clear manner to the reader.
- In the case description, at first a background of the product/technology was provided, including definitions of the product/technology, networks and films (main actors) involved in the technology standards battle. Next, the technology life cycle, which provides an overview of the pattern of development and diffusion of the technology (including hallmarks and phases) (Ortt and Schoormans, 2004), was presented using Ortt and Schoormans' model.
- For Case analysis part 1, both competing firms have been analyzed during two specific data periods in time of the technology life cycle (determined by the researcher). For each specific data period, the aspects of network position, strategic behaviour and performance of each focal firm have been analyzed. Since this was a battle between the firms Apple and Microsoft, these firms have been selected as the focal firms. The 'technology life cycle dimension' is a combination of the models (about the phases during a technology cycle) determined by Ortt and Schoormans' (2004) and Suarez (2004), and has been applied to this research during data analysis. Moreover, aspects of network positions (i.e. network characteristics) have been analyzed by adopting a table from den Hartigh *et al.* (2009)'s paper, which depicted expected measures for each of the characteristics during each phase of the 'technology life cycle dimension'.
- In Case analysis part 2, only one firm was selected to be analyzed, in this case it was Apple. Three data moments in time were chosen by the researcher after which the analysis of the operational for every data moment in time all the operational measures took place. For this purpose, a table was constructed which contained all the operational measures in the rows and the data moments in time in separate columns. All findings from the case analysis were summarized and listed in the table.
- The next step was to validate the findings from the analysis through a horizontal and vertical check of all findings of the table in order to ensure that the analysis is based on correct and useful data and to find out if there are any irregularities.

5. Conducting Case study 2(SACD vs. DVD-A)

The *second case study* (SACD vs. DVD-A) was conducted in a similar way, by replicating the structure/procedure of the first case study.

6. Cross case analysis

Cross-case analysis refers to comparing data across cases in a multiple-case study design, in order to organize, analyze and reduce data retrieved from case studies in order to find patterns and to see if it fits with the existing theory (Miles & Huberman, 1994).

- Based on the findings from both case studies a cross case analysis was performed which first displayed the findings from both case studies in a more concrete and summarized way through tables.
- Based on the data from both cases, similarities and differences across both cases were determined and tabulated.
- Finally the practical evidence from both cases was confronted to theoretical evidence. This resulted in four types of research outcomes like the empirical evidence being either in accordance or conflicting with the theoretical evidence; or empirical evidence being previously unreported; or empirical evidence seemed to be missing.
- A discussion of the findings resulted in identification of some practical difficulties.
- Finally the quality of the research was assessed by the four quality criteria as mentioned by Yin (2003): construct validity, internal and external validity, and reliability.

7. Conclusions and recommendations

Conclusions and recommendations belong to the reporting part of the case study research. According to Tellis (1997) the researcher must avoid using technical terminology in this phase and must instead present clear explanations to the reader, which will help the reader in understanding the implications of the findings. This is the last phase of the case study research and has yet to be reached. According to the initial research approach after the discussion of findings from cross case analysis [phase 6], the research would be completed with conclusions and recommendations. However, since some practical difficulties have been identified which might have influenced the research outcomes, it became important to take a closer look at these difficulties and present possible procedures that could help future researchers to overcome these difficulties and successfully complete the case study research.

This current chapter (chapter 5) elaborates on the identified practical difficulties and provides recommendations on how to overcome them. More importantly this chapter provides recommendations on the research design, including a research protocol, research scenario and “stylesheet” for future researchers. After this chapter the case study research can be completed with conclusions and recommendations for further research.

Practical issues related to the undertaken research approach

In the previous chapter, it has been considered that there may be practical issues related to the undertaken research approach. In this sub-section those problems are discussed by referring back to the phases undertaken during the research approach for this research (See Figure 15); as well as including recommended procedures that could help future researchers.

1. As has been described in the previous section for Phase 2, before doing the literature review, a literature research was needed first. Certain *selection criteria* have been used to select the appropriate literature. However, based on those criteria a limited number of scientific literature has been reviewed and analyzed for this research. Perhaps it would be good to recommend the following paper of Levy and Ellis (2006), where the authors introduced a framework for conducting and writing an effective literature review. The framework consists of three main stages: 1) inputs (literature gathering and screening), 2) processing, and 3) outputs (writing the literature review). The authors also provide detailed instructions on how to conduct each stage effectively in order to get a solid literature review.

   The limited number of scientific literature (due to selection criteria for literature search [research approach] is regarded as another practical difficulty, namely, '*data limitation*'. Data limitation is discussed in the next section.

2. After the literature review and prior to the data collection and data analysis phase, usually a *theoretical research framework* is generated and presented by the researcher which includes the core concepts that have been explored through the literature review and the proposed links between them that have to be explored through data analysis. In this research no theoretical framework has been used. Only theoretical perspectives from previous research have been presented, including possible relationships between concepts (of interest for this research).
   This research has been exploratory by nature and used case study as research strategy. From the descriptions provided for the core concepts of interest and the identified relationships between the concepts, a theoretical framework can be developed or constructed and hypotheses can be formulated in order to guide the data collection and analysis.

3. Data collection methods may also have influenced the whole research process. In the current research literature research and case studies are used are data collection methods.
   - According to Yin (2003), the *selection of the case(s)* is probably the most critical step in doing a case study research. In this research, certain criteria for the selection of appropriate cases have been determined first by the researcher. Based on those criteria the two cases were selected (See Phase 3). However it has to be considered if selecting case study 1 and 2 was correct for this research, which means that it is possible that the selection of cases was biased, due to the used selection criteria. [This issue has been referred to in the previous chapter as 'biased selection of cases', which refers to a form of bias during data collection and is also a practical difficulty that will be discussed later on in this chapter.]
     In their paper Seawright and Gerring (2008) proposed seven techniques of case selection for case study research, also called 'case selection procedures'. These include the 'typical', 'diverse', 'extreme', 'deviant', 'influential', 'most similar', and 'most different' case method. Future researchers can try to identify and select useful cases for in-depth research by following either one of the proposed techniques.

   - As has been mentioned before, in phase 3 the researcher opted for a *multiple case study design*, where only *two cases* have been selected. According to the findings from chapter 4, perhaps another case study design would yield more data.
     - One option could be to use a multiple case study design, but to select more cases to explore the concepts. According to Miles and Huberman (1994), multiple cases increase

generalizability and provide an opportunity for more refined descriptions, more powerful explanations and help in answering questions.

- Another option is to conduct a more in-depth single case study. This means that either case study 1 or case study 2 could be chosen to be explored in more detail. Or what could also be viable, is to look at a new case and conduct an in-depth single case study. In their paper, Atkins and Sampson (2002) have provided practical critical appraisal guidelines for the conduct of single case study research. Their paper may provide useful insights in how to undertake a single case study research.

- In case study research usually multiple *sources of evidence* are utilized to gather qualitative data and ensure validity (Yin, 2003; Darke *et al.*, 1998; Eisenhardt, 1989; Miles and Huberman, 1994). Yin (2003) proposed six sources of evidence for data collection in the case study research: documentation, archival records, interviews, direct observation, participant observation, and physical artifacts.
  In this research only the first two have been used as sources of evidence. Perhaps using interviews would lead towards more data. According to Yin (2003) conducting interviews is an important qualitative method to gather case study information. Before conducting interviews, the appropriate type of interview should be determined and an interview protocol, which contains the rules that guide the administration and implementation of the interview, should be carefully designed. Several researchers elaborated on how to effectively conduct case studies (with interviews as qualitative research method), which may be relevant for further research (Darke *et al.*, 1998; Tellis, 1997; Neale *et al.*, 2006).

The last two problems in the research approach 'case study design & number of cases' and 'sources of evidence' are identified as probable reasons behind other practical difficulty 'data limitation', which is discussed in the next section.

4. Problems with the data analysis techniques in this research may have influenced the research outcomes as well.
   - In the previous chapter it was concluded that the *selection of the focal firm* and the *selection of data moments in time* may have been biased. This means during phase 4 and 5 from figure 15 (Conducting case study 1 and 2). In the previous chapter this issue has been regarded as 'bias in the analysis of data' (biased choice of focal firm; biased selection of data moments in time).
     - *Selection of focal firm*: In the first case study Apple has been chosen as the focal firm, because the report for that case study had also focused on strategies pursued by Apple, iPod business ecosystem over time, and Apple's performance. Therefore Apple was analyzed further in this research. Future researchers may consider selecting Microsoft as the focal firm; or either one of Apple's or Microsoft's network partners as focal firm.
     - *Selection of data moments in time*: The first data moment in time in both case studies have been consciously chosen by the researcher as the year of commercialization of the product/technology (produced by the focal firm). However this suggests the presence of 'selection bias' here, because based on the selection of the data moments, certain operational measures have been found and noted by the researcher, which would not happen if other data moments had been chosen. The best example here is the 'timing of

entry strategy', which is only pursued by the firm for the first market introduction (commercialization).

As can be concluded from the previous discussion, the research approach has to be 'modified' in order to achieve better research outcomes. Modified in this context refers to bringing changes in each of the main phases that have been followed for this research. For each phase, all the practical issues related to the research approach have been posed along with possible recommendations for each practical issue.

Table 14 provides an overview of which phase has been explored in which Thesis Chapter. Moreover, for each phase, all the practical issues related to the research approach have been listed as well, along with possible recommendations for each practical issue.

Table 14: Overview of Phases, Thesis Chapters, Practical issues & Recommendations

Overview of Phases, Thesis Chapters, Practical issues & Recommendations				
Phase		**Chapter [x]**	**Possible practical issues**	**Recommendations**
1	Formulate Research objective & Research Questions	Introduction [1]	--	--
2	Literature Review	Literature review [2]	Selection criteria for literature research('data limitation)	Levy and Ellis' framework for conducting and writing an effective literature review [Levy and Elis, 2006]
			No theoretical framework used	Develop theoretical framework based on the research outcomes
3	Case study research method	Practical Exploration [3]	Case study design & Number of cases	Multiple-case design, but more than 2 cases; or a more in-depth single case study [Atkins and Sampson, 2002]
			Selection of cases	Select most appropriate technique for case selection [Seawright and Gerring, 2008]
			Sources of evidence	Also conduct interviews [Darke *et al.*, 1998; Tellis, 1997; Neale *et al.*, 2006]
4	Conducting Case study 1 (Apple iPod vs. Microsoft Zune)	Practical Exploration [3]	Selection of focal firm	Analyze other firms(network partners)
			Selection of data moments in time	Select other data moments in time
5	Conducting Case study 2 (SACD vs. DVD-A)			
6	Cross case analysis	Discussion of Findings [4]		
7	Conclusions and Recommendations			

5.2 DATA LIMITATION

In this section all the issues related to data limitation are discussed first, after which some recommendations are given on how to overcome them.
Data limitation refers to problems related to the data that has been collected and is associated with the availability and completeness of data. Availability refers to the extent to which data is available as scientific publications as well as reports. Completeness of data is a data dimension that refers to the extent to which data is *not* missing and deals with the "breadth, depth and scope of the information contained in the data" (Wang and Strong, 1996).

As has been pointed out in the chapter 4, it can be considered that data limitation influenced the outcomes of this research. The following practical issues regarding data limitation have been distinguished during this research:

1. *Limited number of scientific literature.* This refers to the lack of theoretical evidence due to the use of limited number of scientific literature, which can be seen as a problem with the *availability* of data. It has been mentioned in the previous section, the underlying reason for this limited amount of scientific literature can be traced back to the selection criteria for literature research. Because of this data limitation, the research resulted in the research outcome that practical evidence could not be compared to the existing theory, simply because there was no identified theoretical evidence.
   In order to overcome this practical issue, perhaps the selection criteria for literature research could be adjusted. This would make more data available coming from more scientific literature.

2. *Lack of case evidence.* This issue deals with the fact that data was either missing or incomplete and therefore influenced the research outcomes. Some examples referring to lack of case evidence in this research are as follows:
   - Data about alliance degree and structural holes have not been found from the case analysis.
   - Data about alliance strategies was only found in case study 1.
   - Market share in case study 2 could not be measured in percentages.
   - Financial performance was difficult to measure.

   The lack of case evidence shows that there is a problem with the *completeness* of data. Incomplete or missing data not only make comparison between cases difficult, but also reduces the generalizability from the cases. A possible reason for this lack of case evidence is the way data has been collection by the researcher (data collection methods).
   In order to deal with missing or incomplete data the following can be recommended:
   - In this research case data has been retrieved from the two case reports and documents and web sources related to those cases. Perhaps using more sources (like reliable web sources, papers or publications about the both battles: iPod vs. Microsoft Zune and SACD vs. DVD-A.) would have produced more complete data.
   - Other sources of evidence could be used, like interviews.

An overview of data limitation recognized in this research and possible recommendations have been provided in Table 15.

Table 15: Overview of Data limitation, Issues, Causes & Recommendations

Overview Data limitation, Causes and Recommendations			
Data limitation	***Issue/problem***	***Cause(s)***	***Recommendations***
Limited number of scientific literature	*Availability* of data	Research Approach: selection criteria for literature research	• Adjust selection criteria
Lack of case evidence	*Completeness* of data	Data collection methods	• Use more sources for the cases • Use other sources of evidence(i.e. interviews)

5.3 BIAS

This section elaborates on the practical difficulty 'Bias in the collection, analysis, and interpretation of data' and provides the practical issues related to this difficulty as identified in this research; and some recommendations to prevent or minimize bias in this (and future) case study research.

Bias refers to "any trend in the collection, analysis, interpretation, publication or review of data that can lead to conclusions which are systematically different from the truth" (Vermooten, n.d.). As has been mentioned in Chapter 4 and section 5.1 'Bias in the collection, analysis, and interpretation of data' has been identified as one of main practical difficulties during the research. The various practical issues related to bias in the collection, analysis and interpretation of data, in this research, are explained next.

1. *Bias in the collection of data*: refers to the following types of bias during data collection: 'biased selection of cases' and 'biased data from case reports'.

    - *Biased selection of cases*: The cases have been selected based on selection criteria like (1) similarity between cases, (2) preliminary evidence that the cases comprise of the characteristics that match with the objective of the research, and (3) Richness of the available data. For all available cases for this research (See Table 1), a preliminary analysis had been conducted first, See Table 19-22 (in Appendices 1-5). The selection criteria were established from the preliminary analysis. It is said to be biased selection of cases, since the case study reports of those cases have been used as documents for the conduct of the case studies. The reports had been made for a purpose other than the purpose of this research and information included in those reports are therefore based on satisfying that purpose.

    - *Biased data from case reports*: refers to "built-in bias" in the case reports. Data that had been analyzed by authors of the case reports (such as the hallmarks of the technology life cycle or the evolution of the business ecosystem/network over time) have been adopted for this research. However, depending on how data has been collected, analyzed and inferred by the students, it can be assumed that the data may be biased. This refers to biased selection and biased analysis of data by the authors of the reports, and also the 'biased viewpoint effect' of them. The authors have used scientific information available on the Internet

(websites of the companies involved and other reliable sources) during data collection and data analysis. However, there is no guarantee that the information provided on the web is completely *reliable.* During data analysis, subjective judgments may have been placed upon the data by those students.

2. *Bias in the analysis of data*: Two types of bias during data analysis include 'biased selection of focal firm' and 'biased selection of data moments in time'.
   - *Biased selection of focal firm*: Based on which firm has been analyzed in the case reports by the student, the focal firms have been selected. For example, in the first case study Apple has been chosen as the focal firm, because the report also focused Apple's strategies and the iPod business ecosystem over time and also because Apple's iPod was the clear winner of the battle. Future researchers may consider selecting another or more firms as focal firm. For example, besides Apple also one of Apple's network partners. Or Microsoft or Microsoft's partners as focal firm. This would not only yield in more data, but will also minimize bias.

   - *Biased selection of data moments in time*: The first data moment in time in both cases referred to the year of commercialization. This data moment in time has been chosen consciously by the researcher and this suggests the presence of bias. It is then obvious why 'timing of entry' has been noted down by the researcher as strategy that has been found for that data moment in time. It is therefore recommended to look at other data moments in time to investigate the aspects of strategic behaviour, network position and performance.

3. *Bias in the interpretation of data*: refers to the bias due to the *perception of the researcher.* This type of bias refers to 'biased viewpoint effect' which mainly influences the data collection and data analysis processes and leads to biased interpretations or conclusions.
   - The way data has been interpreted by the researcher is subjective to the researcher's own opinion and understanding. For example if and how certain strategies, pursued by the firms, possibly may have influenced the network characteristics or market share, is also based on the researcher's subjective view.

   - The perception about the measurements of the networks characteristics during the technology life cycle may have possibly resulted in empirical findings that contradicted the prior theoretical views from existing literature. Based on the researcher's own interpretation/understanding of for example a 'small', 'medium' or 'large' network; or a network with 'low', 'medium' or 'high' density/diversity, etc., conclusions about the characteristics of the networks from both case studies have been drawn.

Vermooten (Vermooten, n.d.) posed that proper research design, data collection technique(s), and data analysis methods may prevent or minimize bias.

5.4THEORY PROBLEM

This section elaborates on this practical difficulty and starts with the practical issues related to the theory that has been used in this research and provides recommendations on how to overcome the theory problem.

Theory problem refers to a problem with the applied theory or rationale behind the theory during this research. This practical difficulty has been identified as having influenced the research.
The following indications of theory problem have been identified in this research (In Chapter 4):

1. In this research 'measurement concepts' have been used for the within case and cross case analysis such as 'technology life cycle dimension' (See figure 4) or 'network characteristics belonging to specific phases'(See Table 3). The analysis of the networks characteristics was quite difficult. This theory problem can therefore be seen as a measurement problem. As mentioned before there were no exact guidelines about how to measure network characteristics. To be more precise when analyzing there was no reference data to what can be assumed as a 'small', 'medium' or 'large' network size; or 'low', 'medium' or 'high' diversity/density etcetera. Same goes for structural holes, where the measurement categories are 'few' or 'many' (See Table 16).

Table 16: Description and measurement categories of network characteristics

Aspects of network positions		
Network characteristic	**Description**	**Measurement categories**
Network size	The total number of actors supporting a specific technology/ standard	Small Medium Large
Network diversity	The different types/kinds (variety) of actors present in the network	Low Medium High
Network density	The number of connections in the network	Low Medium High
Structural holes	The spaces present in an actor's network of interfirm relationships when the focal actor is connected to other actors who are not connected to each other.	Few Many

Perhaps it would be best to overcome this difficulty, by looking for the rationale behind measuring these network dimensions (characteristics) and where needed, to create an inventory for what can be assumed as the standard measurement parameter(in this case network size, density, diversity, structural holes). Then, any researcher can refer back to the inventory, when analyzing network characteristics. For example, how can we define a network having a 'small' or 'large' size? Can we just define a network size as 'small' when there are less than 10 firms involved and a networks size as 'large' when there are more than 100 firms involved? It is perhaps not that simple. Strict definition of the measurement categories of the network characteristics depends on some other factors like the type of network or industry involved in the technology standards battle, as well as the different phases during the technology life cycle. It is recommended to look at a number of case studies, involving the same industries and types

of networks (similar cases) and define strict measurement categories based on those similar cases. This means that perhaps a preliminary research is needed aiming at reaching strict definitions for measurement categories.

2. Key definitions of for example the firm as a 'dominator' or 'keystone' within a business ecosystem and how dominators or keystones influence network characteristics are yet to be explored before concluding if a relationship actually exists between the role that has been exercised and the network position. Therefore by delving deeper into the theory a re-evaluation of the concepts can take place as well as new definitions for the various concepts can be established. This would not only overcome the theory problem, but also the problem arising from the perception of the researcher.

5.5 RECOMMENDED RESEARCHDESIGN

5.5.1 RESEARCH PROTOCOL

In the previous sections overviews have been provided of the practical difficulties and the recommendations for overcoming them. Considering those practical difficulties and recommendations and based on basic case study methodologies previously described by scholars (Yin, 2003; Eisenhardt, 1989; Darke *et al.*, 1998; Halinen and Törnroos, 2005; Tellis, 1997; Neale *et al.*, 2006; van der Velde & Anderson, 2004, etc.), a list of steps for a good case study research process has been synthesized and proposed in this section. This list represents specific issues that should be considered when attempting to undertake a case study research and has been termed 'research protocol'.

Before presenting the research protocol, an elaboration on practical difficulties when undertaking case study research described by Darke *et al.* (1998) is provided first.

According to Darke *et al.* (1998) researchers have to deal with five specific practical difficulties when undertaking case study research. These include:

1. *Selecting appropriate research areas for using the case study research approach*. This difficulty deals with the question if the case study research approach would be an appropriate research method of addressing the research issue or not. This can be explained as follows. Case study research may be appropriate for:
   - Research areas where examination and understanding of context is important. This refers to areas:
     - where there is little understanding of 'how' and 'why' phenomena occur
     - where understanding of the context of actions and experiences of individuals is important.
   - Research areas where phenomena are dynamic and not well understood or mature.
   - Research areas where constructs (terminology, common language) are not yet clearly developed or widely accepted.

Conversely, case study research may not be appropriate for research areas where understanding of how and why phenomena occur; or the context of actions and experiences of individuals is not of interest; where phenomena are rather mature; and where constructs are well developed.

2. *Designing, shaping, and scoping a case study research project in order to adequately answer a research question*.
   - For the design and scoping of a case study research, a comprehensive *literature review* is required to get an overview of the existing literature within the research area(s) and to position the research questions within the context of that literature.
   - After the literature review, appropriate *units of analysis* and *type of case study design* (single- or multiple- case design) have to be determined.
     - A unit of analysis refers to sources of information and may include an individual, a group, organization, or events or certain phenomena of interest within the research. The unit of analysis must be carefully selected in order to answer the research question adequately.
     - A 'single case' is established by the entire collection of data for one study the unit of analysis (Yin, 2003). A single-case design, where only one case will be conducted, offers richer description and a more in-depth investigation. On the other hand a multiple-case design uses more than one case and allows cross-case analysis and literal and theoretical replication.
   - Darke *et al.* (1998) also describe some other important practical issues that may influence the design and scope of a case study research project, which are related to the researcher. These include the purpose for undertaking the research project, the availability of resources to the researcher, and the required deliverable(s). For example, the author of this case study research project is a student researcher who wants to meet the requirements of a master research (MSc Thesis Project) in order to acquire a MSc title (*purpose*); with limited resources since it is an individual exploratory project where funding /sponsorship are not needed (*availability of resources*); and with a thesis as an end product (*required deliverable)* here.

3. *Obtaining the participation of organizations in a case study research*. This refers to the practical issues for a researcher when he wants to obtain the support of potential participant organizations in acquiring access to their people and resources for the purpose of the case study research.
   - Before starting, the researcher should send a covering letter to all potential participants with details about the nature, context and objective of the research project; as well as an outline of the research timeframe, an overview of the nature of the involvement of the case participants during the research project; and the expected research outcomes (highlighted as benefits for the participant organizations).
   - The benefits of participation in the research for the organizations should be made clear by the researcher before conducting research on the chosen case study sites.
   - Agreements need to be reached with the participant organization about the confidentiality of case study data and findings and of the identities of case study participants.

4. *Collecting case study data from case participants effectively and efficiently*. This difficulty takes places when *interviews* are selected as data collection method for the case study research. It

refers to how data from case participant can be collected in an effective and efficient way. The authors stress on the fact that collecting data from case participants is time consuming and also difficult. Therefore careful planning and use of time (of the researcher and case participants) is required. After data collection, documentation and organization of data is required. For this, a case study database (Yin, 2003), which will include all the case data or evidence, is apt.

5. *Establishing rigour in writing up case study research*. This difficulty deals with presenting the case and outcomes in an effective way to establish confidence in the research and its outcomes to the reader.
   - In order to show credibility to the reader, the researcher should present in detail all procedures towards achieving research results.
   - To establish validity in the view of the reader, the researcher must show a coherent point of view regarding the empirical findings. Evidence must be presented efficiently, but should also be carefully evaluated and supported with sound arguments. Besides, the reasoning behind each argument has to be logical. By doing so, rigour and reliability of the research are ensured.
   - A clear writing style can be adopted to present the evidence in an effective and efficient way.
   - What is more important is the fact that the case study should be presented convincingly and appealing to the reader.

Research Protocol

Based on Darke *et al.*'s classification (1998) and previously described basic case study methodologies by scholars (Yin, 2003; Eisenhardt, 1989; Halinen and Törnroos, 2005; Tellis, 1997; Neale *et al.*, 2006; Runeson and Höst, 2009; Soy, 1997; van der Velde & Anderson, 2004), the following research protocol for conducting a case study research successfully has been proposed. This research protocol consists of 5 important steps for successfully undertaking a case study research.

1. ***Formulating Research questions***

   The research questions address what is needed to investigated in order to achieve the research objective. The research objective indicates what is expected to be achieved from the (case study) research. Therefore research questions have to be specified based on the research objective. The Research questions are commonly framed as "who", "what", "where", "how", and "why". It is important to look at the nature (type) of the research questions to determine the relevant research strategy. In case study research the research questions are most likely "how" and "why" questions.

2. ***Theory***

   Theory serves as the necessary frame of reference to make the context of the research clear. This frame of reference also helps to conduct the research and to review the research outcomes (Runeson and Höst, 2009). Existing theories can be critically assessed through a comprehensive Literature review. The literature review process is defined by Levy and Ellis (2006) as: *"sequential steps to collect, know, comprehend, apply, analyze, synthesize, and evaluate quality literature in order to provide a firm foundation to a topic and research method"*. This refers to searching and reviewing the pre-existing literature (established academic theories by previous scholars) prior to initiating any empirical research.

3. ***Scoping of research areas and data***

   This step deals with selecting the relevant research areas and data sources.

   - *Selecting appropriate research areas*: Important here is to look at the research scope and delineating the research areas. For research areas where there is a lack in understanding of how and why phenomena occur; or where constructs are not well developed, a case study research can be conducted. The researcher has to look at the context of the case and based on that it has to be determined for example which research areas to select. For example if the context is to investigate the strategic behaviour of a focal firm in a networked environment, the researcher has to determine which and how many firms, industries or networks are likely to be investigated.
   - *Determining relevant data sources*: By forehand the researcher has to decide which data sources to use. Using data from multiple sources (data triangulation) is considered important in case study research, since it produces more credibility of results. This can be explained as follows. If the same results are retrieved from several sources, the results are most likely to be considered reliable, than if the results are retrieved from one single source. Furthermore, in case study research most often firms are involved, which means that the researcher should determine whether valuable information about the firm (needed for the case studies) should be collected from web sources or from direct contact (through company visits/interviews).

4. ***Research method***

   In a case study research, the research has to determine the appropriate methods for data collection and data analysis. In case study research, a multi-method approach (method triangulation) is most commonly used to satisfy the research objective(s) and research question(s). This means that both quantitative and qualitative research methods can be used.

   - *Determining data collection and data analysis techniques:* The researcher has to decide on which techniques to use for the collection and analysis of data.
     - *Data collection techniques*: Some techniques for data collection include document analysis, observation, surveys and interviews, of which document analysis and interviews are most commonly used in case study research.
     - *Data analysis techniques*: Some techniques for data analysis include within-case and cross-case analysis of data. During the within case analysis usually codification and tabulation of data, checks for irregularities are performed; and cross case analysis is conducted in order to find patterns.
   - *Selecting case study design & cases*: Before conducting the case studies, choosing the case study design and cases is important. Case studies can be either single or multiple-case designs (Yin, 2003; Darke *et al.*, 1998; Eisenhardt, 1989). In a single-case design, a single case is used to confirm or challenge a theory, or to represent a unique or extreme case.In a multiple-case design, on the other hand, more than one case is used to gather data and to draw conclusions from the empirical findings. Multiple-case designs allow cross-case analysis and may enhance the validity of a study.After selection of the case study design; the researcher must determine which cases to select. This can happen by recalling the research objective(s) and research questions and focusing on finding case(s) that may help satisfying the objective(s) and formulated research questions.

- *Interviews* are one of the most important sources of case study information (Yin, 2003). However, the main problem with conducting interviews is that it can be time consuming and also difficult to collect, document and organize data. When using interviews as a source of evidence, the interview technique and interviewees have to be determined first.
  - *Interview techniques* include open-ended, focused, and structured or survey.
  - *Selection of interviewees*: Depending on the firms involved in the case studies being conducted, interviewees may be selected.

5. ***Ensuring Validity& Reliability***

   This step deals with ensuring the quality of the research, which means ensuring the credibility of the findings of the research and whether or not these findings are true and influenced by practical issues such as the subjective point of view of the researcher(bias) or problems related to the research design. Yin (2003) distinguished four aspects of quality, namely construct validity, internal validity, external validity and reliability, which can be described as follows:

- *Construct validity* deals with the question whether the research questions and research objectives have been fully addressed by the research design and whether the researcher uses the correct measures for the concept of interest. Some techniques to ensure construct validity according to Yin (2003) include using multiple sources of evidence (data source triangulation), and having drafts reports of the case studies reviewed by "key informants".
- *Internal validity* is the extent to which a certain causal relationship can be established, whereby certain conditions are shown to lead to other conditions, as distinguished from spurious relationships. A clear research framework and techniques like methodological triangulation (case study, surveys, interviews, etc.); cross case analysis and pattern matching logic are most commonly used to ensure the internal validity.
- *External validity* establishes a domain to which the findings of a research can be generalized to some broader theory. According to Yin, statistical generalization is not available from case studies, but analytical generalization is possible by techniques like a literature review, multiple case study design, and within-case and cross-case analysis.
- *Reliability*, which is the extent to which the research process can be repeated by other researchers and whether the same research design, will lead to similar findings. Techniques that are commonly used to ensure reliability on the research are: implementation of controls to evaluate the research outcomes and use of case study protocol, pilot cases and standard databases. Yin (2003) emphasized that the case study researcher must demonstrate a 'chain of evidence' as each analytic step is conducted to increase the reliability of information in a case study. This may be achieved by creating an annotated bibliography of documents, and by explicit citation of particular pieces of evidence, as one shifts from data collection to within-case analysis to cross-case analysis and to overall findings and conclusions ("cross referencing" documents) (Yin, 2003; Darke *et al.*, 1998).

The proposed research protocol has been presented in Table 17. The Table listed the five recommended steps in the left column and all the actions belonging to the steps have been noted in the right column.

Table 17: Research Protocol for Case study research

Research Protocol for Case study research		
Step		***Action(s)***
1.	Formulating Research questions	• Define clear research objectives • Formulate Research Questions
2.	Theory	• Define a frame of reference
3.	Scoping of research areas and data	• Select appropriate research areas • Determine data sources
4.	Research method	• Determine Data Collection techniques • Determine Data Analysis techniques • Select Case study design • Select Cases • Interviews - Interview techniques and - Selection of interviewees
5.	Ensuring Validity& Reliability	• Ensure Construct Validity • Ensure Internal Validity • Ensure External Validity • Ensure Reliability

5.5.2 RESEARCH SCENARIO

Based on the developed research protocol, research scenarios can be proposed for future researchers trying to replicate this research. With the term 'scenario' is meant the whole series of actions that have to be undertaken by a researcher for conducting the case study research.

After evaluating the main research outcomes, the following research scenario has been proposed by the researcher. This research scenario includes all the steps (based on the research protocol) that could be undertaken by future researchers who would like to replicate this research. By using this scenario more valuable outcomes from the current research can be expected.

Proposed Research Scenario

1. ***Formulating Research questions***
   Based on both research objectives, the following research question had been formulated for the current research:
   "How to determine if and how a focal firm's strategic behaviour and its position within a network of interorganizational relations are related and impact the firm's performance over time?"
   The nature of the research question is exploratory and therefore a case study research is appropriate.
   Assumption: The future researchers will use the same research question in their research.

Additional remark: This research question may be changed by the future researcher and based on the change; it is also possible that the nature of the research might change as well. Is the nature changes, it is possible that a case study research is not appropriate anymore.

2. ***Theory***

The researcher should perform a more solid literature review.

This can be achieved by using Levy and Ellis (2006) proposed framework for conducting and writing an effective literature review. The framework consists of three main stages: 1) inputs (literature gathering and screening), 2) processing, and 3) outputs (writing the literature review). Detailed instructions on how to conduct each stage effectively have been presented and can be applied to get a concrete literature review.

3. ***Scoping of research areas and data***

- *Selecting appropriate research areas:* The current research involved a longitudinal analysis of case studies about technology standards battles between two high tech products/technologies in *high tech industries,* such as theMP3 Player industry (iPod vs. Microsoft Zune) and Hi-fi digital audio industry (SACS vs. DVD-A). Also, per case study only *one* of the two competing firms has been analyzed. Future researchers can focus on both firms.

- *Determining relevant data sources:* In the current case study research two sources have been used: documents and archival records. Besides these two sources, it is recommended to make use of reliable company websites and interviews conducted with key persons of the firms of interest, in future research.

4. ***Research method***

- *Determining data collection and data analysis techniques*
  - *Data collection techniques*: As mentioned before a combination of quantitative and qualitative methods is most appropriate for a case study research. Therefore document analysis and interviews can best be conducted by future researchers.

  - *Data analysis techniques*: In this research, within-case and cross-case analysis have been used. Future research can also use the same techniques. However, during the within case analysis, bias should be minimized. This can be achieved by selecting data moments in time differently. Also, during data analysis, additional data can be collected simultaneously (from more interviews or analysis of more documents) to support the data analysis process, which would also minimize bias.

- *Selecting case study design& cases*: In this research, the researcher opted for a *multiple case study design*, but only *two cases* had been selected. Using a multiple case study design, with more than two cases to explore the concepts would more likely increase the generalizability and provide an opportunity for more refined descriptions, more powerful explanations and help in answering research questions (Miles and Huberman (1994). Therefore it is recommended to select more cases from the same collection of cases (See Table 1). A preliminary analysis of all the cases in Table 1 can be found in Table 19-23 (See Appendices

1-5). Based on the preliminary analysis the researcher may select the most appropriate cases. Moreover, the paper by Seawright and Gerring (2008) may prove to be useful for researchers in order to do the right case selection.

Additional remark: It is perhaps also possible that instead of a multiple case study design, the future researcher is interested to conduct a single case study, but more in-depth. This means that either case study 1 or case study 2 (of this research) could be chosen to be explored in more detail. However, it is also possible that the researcher selects a complete new case (From Table 19-23). If this is the case, it is recommended to use the paper by Atkins and Sampson (2002), which provides practical critical appraisal guidelines for conducting a single case study research.

- *Interviews*: Prior work on "Interviews" by scholars like Yin (2003), Darke *et al.* (1998), Tellis (1997), and Neale *et al.* (2006) may be relevant for researchers in order to gain insight in how to conduct interviews.
  - *Interview technique*: One specific form of interview that is appropriate for this research is the 'semi-structured interview', which produces a higher response rate and allows for focused, conversational, two-way communication. The interviewer starts with more general questions or topics and it is possible to acquire a relatively large amount of information in a relatively short time. However, some reliability issues can arise regarding to the data acquired from interviewing, as respondents may have the tendency to provide only socially desirable answers or may even suffer from bad memory.

  - *Selection of interviewees*: Interviewees should belong to the focal firms which are of interest for the research. In order to get valuable information from managers about how the strategic behaviour of their firms in networks influenced the performance of their firm in practice, interviews with managers of firms involved in strategic networks may be conducted. The interviewees have to be contacted first and after making an appointment, they may receive an introduction to the research topic and the reason behind interviewing as well. Before starting the interviews on the planned days, the interviewer (which of course is the researcher) may ask for permission to record the interview sessions. Only if permission is granted the interview sessions may be recorded, otherwise notes have to be made during the interviews. Before leaving, it will be asked to the interviewees if they would like to see a report first before giving their approval to use the collected data. Is so, a report has to be sent out to them and after their remarks and approval the collected data can be analyzed.

5. ***Ensuring Validity& Reliability***
   - *Construct validity*: The future researcher can ensure the construct validity by using multiple sources of evidence: documents, archival records and interviews (data triangulation). Also, the researcher should use correct operational measures for the concepts being studied. An overview of operational measures of concepts being studied in this research has been presented in Table 13. One recommendation to the future researcher is to dive deeper into the literature in order to establish correct operational measures.

- *Internal validity*: can be ensured by methodological triangulation (case study and interviews), cross case analysis and pattern matching logic.
- *External validity* (analytical generalization): may be ensured by a more solid literature review, a multiple case study design, and by conducting a within-case and cross-case analysis.
- *Reliability*: can be ensured if the researcher demonstrates a 'chain of evidence' (Yin, 2003).

5.5.3 RESEARCH "STYLESHEET"

The research "stylesheet" can be seen as a checklist for future researcher/students who will attempt to undertake a case study research into the possible relationships between strategic behaviour, network position and performance of the firm. This stylesheet is generated by the author and is based on the author's own experience from conducting this current case study research, as well as on the recommended research protocol and scenario and guidelines from different research methodology books or papers. All recommended steps about how to conduct a case study research into the possible relationships between strategic behaviour, network position and performance of the firm are included in the stylesheet.

The stylesheet has been presented in Table 18 below.

Table 18: "Stylesheet"- Checklist for How to conduct case study research

"Stylesheet"- Checklist for How to conduct case study research		
Phase	***Steps***	***Remarks [Recommended source]***
Start case study research	Formulate Research Problem	• What is the research problem being addressed?
	Define clear research objective(s)	• What do you want to achieve?
	Formulate Research Question(s) (and sub-questions)	• What do you want to know? "How" and "Why" questions.
Literature Review	Define a frame of reference	• Perform a comprehensive literature review[Levy and Ellis, 2006] • Explore the core concepts of interest • Establish correct operational measures for the concepts being studied to guide the data collection and data analysis.
Research design	Select appropriate research areas	• What is the case/context? • Which research areas are of interest?
	Case study design	• Preferably use multiple-case design: two or more case studies, since it allows for replication.
	Case selection	• Select most appropriate technique for case selection [Seawright and Gerring, 2008] • Use findings from preliminary analysis of case reports for the courses MOT959x/1431 [Tables 19-23] to determine if the relevance/usability of the case(s) for the intended research.
	Determine Data collection techniques	• Apply the 3 main principles of data collection[Yin, 2003]: - Use multiple sources of evidence (= 'data triangulation') to ensure construct validity; and to avoid bias and data limitation (lack of evidence). - Create a case study database - Maintain a 'chain of evidence' with traceable inferences from data to research question(s) and existing theoretical views from prior literature • Use multi-method approach: qualitative and quantitative

"Stylesheet"- Checklist for How to conduct case study research			
Phase	***Steps***		***Remarks [Recommended source]***
			methods(Method triangulation)
	Determine data sources		• Use multiple sources of evidence: - Documents, archival records - Interviews [For insight in how to conduct interviews: Yin, 2003;Darke *et al.*, 1998, Tellis, 1997; Neale *et al.*, 2006]
	Determine Data analysis techniques		• Preferably use within-case and cross-case analysis [Yin, 2003; Miles & Huberman, 1994]
	Determine how to ensure Quality of the research (Validity & Reliability)		• Construct validity: Use multiple sources of evidence, establish correct operational measures. • Internal validity: Create a case study database; use cross case analysis and pattern matching logic. • External validity: Establish the domain to which the research findings can be generalized. Perform a solid literature review, conduct a within-case and cross-case analysis. • Reliability: Demonstrate that the operations of a research can be repeated with the same results; demonstrate a 'chain of evidence'
Data Collection	Collect evidence		• Analyze case reports and use additional data from reliable sources (web sources: journals/ books/articles/company websites) to complete the cases. • Conduct interviews: - Interview technique: semi-structured interview - Select interviewee(s): key employees from the focal firms being studied. - Take into consideration the disadvantages of interviews: 1. Selective memory of the respondents 2. Respondents may provide socially desirable answers to questions or 3. Data may be influenced by the researcher • Use a case study database to document and organize all the case data or evidence (obtained from the documents/archival records and from interviews)[Yin, 2003]
Data Analysis	Analyze data from case studies	Within-case analysis: For each case study- Analyze data obtained from: 1. Case reports & additional sources ; 2. Interviews. After that combine the results from all data sources.	• Analyze data from case reports & additional sources: - Define hallmarks for the pattern of development and diffusion of the breakthrough technologies being studied. - Select the focal firm(s) - Select three or more data moments in time - For each focal firm and each data moment in time, explore the operational measures of the concepts being studied. - Start coding of data • Analyze data from interviews: - Read and review data obtained from interviews - Code data • Combine analyzed data from case reports and interviews. - Identify possible patterns/themes/structures - Interpret the results from the within case analysis.
		Cross-case analysis	• Retrieve similarities and differences across cases. • Confront evidence to existing theoretical views from prior scholarly work (Use pattern matching logic).

"Stylesheet"- Checklist for How to conduct case study research		
Phase	***Steps***	***Remarks [Recommended source]***
		• Make interpretations about the results from the cross case analysis and provide enough evidence for every interpretation to make them clear and credible to the reader(s). [Miles & Huberman, 1994]
Reporting	Provide a Case "write-up" for each case study, which contains three parts: 1. Case description, 2. Case analysis and 3. Discussion of findings	1. Case description: • Background of the case • Description of the breakthrough technology • Main actors • Technology Life Cycle(Hallmarks) [den Hartigh *et al.*, 2009; Ortt & Schoormans, 2004] 2. Case analysis: • Within-case analysis: - Describe the data analysis procedure - Present the evolution of the network/business ecosystem over time(Figures/tables) - Detail the obtained operational measures from all data sources(documents, archival records, interviews) - Synthesize and summarize data obtained from case reports and interviews in tables. [You can make use of format of Table 5]. • Cross-case analysis: - Describe the cross case procedure - Provide results from each case study [Use format of Table 8] - Provide the main results from the cross case analysis [Use format of Table 11] 3. Discussion of Findings: • Discuss research outcomes • Evaluate possible practical issues • Evaluate the research quality(validity & reliability)
	Conclusions	• Provide clear conclusions from the case study research. • Evaluate if the research outcomes satisfy the research objectives and research questions.
	Limitations	• What are the limitations? Possibilities: - Data limitation: lack of evidence due to small sample size(only two case studies) or used data sources; or using a limited number of scientific literature[Table 15] - Bias in the collection, analysis, and interpretation of data.
	Further Research	• Provide recommendations for future researchers: - Recommend if certain concepts are identified from the research as being relevant to be researched further. - Recommend on research design
	• The report should be easy to read, convincing, appealing and well structured • Present in detail all procedures towards achieving research results.	

5.6CONCLUSION

This chapter first provides an overview of the four types of practical difficulties that challenged the researcher and influenced the outcomes of this case study research. These practical difficulties include: (1) Research approach, (2) Bias in the collection, analysis and interpretation of data, (3) Data limitation, and (4) Theory problem. Recommendations to overcome these difficulties have been presented as well. Next, the researcher proposes recommendations on the research design which would possibly lead to more valuable research outcomes. The researcher therefore introduces a research protocol, which includes the recommended steps for successfully undertaking a case study research. Based on the research protocol, the researcher then proposed a research scenario, which can be seen as a systematic plan for future researchers/students who will also attempt to undertake a case study research into the possible relationships between strategic behaviour, network position and performance of the firm; and will also use the same collection of cases that has been used in this research (See Table 1). Finally a research "stylesheet" has been generated for these future researchers/students, which can serve as a checklist when undertaking the case study research.

6. CONCLUSIONS

In this chapter, the conclusions from the research are presented. In the first section of the chapter answers to the formulated research questions are provided. The next section deals with a reflection on the theory and research methods used in this research. Finally, some limitations of the research and recommendations for further research are provided in the final section of this chapter.

6.1ANSWERS TO THE RESEARCH QUESTIONS

In this section a reflection on the results of this research is presented by answering each research question (formulated in Chapter 1).

The core concepts being studied in this context included the strategic behaviour, network position and performance of a focal firm in a networked environment.

- A firm's strategic behaviour deals with all strategic actions, including all strategies that are used, strategic decisions or choices that are made, taken by firm in order to maintain a sustainable position in the market (Teece, 2007).
- The network position of a firm refers to the structural position of the firm within its network. This structural position can be either central or peripheral, based on the total number and diversity of network ties (Powell *et al.*, 1996).
- The firm performance is a measure of the results of activities (by the firm) achieved.

Recalling the objectives of this research, the first objective was "to evaluate to which extent the case study approach is suitable to investigate the core concepts and to examine whether there is a relation between strategic behaviour, network position and firm performance", and the second objective was "to determine and propose the best research design for future researchers who might attempt to conduct a case study research to explore a similar research topic by making use of the same collection of available case reports".

The main research question was formulated as:
"*How to determine if and how a focal firm's strategic behaviour and its position within a network of interorganizational relations are related and impact the firm's performance over time?*"

The answer to this question is as follows.
From the results of the case study research in the possible relationships between strategic behaviour, network position and performance of a firm, it can be concluded that in order to determine if and how a focal firm's strategic behaviour and its position within a network of interorganizational relations are related and impact the firm's performance over time it is important to investigate:

1) which aspects of strategic behaviour, network position and performance have to be obtained and have been obtained from the case studies.
2) if possible relationships between the aspects (as proposed from the literature review) have been obtained from the case studies.
3) whether possible practical issues influenced the results obtained from the case studies.
4) If recommendations for future researchers have been established.

The results from the case study research show that investigation of points 1-4 resulted in the following:

- Which aspects have to be obtained has been determined. This will be elaborated in the answer to sub-question 1.
- Aspects of strategic behaviour, network position and performance have been obtained from the case studies. This will be elaborated in the answer to sub-question2.
- Possible relationships between the aspects have been obtained from the case studies. This will be elaborated in the answer to sub-question 2.
- Possible practical issues have been identified, which seemed to influence the results obtained from the case studies. This will be elaborated in the answer to sub question 3.
- For researchers a recommended research design and research "stylesheet" has been made. More elaboration will be provided in the answer to sub-question 4.

In order to answer the research question initially four sub-questions were formulated. For the purpose of the first objective, sub-questions 1 and 2 were formulated. In order to answer sub-question 2, supporting questions had been derived. Sub-questions 3 and 4 were formulated for the purpose of the second objective. All the sub-questions with their respective answers are presented next.

1. **Insight in which aspects of strategic behaviour, network positions and firm performance has to be obtained from the case studies?**

   Based on the context of the research and a preliminary analysis of case reports that have been utilized for this research, only certain aspects of strategic behaviour, network position and firm performance had been considered from start of the research. The long list of aspects considered for this research included:

   - Aspects of strategic behaviour
     - Porters generic strategies: Cost leadership, Differentiation, Focus
     - Standard support strategy: Pricing strategy, Appropriability strategy, Timing of entry, Marketing communications, Pre-emption of scarce assets, Distribution strategy and Commitment
     - Hoffmann's alliance strategies: Shaping strategy, Adapting strategy, Stabilizing strategy
     - Business ecosystems strategies: Shaper strategy (dominator/keystone); Adapting strategy; Reserving the right to play
   - Aspects of Network position
     - Network characteristics: Size, Diversity, Density, Generic structure
     - Presence of structural holes
     - Alliance degree
   - Aspects of performance:
     - Market share
     - Financial performance

   Preliminary insight in these aspects of strategic behaviour, network positions and firm performance has been obtained from the comprehensive literature study that has been performed(Chapter 2).This resulted in establishing an overview of all possible relationships between the aspects retrieved from prior theoretical views by various scholars. From that list it

became evident that from all aspects being considered, Porter's generic strategies did not fit into the research. Evidence for Porter's strategies having a possible influence on the network position or performance, has not been gained from the literature review that has been assessed. Moreover, the preliminary analysis of case reports (Table 22- See Appendix 4) also showed that the two cases that have been selected for this case study research (Apple iPod vs. Microsoft Zune & SACD vs. DVD-A) did not contain data about Porter's generic strategies. Hence Porter's generic strategies were not considered further for this research for collecting evidence and data analysis of the case studies. All the other aspects (also termed as 'operational measures' throughout the thesis)have been considered for the practical exploration (See Table 13).*This means that insight in only these aspects had to be obtained from the case studies.*

2. **How can it be determined if insight in the aspects of strategic behaviour, network positions and firm performance being studied and their possible relations can be obtained from the case studies?**

   Before being able to answer this research question, answers to the following questions, derived from research question 2, have been provided first.

   - ***Which of the aspects of the strategic behaviour, network positions and performance of the focal firm (addressed in research question 1) have been obtained from the case studies?***

     The results from the case studies show that from all the aspects of strategic behaviour, network positions and performance, considered in this research, some have been obtained easily from the case studies and others with some difficulty. There were also aspects which have not been obtained party (only from one case study or in a different way) and aspects which have not been obtained at all.

     An overview of aspects that were not obtained is presented first.

     - The aspects of network positions 'structural holes' and 'alliance degree' were not identified from case studies, mainly because of two reasons: (1) *data limitation* (lack of evidence) and (2) *theory problem*: the way these aspects have been defined in prior literature. More elaboration on these practical issues takes place while answering question 3.
     - While the initial idea was use market share and financial performance as indicators for aspects of performance, the findings of this case analysis showed market share being the only performance indicator.

     Aspects that were partly obtained are described next.

     - Alliance strategies were obtained from the first case study (Apple iPod vs. Microsoft Zune), but not from the second case study (SACD vs. DVD-A).
     - In the first case study (Apple iPod vs. Microsoft Zune) market share has been measured as the percentage of an industry or the total unit of sales earned by the firm (in this case Apple) over a particular data moment in time. Measuring market share seemed different in the second case study (SACD vs. DVD-A), since the market share has been presented in terms of total number of SACD titles released, and not in percentages.

Aspects, which have been obtained from the case studies, however with some difficulty, are described below.

- The aspects of network position 'network size', 'diversity', 'density' and 'generic structure'. When starting the case analysis, there were no exact guidelines about how to measure these aspects. The Table *'Overview of Networks characteristics during the Technology Life cycle'* (See Table 2), adopted from the conference paper by den Hartigh *et al.* (2009), has been used extensively during data analysis to make measurements about the network characteristics. However, there were no instructions included for researchers on how to measure the characteristics. For example how to measure the network size as being 'small', 'medium' or 'large'. The aspects have been obtained, based on the researcher's own perception of those measurements. This indicates the presence of two practical issues: '*theory problem'* and '*bias in the interpretation of data'*, which will be described later on.

All the other remaining aspects that had been considered for this research have been obtained easily from the case studies, such as the aspects of strategic behaviour: standard support strategies and business ecosystem strategies.

- ***Is there a possible relationship between strategic behaviour and network position of a firm?***

The results from the case studies suggest that strategic behaviour may influence the network position of a firm:

- There is empirical evidence that business ecosystems strategy shaper strategy (keystone/dominator role) may influence the network characteristics size, density, diversity and generic structure.
- There is empirical evidence that alliance strategy (i.e. shaping strategy) may influence the network size, diversity and density.
- There is empirical evidence that standard support strategies may influence the network characteristics size, density, diversity and generic structure. Based on the type of standard support strategy that has been pursued by the focal firm, the total number of actors (size), the type of actors (diversity) and the linkages between actors in the network seemed to have changed over time.

The first two results seem to be in accordance with the theoretical views from prior scholarly work by Hoffman (2007) and den Hartigh & van Asseldonk (2004), which are presented in Chapter 2 of this thesis.

- Hofmann (2007) showed that the alliance strategy influences the configuration of the alliance portfolio. Since the configuration of the alliance portfolio is measured by the parameters 'number', 'dispersion', and 'redundancy' of alliances, which are equivalent to respectively the network characteristics 'size', 'diversity' and 'density', it can be concluded that alliance strategies influence the network characteristics.
- Den Hartigh & van Asseldonk (2004) mentioned that the business ecosystem strategy may have an impact on the 'network structure', which can be measured along dimensions like network size, connectivity, concentration and entropy. These dimensions are equivalent to the network characteristics: network size, density, diversity and generic structure of the network.

The last result cannot be confirmed or contradicted with the theoretical views from prior scholarly, since there seems to be no existing theory confirming or contradicting this evidence.

- ***Is there a possible relationship between strategic behaviour and performance of a firm?***
  The results from the case studies suggest that strategic behaviour may influence the firm performance:

- There is empirical evidence that standard support strategies may have a possible impact on performance. The strategies timing of entry, distribution strategy and marketing communications seemed to increase the market share.
- There is empirical evidence that business ecosystem strategies may have a possible impact on performance. The pursued shaper strategy by the respective firms (Apple in the first case study and Sony in the second case study) seemed to influence the diversity, density and generic structure of their respective networks. In the first case study Apple used shaper strategy, but changed its role from dominator to keystone to dominator again. When Apple changed its role from dominator to keystone the diversity and density of the network increased, since more and more firms started joining the iPod network. In the second case study, Sony also pursued shaper strategy and remained a keystone during both data moments in time. As a consequence the generic structure of the SACS network (core-periphery) also remained the same.
  These results seem to be in accordance with the proposed relationships between strategic behaviour and firm performance by Hoffman (2007), van de Kaa (2009) and den Hartigh & van Asseldonk (2004).
    - In his research, van de Kaa (2009) for example found that standard support strategies help firms in gaining market dominance and winning a standards battle.
    - While studying the relation between network structure, firm strategy and the pattern of innovation diffusion, den Hartigh & van Asseldonk (2004) found that by selecting the right business ecosystem strategy, a firm in a business ecosystem can influence its own performance.

  However, evidence that alliance strategies may have a possible impact on performance, as proposed by Hoffman (2007), has not been obtained from the case studies.

- ***Is there a possible relationship between network position and firm performance?***
  The results from the case studies suggest that network position may not influence firm performance. No empirical evidence has been obtained from the case studies to verify or contradict the theoretical views of many scholars (Venkatraman *et al.*, 2008; Zaheer & Bell, 2005; Tsai, 2001 and Ahuja, 2000) that network position (i.e. the number of alliances, network density and structural holes) may influence the firm performance (i.e. the firms' market share or profitability).

Now we able to answer research question 2 - "How can it be determined if insight in the aspects of strategic behaviour, network positions and firm performance being studied and their possible relations can be obtained from the case studies?"- as follows:

- The results from the case studies show that from all the aspects of strategic behaviour, network positions and performance, considered in this research, some have been obtained easily from the case studies (i.e. standards support strategies, business ecosystem strategy) and others with some difficulty (i.e. network characteristics). There were also aspects which have been partly obtained (alliance strategy/ only in case study 1, market share/in percentages in the first case study and in total number of titles in the second case study) or not obtained(structural holes, alliance degree, financial performance).
- The results obtained from the cases studies suggest that strategic behaviour may influence the network position and firm performance, which is in accordance with the existing theoretical views by prior scholarly work. The results from the case studies further suggest that network position may perhaps not influence firm performance, contrary to the theoretical views from prior literature. An overview of the results from the case studies has been provided in Table 11. However, because of the fact that some practical issues were identified as having influences the results from the case studies, it can be concluded that the credibility of these results is questionable. The practical issues are discussed while answering the third research question, but an overview of all the results from the case studies, including practical issues can be found in Table 12.

3. **Which practical issues may have influenced the results obtained from case studies and which recommendations can be provided in order to overcome them in further research?**

   From the case studies four practical issues have been identified as having influenced the results from this case study research. These include research approach, data limitation, bias in the collection, analysis, interpretation of data and theory problem. All are briefly summarized below, including recommendations to overcome them.

   - Research approach

     Research approach refers to the way this research has been approached by the researcher from start till conclusion of the research. The issues related to the research approach, which may have influenced the results from the case studies include the following:

     - *Selection criteria for literature research*: based on certain selection criteria, scientific literature has been selected to be reviewed during the literature study.
     - *Case study design and selection of cases*: In this research a multiple case study design has been chosen, but only two cases were selected. Due to the small sample size, the generalizability was not possible.
     - *Data sources*: in this research only documents and archival record have been used to collect data.

     These three issues resulted in evidence from the case studies that were either missing or previously unreported. From the case studies there was empirical evidence that standard support strategies may influence the network characteristics size, density, diversity and generic structure (as mentioned while answering question 2). However, this evidence can be seen as being previously unreported, since the literature review did not result in a theoretical view from prior literature which would confirm or contradict this empirical evidence. Furthermore, alliance strategies were not found to influence performance (as proposed by Hoffmann, 2007).

Future researchers have to modify this research approach in order to get more credible results. All recommendations to modify the research approach in order to overcome practical issues related to the research approach, can be found in Table 14.

- Data limitation

  Data limitation refers to problems related to the data that has been collected and is associated with the availability and completeness of data. Availability refers to the extent to which data is available as scientific publications as well as reports. Completeness of data deals with the breadth, depth and scope of the information contained in the data. The following practical issues regarding data limitation have been distinguished in this research:

  - *Limited number of scientific literature*: This refers to the lack of theoretical evidence due to the use of limited number of scientific literature, which can be seen as a problem with the *availability* of data. It is therefore recommended to select more scientific journals for a more comprehensive literature review.
  - *Lack of case evidence*: This issue deals with the fact that data was either missing or incomplete and therefore influenced the research outcomes. In this research only documents and archival records have been used as sources of evidence. Therefore it is recommended to use more sources of evidence.

  An overview of issues related to data limitation in this research and possible recommendations have been presented in Table 15.

- Bias

  Bias refers to any trend in the collection, analysis, interpretation, publication or review of data that can lead to conclusions which are systematically different from the truth. In this research three types of bias have been identified: 'bias in the collection of data', 'bias in the analysis of data', and 'bias in the interpretation of data'.

  - *Bias in the collection of data* includes *'biased selection of cases'* and *'biased data from case reports'.* Case reports compiled by students for the MOT9592 course have been used for the case studies. More specifically, analyzed data (such as the hallmarks of the technology life cycle or the evolution of the business ecosystem/network over time) have been adopted for this research. However, depending on how data has been collected, analyzed and inferred by the students, it can be assumed that the data may be biased.
  - *Bias in the analysis of data* includes 'biased selection of focal firm' and 'biased selection of data moments in time'.
    - In the first case study Apple has been chosen as the focal firm, because the report for that case study had also focused on strategies pursued by Apple, iPod business ecosystem over time, and Apple's performance. Therefore Apple was analyzed further in this research. Future researchers may consider selecting Microsoft as the focal firm; or either one of Apple's or Microsoft's network partners as focal firm.
    - *Selection of data moments in time*: The first data moment in time in both case studies have been consciously chosen by the researcher as the year

of commercialization of the product/technology (produced by the focal firm)

- *Bias in the interpretation of data* refers to the bias due to the *perception of the researcher*. The (biased) perception of the researcher may result in biased interpretations or conclusions. For example network characteristics may have been analyzed incorrectly based on the researcher's own opinion about what can be considered as "small", "medium", "large" network size; or "low", "high" diversity/density.

- Theory problem
  Theory problem refers to a problem with the used theoretical views from prior literature in this research or rationale behind the theory that has been used during the research. This deals with either incomplete definitions for operational measures or lack of guidelines on how to measure the established operational measures during data analysis (within-case analysis and cross case analysis).
  - Before conducting the case studies, operational measures had been established, but some of them were not obtained from the case studies, such as alliance degree and structural holes. This research shows that the reasons include incomplete definitions for these aspects, as well as lack of guidelines for how to measure them.
  - Definitions for keystone/dominator and when to exercise the role of keystone/dominator have to be re-evaluated and explored in more detail before being able to conclude whether business ecosystem strategies influence the network position or performance.
  - From the paper by den Hartigh *et al.* (2009) the table 'Overview of Networks characteristics during the Technology Life cycle' (See Table 2) has been adopted to measure the network characteristics. But as mentioned before while answering question 2, there were no instructions included for researchers on how to measure the characteristics. To overcome this difficulty it is recommended to look at the rationale behind measuring the network characteristics in order to create an inventory with measurement parameters that can be used by future researchers.

4. **What constitutes a comprehensive research design for conducting a case study research into the possible relationships between strategic behaviour, network position and performance of the firm?**

   The results of the case studies provided insight in practical issues that have influenced the research outcomes. Based on those practical issues and recommendations to overcome them, a comprehensive research design has been developed and proposed to future researchers who would attempt to undertake a case study research.

   A comprehensive research design constitutes of all recommended steps for successfully undertaking a case study research. At first a *research protocol* has been generated, followed by a recommended *research scenario* for conducting a case study research into the possible relationships between strategic behaviour, network position and performance of the firm.

The research protocol comprises of 5 important steps:

1) **Formulating Research questions**: Clear research objectives should be defined and research questions have to be formulated. In case study research the questions are exploratory of nature and are mostly “How” and “Why” questions.
2) **Theory**: A frame of reference has to be defined which will guide the data collection and data analysis procedures.
3) **Scoping of research areas and data:** Important here is to select the appropriate research area(s) and determining the data sources.
4) **Research method**: Data collection and data analysis techniques should be determined; and the case study design and cases have to be selected. One data collection technique that has to be included in future case study research is Interviews. Taken into consideration by forehand are ‘interview techniques’ and ‘selection of interviewees’.
5) **Ensuring Validity & Reliability**: By forehand it should be determined how to ensure construct validity, internal validity, external validity and reliability of the research.

The proposed research protocol has been presented in Table 17.

Finally based on the research protocol; research scenario; prior literature on case study research and the researcher’s own experience while conducting this case study research, a research “stylesheet” has been proposed, which may serve as a checklist for future researcher/students (See Table 18).

6.2 REFLECTION ON THE RESEARCH

In this section the value of the research is evaluated by a reflection on the theory and research method.

Remarks on Theory

Theory serves as a frame of reference to make the context of the case study research clear. This frame of reference also helps to conduct the case studies and evaluating results obtained from the case studies. In this research, a comprehensive literature study has been performed; however in order to establish confidence in the results a more solid review is needed. This can be explained as follows. In this research one of the main practical issues having influenced the research outcome has been ‘theory problem’. Due to the selection criteria that were established for the literature research, only a limited number of scientific books/journal/papers have been selected for the actual literature review. Based on the reviewed literature on aspects of strategic behaviour, network positions and firm performance, certain operational measures have been established in Chapter 2, which have been considered for the case studies. Moreover, from the prior scientific literature, various theoretical views on possible relationships between the various aspects have been proposed in the same chapter. Those proposed relationships have been taken into account during the case analysis.

One extensively used paper throughout the research and also reviewed during the literature review, is the conference paper by den Hartigh *et al.* (2009), which provides information about the changes in the structure and composition of networks supporting technologies during the phases of the technology life cycle. Also, a case study of the technology battle between the HD DVD and Blu-ray

technologies has been performed to identify these changes. From this paper 'measurement concepts' such as 'technology life cycle dimension' (See figure 4)or 'Overview of Networks characteristics during the Technology Life cycle' (See Table 2)have been reviewed and applied during the within case and cross case analysis. However, the measurement of the network characteristics size, diversity, density, generic structure, became difficult. The measurement took place based on the researcher's own understanding of measurement dimensions such as 'small', 'medium', 'large' for network size or 'low', 'medium' or 'high' for diversity/density. More insight in how to measure these dimensions is needed to avoid complexity and bias in the analysis and interpretation of data. This brings us back to the theory problem. Insight in how to measure the network dimension can be gained by firstly reviewing more papers on network dimensions and how to measure them. Secondly because network dimension are not the same in every industry, a preliminary research is needed first to collect, rank and explore data on these network dimensions and how to measure them. What can be considered 'small' network in for example a high tech industry may perhaps be considered as a 'large' network in another industry. This indicates that research on how to standardize measurements parameters for network characteristics is needed.
For structural holes and alliance degree, which are the aspects of network positions that were not obtained from case studies the same can be concluded. More literature on structural holes, alliance degree is needed in order to get clear definitions and standardized measurement parameters for them.

On the whole it can be said that having a more solid theoretical frame of reference, including standardized measurement parameters, may prevent or minimize issues like theory problem and bias, and may also increase the validity of the research.

Remarks on Research Method

This research involves a longitudinal analysis of two cases in order to investigate the core concepts of interest, which are strategic behaviour, network position and performance. Since using case studies makes it possible to investigate relationships between concepts over time and also results in exploring if the reality (case studies) corresponds well with the theory (Yin, 2003), and considering the exploratory nature of the research questions in this research, a case study research seemed to be the apt. According to Yin (2003) the case study research method is "an empirical inquiry that investigates a contemporary phenomenon within its real-life context; when the boundaries between phenomenon and context are not clearly evident; and in which multiple sources of evidence are used".
In this research a multiple-case study design was chosen, since it allows cross-case analysis and may also enhance the validity of a study. In order to collect data for the case study research, documents and archival records were used as the two sources of evidence. After a preliminary analysis of available cases for the courses MOT959x/MOT1431, which can be found in Tables 19-23 (See Appendices 1-5) and based on the selection criteria for cases, two cases were selected.
After both case studies were conducted, a cross-case analysis took place. Cross-case analysis refers to comparing data across cases in a multiple-case study design, in order to organize, analyze and reduce data retrieved from case studies in order to find patterns and to see if it fits with the existing theory (Miles & Huberman, 1994). In this research both cases were first compared to each other and similarities and differences across both cases were determined. After that the evidence from the case studies were confronted to the existing theoretical views from prior literature by scholars.

It can be concluded that the chosen research method affected the validity of the research. Only two case studies have been conducted and from the discussion of the findings it was apparent that the credibility of these findings was questionable because of challenges the researcher faced, like (1) Bias in the collection, analysis, interpretation of data (2) Data limitation, (3) Theory problem and (4) Research approach. Only two sources of evidence have been used as mentioned before, document and archival records. The generalizability of this research would have been increased if conducting interviews was chosen as data collection method. Therefore it is recommended to conduct interviews when undertaking a case study research. However, disadvantages of interviews have to be taken into account.

6.3LIMITATIONS AND FURTHER RESEARCH

The limitations are all related to the research design. In this research multiple case study design has been used and because of the fact that every case study is context dependent, different sources of evidence are needed. Therefore in a case study research a multi-method approach is recommended, with qualitative and quantitative methods to conducts the case studies. In this research however, only two sources of data have been used: documents and archival records. No interviews. Another limitation is the use of only two cases, which makes it difficult to establish confidence in the data. The underlying reason for these two limitations can be traced back to the time constraint. It is time-consuming to collect data from case studies, and even more time-consuming to analyze the data. Initially it was planned to conduct interviews, but the in-depth conduct of both case studies by analyzing the case reports only and searching for additional sources to complete the case, took more time than expected. Therefore the decision was taken to leave interviews out of the research. The plan was thus to conduct two case studies and after obtaining results from those case studies, to conduct more case studies before making concrete conclusions. However, the two case studies showed that there were practical issues that made the research outcome less credible than planned. The focus then shifted towards determining and proposing a comprehensive research design for future students/researchers willing to undertake a case study research with a similar research topic or using the same collection of MOT case reports.

Another limitation in this research comes from the selection of the focal firm. The case studies are about one focal firm in a networked environment, but only the strategic behaviour, network positions and performance of the focal firm are of interest. In further research, the strategic behaviour, network position and performance of other network partners of the focal firm can be explored too. This would lead towards gaining valuable insight in if and how the pursued strategies, occupied network positions of the network partners of the focal firm influence the performance of the focal firm. It may also be considered in further research to explore the impact on the overall network performance besides firm performance.

Finally the main recommendation to future students/researchers is to use the proposed comprehensive research design, which includesall recommended steps for conducting a case study research into the possible relationships between strategic behaviour, network position and performance of the firm. This recommended research design is for those researchers who may want to explore a similar research problem and using the existing cases from the same collection of cases that has been used by the current researcher. Hence, in order to get more valuable outcomes from a case study research, the research protocol, research scenario and research “stylesheet” are recommended.

REFERENCES

Achman, R., Cikili, O., van Leeuwen, O. and Warnar, P. (2010). DVD-Audio vs. SACD. *Report submitted for the course MOT1431: Technology and Strategy Assignment A, TPM, TU Delft.*

Ahuja G. (2000). Collaboration networks, structural holes, and innovation: a longitudinal study. *Administrative Science Quarterly.* Vol. 45, 425–455.

Atkins, C. and Sampson, J. (2002).Critical Appraisal Guidelines for Single Case Study Research, In Proceedings of the Xth European Conference on Information Systems (ECIS), Gdansk, Poland.

Bruijn, J.A. de & Heuvelhof, E.F. ten (2008). Management in Networks. On multi-actor decision making. *New York: Routledge*.

Carpenter, M.A., Bauer, T. and Erdogan, E. (2009). Principles of Management. *Flatworld Knowledge*. Available at: http://www.web-books.com/eLibrary/ON/B0/B58/TOC.html

Coyne, K. P. and Subramaniam, S. (1996). Bringing Discipline to Strategy. *McKinsey Quarterly*. Vol. 4, 15-25.

Darke, P., Shanks, G. and Broadbent, M. (1998) Successfully Completing Case Study Research: Combining Rigour, Relevance and Pragmatism, *Information Systems Journal*. Vol. 8, 273-289.

den Hartigh, E. & van Asseldonk, T. (2004). Business ecosystems: A research framework for investigating the relation between network structure, firm strategy, and the pattern of innovation diffusion. ECCON 2004 Annual Meeting: Co-Jumping on a Trampoline, The Netherlands.

den Hartigh, E., Ortt, J. R., van de Kaa, G. and Stolwijk, C.C.M. (2009).Technology Standards Battles and Networks During the Technology Lifecycle: The Battle Between HD-DVD and Blu-ray. International Product Development Management Conference, 7-9 June 2009.

Dittrich, K., Duysters, G.M. & Man, A.P. de (2007). Strategic repositioning by means of alliance networks: The case of IBM. *Research Policy,* 36(10), 1496-1511.

Eisenhardt, K. M. (1989) 'Building theories from case study research', *Academy of Management Review.* Vol. 14, (4), 532 - 550.

Gemünden, H. G. and Heydebreck, P. (1995).The Influence of Business Strategies on Technological Network Activities. *Research Policy*. Vol. 24, 831-849.

Gulati, R. (1998). Alliances and Networks, *Strategic Management Journal*. Vol. 19, 293-317.

Gulati R. (1999). Network location and learning: the influence of network resources and firm capabilities on alliance formation. *Strategic Management Journal*. Vol. 20(5): 397–420.

Gulati, R., Nohria, N., & Zaheer, A. (2000). Strategic networks. *Strategic Management Journal*. Vol. 21 (Special issue), 199–201.

Halinen, A. and Törnroos, J.-Å. (2005). Using Case Methods in the Study of Contemporary Business Networks. *Journal of Business Research.* Vol. 58 (9), 1285-1297.

Hambrick, D.C. and Fredrickson, J.W. (2001). Are You Sure You Have a Strategy? *Academy of Management Executive*. Vol. 15(4), 48–59.

Hawawini, G., Subramanian, V. and Verdin, P. (2003). Is performance driven by industry or firm-specific factors? A new look at the evidence. *Strategic Management Journal*. Vol. 24(1), 1-16.

Hoffmann, W.H. (2007). Strategies for managing a portfolio of alliances. *Strategic Management Journal*. Vol. 28, 827–856.

Hutjes, J.M. en Van Buuren, J.A. (1996), *De gevalsstudie, strategie van kwalitatief onderzoek*, Open Universiteit, Heerlen.

Iansiti, M. and Levien, R. (2004). Strategy as Ecology. *Harvard Business Review.* Vol. 82(3), 68.

Ireland, R. D., Hitt, M. A. & Vaidyanath, D. (2002). Alliance Management as a source of Competitive Advantage. *Journal of Management.* Vol. 28, 413–446.

Janssen, E. and Reefman, D. (2003). Super-audio CD: an introduction. Signal Processing Magazine, IEEE. Vol. 20 (4), pp. 83–90.

Konstantinides, K. (2003). An introduction to super audio CD and DVD audio. Signal processing forum. Available at: http://decoy.iki.fi/dsound/ambisonic/motherlode/source/01215233.pdf

Lavie, D. (2007). Alliance Portfolios and Firm Performance: A Study of Value Creation and Appropriation in the U.S. Software Industry. *Strategic Management Journal*. Vol. 28(12), 1187-1212.

Leitner, K-H. and Gueldenberg, S. (2010). Generic strategies and firm performance in SMEs: a longitudinal study of Austrian SMEs. *Small Business Economics*. Vol. 3 (2), 169-189.

Levy, Y. and Ellis, T. J. (2006). A Systems Approach to Conduct an Effective Literature Review in Support of Information Systems Research. *Science Journal 9,* 181-212. Available at: http://www.scs.ryerson.ca/aferworn/courses/CP8101/CLASSES/ConductingLiteratureReview.pdf.

Menta, R. (2004). *Collecting MP3 Portables*. Retrieved September 15, 2010, Available at: http://www.antiqueradio.com/Dec04_Menta_mp3pt1.html

Miles, M. B. & Huberman, A. M. (1994). Qualitative data analysis, 2nd ed. Thousand Oaks, CA: Sage Publications.

Millard, A. J. (2005). *America on Record: A History of Recorded Sound.* New York: Cambridge University Press.

Mintzberg, H. (1978). Patterns in strategy formulation. *Management Science, 24*, 934– 948

Mintzberg, H. (1992). Five Ps for strategy. In H. Mintzberg & J. B. Quinn (Eds.), The strategy process. (pp. 12-19). Englewood Cliffs, NJ: Prentice-Hall International Editions.

Mintzberg, H., & Waters, J. A. (1985).Of strategies, deliberate and emergent. *Strategic Management Journal, 6*, 257–272.

Mohr, J., Sengupta, S. & Slater, S. (2010). Marketing of High-Technology Products and Innovations. *Prentice Hall.*

Moore, J. F. (1993). Predators and Prey: A New Ecology of Competition. *Harvard Business Review*. Vol. 71(3), pp. 75-86.

Moore, J. F. (1996).The Death of Competition: Leadership and Strategy in the Age of Business Ecosystem. *John Wiley & Sons, Ltd.*

Neale, P., Thapa, S. & Boyce, C. (2006). Preparing A Case Study: A Guide for Designing and Conducting a Case Study for Evaluation Input. *Pathfinder International: Writing a case study*. Retrieved from www.pathfind.org/site/DocServer/m_e_tool_series_case_study.pdf

Neblett, J. (2004). Environmental factors affecting a firm's ability to compete: A Retail perspective. Paper Accepted for Publication at International Association for Management of Technology, Washington, DC.

Ortt, R. (2009). Concept chapter pre-diffusion phases Delft university of Technology.

Ortt, J.R. and Schoormans, J.P.L. (2004).The pattern of development and diffusion of breakthrough communication technologies. *European Journal of Innovation Management*. Vol. 7(4), 292-302.

Ortt, J.R., Zegveld, M. and Shah, C.M. (2007). Strategies to Commercialise Breakthrough Technologies. *International Association for Management of Technology*. IAMOT 2007 Proceedings.

Özcan, P. and K.M. Eisenhardt. (2009). Origin of alliance portfolios: Entrepreneurs, network strategies, and firm performance. Academy of Management Journal. Vol.52, 246-279.

Powell, W. W., Koput, K. W. and Smith-Doerr, L. (1996). Interorganizational Collaboration and the Locus of Innovation: Networks of Learning in Biotechnology. *Administrative Science Quarterly.* Vol. 41, 116-45.

Powell, W. W., Koput, K.W., Smith-Doerr, L., & Owen-Smith, J. (1999). Network position and firm performance: organizational returns to collaboration in the biotechnology industry. *Research in the sociology of organizations.*

Reefman, D. and Nuijten, P. (2001). Why Direct Stream Digital is the best choice as a digital audio format. Audio Engineering Society Convention Paper, Presented at the 110th Convention; 12-15 may, 2001. Amsterdam, The Netherlands. Retrieved on April 10, 2011; Available at: http://tech.juaneda.com/en/articles/dsd.pdf

Ritter, T. & Gemünden, H. G. (2003). Network Competence: Its Impact on Innovation Success and its Antecedents. *Journal of Business Research*. Vol. 56, 745– 755.

Rowley, T. J. & Baum, J. A. C. (2008). The dynamics of network strategies and positions. *Network Strategy Advances in Strategic Management*, Vol. 25, 641-667, Emerald Group Publishing Limited.

Runeson, P. and Höst, M. (2009). Guidelines for conducting and reporting case study research in software engineering. *Empirical Software Engineering.*Vol. 14(2), 131-164.

Seawright, J. and Gerring, J. (2008). Case Selection Techniques in Case Study Research: A Menu of Qualitative and Quantitative Options. *Political Research Quarterly.* Vol. 61(2), 294-308.

Shapiro, C. (1989). The theory of business strategy. *RAND Journal of Economics*. Vol.20 (1), 125–137.

Shapiro, L. (2001). Surround Sound: The High-End: SACD and DVD-Audio. Retrieved on April 10, 2011; Available at: http://www.extremetech.com/article2/0,2845,1180143,00.asp

Schilling, M. A. (2008). Strategic management of technological innovation (2nd ed.). Boston: McGraw Hill.

Smith, T. (2008). Ten years old: the world's first MP3 player. Retrieved September 19, 2010, Available at: http://www.reghardware.com/2008/03/10/ft_first_mp3_player/

Soy, S. K. (1997). The Case Study as a Research Method. Available at: http://www.gslis.utexas.edu/~ssoy/usesusers/l391d1b.htm

Suarez, F.F. (2004*).* Battles for technological dominance: an integrative framework. *Research Policy*. Vol. 33, 271-286.

Teece, D. J., Pisano, G. and Shuen, A. (1997). Dynamic Capabilities and StrategicManagement. *Strategic Management Journal*. Vol. 18(7), pp. 509-533.

Teece, D. J. (2007).Explicating dynamic capabilities: The nature and microfoundations of (sustainable) enterprise performance. *Strategic Management Journal.* Vol. 28, 1319-1350.

Tellis, W. (1997, September). Application of a case study methodology [81 paragraphs]. The Qualitative Report [On-line serial], 3(3). Available at: http://www.nova.edu/ssss/QR/QR3-3/tellis2.html.

Treviño Barbosa, S.I. (2010). MP3 players: Technology pattern, standards battle and business ecosystem. *Report submitted for the course MOT9592, TPM, TU Delft.*

Tsai, W. (2001). Knowledge transfer in intraorganizational networks: Effects of network position and absorptive capacity on business unit innovation and performance. *Academy of Management Journal*. Vol. 44(5), 996-1004.

Van Asseldonk, A.G.M., den Hartigh, E. & Berger, L. (2003). Morphology, entropy, and stability in networked structures, European Chaos/Complexity in Organisations Network (ECCON) annual meeting 2003, in: Putnik, G.D. & A. Gunasekaran (eds.) Business Excellence I: Performance Measures, Benchmarking and Best Practices in New Economy; University of Minho, Braga, pp.255-260.

van de Kaa, G. (2009). Standards Battles for Complex Systems, Empirical Research on the Home Network: Chapter 4 *Factors for standard dominance: a comparative case study.* Erasmus Research Institute of Management: Rotterdam

van der Kleij, D. (2010). DVD Audio versus Super Audio CD: Technology pattern, standards battle and business ecosystem. *Report submitted for the course MOT9592, TPM, TU Delft*.

Velde, E.G., van der, Jansen, P.G.W. & Anderson, N. (2004). Guide to Management Research Methods. Oxford: Blackwell Publishing Ltd.

Venkatraman, N., Lee, C. -H. and Iyer, B. (2008). Interconnect to win: the joint effects of business strategy and network positions on the performance of software firms, in Professor Brian Silverman (ed.) *Network Strategy (Advances in Strategic Management, Volume 25)*, Emerald Group Publishing Limited, pp. 391- 424.

Vermooten, H. (n.d.). Bias and confounding. Available at: http://www.ais.up.ac.za/med/tnm800/tnmbiasandconfoundingvermooten.doc

Verschuren, P. & Doorewaard, H. (1999). Designing a research project. Utrecht, LEMMA.

Voss, C., Tsikriktsis, N. and Frohlich, M. (2002). Case research in operations management. *International Journal of Operations & Production Management.* Vol.22 (2), 195 - 219.

Wang, R. Y. and Strong, D.M. (1996). Beyond accuracy: what data quality means to data consumers. *Journal of Management Information Systems.* Vol. 12(4), 5–34.

Yin, R. K. (2003). Case study research: Design and methods (3rd ed.). Thousand Oaks, CA: Sage.

Zaheer, A. & Bell, G. (2005). Benefiting from network position: Firm capabilities, structural holes, and performance. *Strategic Management Journal*. Vol. 26, 809–825.

APPENDIX 1: OVERVIEW OF CASE STUDIES (MOT9591, YEAR 2007)

Table 19: Analysis of the cases for MOT9591, year 2007

MOT9591 2007					
Case		**Remarks on Content**			**Important Findings**
		Network (-position)	**Strategy**	**Performance**	
1.	**GPS Navigation TomTom** *BE report*	TomTom BE Main players described TomTom's network position: high concentration of connections	• shaper strategy, keystone • exploration/ exploitation strategies	• TomTOm BE health: using connectivity, performance, market visibility. • TomTom financial health using: annual report 2006	• No data moments, only the general network position is described. • Strategies are also generally mentioned, not per data moment. • Performance of TomTom is only measured for 2006.
	CSI report Tom Tom	Many partners, strong ties within its supply chain; a strong distribution network.	Marketing &distribution strategies	--	Company analysis: entities, processes, interrelationships, Competences and capabilities of the company
	Final report	Integrates the 3 separate reports on 3 models TP, BE & CSI: the analyses of the 3 separate models are compared with supporting and contradicting evidence from the other models.			
2.	**Lithography ASML** *BE report*	ASML's BE: main actors and type of actors, connections and connectivity levels shown.	• ASML: keystone and dominator combined; • exploration/ exploitation strategies • smart follower strategy	performance of ASML's BE	• No data moments; general network position of ASML described. • Strategies are also generally mentioned. • Only performance of ASML's BE, not of the company.
	CSI report ASML	ASML's entities and their interactions	ASML's modular production strategy; outsourcing strategy; marketing	--	Same as in 1

MOT9591 2007					
Case		**Remarks on Content**			**Important Findings**
		Network (-position)	**Strategy**	**Performance**	
			strategy		
3.	**MP3 Apple iTunes** *BE report*	Apple/iTunes BE: Highly connected; Highly concentrated; High number of external links	Apple:Keystone strategy Strategies of all partners also mentioned(value dominators, niche players)	Performance measured in terms of % share of total music saleson the iTunes platform	• No data moments; general network of Apple/iTunes described. • Overall Strategies of the main players mentioned.
	CSI report Apple Inc.	Apple's entities and their interactions	Follower; late entrant; wait and see strategy; pre-announcement strategy	--	Analysis of the company from the System and Innovation perspective leading towards all core competencies and dynamic capabilities.
4.	**Operating systems IBM** *BE report* OSS Community	• Open Source Software (OSS) BE; development network • Main actors/types of actors defined; central actor: OSS community with big player: IBM.	OSS BE: shaper strategy Main players are keystone and dominator at the same time (coopetition)	Performance of the OSS BE measured by: • Market share OSS: 1999, 2001 • Productivity; Robustness; Niche creation	• General analysis of the OSS BE • Again no data moments and focus on network positions. • Perhaps looking at IBM's position within the network would be a good idea.
	CSI report IBM	IBM's entities and their interrelationships	--	--	Competencies and dynamic capabilities from the System and Innovation Approach are listed.
5.	**PDAs Palm** *BE report* Palm, Inc.	• PDA BE: all actors mapped with Palm Inc. as focal firm; • Many partners and some strong ties.	Palm: Shaper strategy; keystone; exploration strategy.	Performance on both BE and company level measured by: • Productivity; Robustness; Niche creation	• Good analysis of the BE and also of the company. • But no data moments in order to look at the different network positions and strategies applied during the different

MOT9591 2007					
Case		**Remarks on Content**			**Important Findings**
		Network (-position)	**Strategy**	**Performance**	
					data moments.
	CSI report Palm, Inc.	Entities of Palm Inc.	consumer driven, experience based and technology push strategy	• Worldwide handheld market share from 2001-2006. • Revenues by product line from 2005-2007.	Overview of competencies and capabilities.
6.	**Search engines Google** *BE report*	• Google's BE: all main actors(not specifically for the search engine platform); • Google's overall relation-map; private and public clusters maps	• Google: shaper strategy; keystone; combination of exploration and exploitation strategies. • Other actors: follower strategy	Performance of Google's BE evaluated by the following indicators: • Productivity • Niche Creation • Financial Performance • Robustness ➔ BE and company level	A complete analysis of Google's BE, and not of Google search engine BE particularly! Same as in previous cases, no data moments defined, so no comparison possible between network positions and strategies during those moments.
	CSI report **Google Inc.**	Google's entities and interactions	--	--	Competencies and capabilities listed.

***BE= Business ecosystem, TP= Technology Patterns, CSI=Company system of Innovation**

APPENDIX 2: OVERVIEW OF CASE STUDIES (MOT9591, YEAR 2008)

Table 20: Analysis of the cases for MOT9591, year 2008

MOT9591 2008					
Case		**Remarks on Content**			**Important Findings**
		Network(-position)	**Strategy**	**Performance**	
1.	**Blu-Ray Philips** *BE report*	Blu-ray BE, Main Actors, and Central Actor in three different times (2002, 2004, 2008) are given. Sony, Philips, and Pioneer as the initiators of the DVR Blue. Blu-ray Dics Association (BDA) is the central actor.	• Alliance strategies used by companies within the Blu-ray BE: • Change of strategy from adapting to shaping and finally to stabilising.	• BE health measures and their indicators provided – firm level and BE level. • Financial health of the main actors of the two competing ecosystem the Blue-ray BE and HD-DVD BE: Sony vs. Toshiba	• BDA = central actor • The financial analysis is on Sony, so Sony should be the focal firm. But the CSI report is on Philips. • Strategies applied and performance (measured) during different network positions are missing.
	CSI Philips report	--	Strategy definition = most important process	--	Only an analysis of the entities, interrelations, innovation processes within Philips; competencies dynamic capabilities in general.
	Final report	Integrates the 3 separate reports on 3 models TP, BE & CSI: the analyses of the 3 separate models are compared with supporting and contradicting evidence from the other models.			
2.	**HD-DVD Toshiba** *BE report*	All actors in the HD-DVD BE are shown for only one data moment (2007). However, there is a table with member count from 2004-2008	Shaper, follower, wait and see strategy identified for the various actors; Toshiba's keystone strategy	Financial analysis; Partner health (Toshiba vs. Sony) Network health (HD-DVD BE vs. Blu-ray BE.	Toshiba can be seen as the focal firm.
	CSI Toshiba report	--	--	--	Analysis on entities and the dominant processes; competences and dynamic capabilities of Toshiba.

MOT9591 2008					
Case		**Remarks on Content**			**Important Findings**
		Network(-position)	**Strategy**	**Performance**	
3.	**Wifi HP** *BE report*	Wi-Fi alliance as Main actor and within the Wi-Fi alliance sponsor companies as the central actors. However, no clear data moments defined. During the period of 2004-2006: network in Wi-Fi ecosystem seems to be in the type of **Development Network**. The network in Wi-Fi business ecosystem is highly connected within and outside the Wi-Fi Alliance, which creates less structural holes.	• The Wi-Fi Alliance uses a shaper strategy and became the keystone in the ecosystem • Wi-Fi Alliance also uses strategy from organizational behaviour perspective.	• Focus on how Wi-Fi Alliance performs in the Wi-Fi business. • Performance of Wi-Fi network measured using Ahuja's findings that a network with less structural holes creates more innovation output.	The relationship between companies in the Wi-Fi Alliance is 'strong ties'
	CSI HP report	--	--	--	General system and innovation analysis and dynamic capabilities overview of HP.

***BE= Business ecosystem, TP= Technology Patterns, CSI=Company system Innovation**

APPENDIX 3: OVERVIEW OF CASE STUDIES (MOT9592, YEAR 2009)

Table 21: Analysis of the cases for MOT9592, year 2009

MOT9592 2009					
Case		**Remarks on Content**			**Important Findings**
		Network(-position)	**Strategy**	**Performance**	
1.	**PC Operating systems** *BE report*	3 data moments defined: 1991, 1997, and 2007 for BE of Microsoft Windows, Apple Mac OS & Linux. However all 3 BEs are shown in one graph and not separate per BE for each data moment.	• For every data moment strategies of the main players and the stage of network evolution of each BE has been described. • In the Appendices Microsoft's, Apple's & Linux's General Strategy and Boundaries in Operating System Market can be found.	• For every data moment performance of each BE and the focal firm has been described in terms of : – Market share – Revenues	• 3 BE's with 3 focal firms per BE: Microsoft, Apple & Linux Mark Institute. • For each BE, mapping the network partners and connections over time should be done. • Good analysis
	TP report	--	• Strategic maneuvers of Microsoft & Apple between 1984-1991 are discussed • Linux' open business model & wait-and-see and niche	Linux strong position between 1994-2003 is given by using Server OS Market Share	

MOT9592 2009					
Case		**Remarks on Content**			**Important Findings**
		Network(-position)	**Strategy**	**Performance**	
			market strategies are discussed.		
	SB report Microsoft vs. Apple	Microsoft's Strategic alliances with IBM and Intel, OEM licensing agreements	Miscrosoft's strategies Apple's strategies	market share of PC Operating systems	Factors for dominance explained using van de Kaa's framework.
	Final report	Integrates the 3 separate reports TP, BE & SB: the analyses of the 3 separate models are compared with supporting and contradicting evidence from the other models.			
2.	**Smartphones** *BE report*	BE of Symbian OS, Blackberry OS and iPhone OS. No data moments defined.	Strategies of the main players of each BE are described.	• Performance data: from market sales and market share from 2007-2008 and for Q2 2009 of smartphone products. • Also measured by market share growth(2007-2008)	Focal firm Symbian OS BE = Symbian Ltd.(evolved from joint venture among Nokia, Ericsson, Motorola and Psion to single owner Nokia) → Nokia Focal firm Blackberry OS BE = Research in Motion Ltd (RIM). Focal fim iPhone OS BE=Apple. • Data about network position is missing as well as Performance data of the focal firms.
	SB report	--	Standard support strategies(pricing, distribution strategy, timing of entry)	--	Factors for dominance explained using van de Kaa's framework.

3.	**Video game consoles** *BE report*	BEs of the video game console producers of the 128-bit era, Sega with Dreamcast, Sony with PlayStation 2, Nintendo with Gamecube &	Timing strategy, distribution strategy	• 2 sub eras defined:
				  • Dreamcast vs. PlayStation 2 (1998-2001)
				  • Gamecube, Xbox and Playstation 2 (2002-2005)
				• Technological
					• Data moments should be taken in order to look at specific strategies per network position.
					• Performance of

MOT9592 2009					
Case		**Remarks on Content**			**Important Findings**
		Network(-position)	**Strategy**	**Performance**	
		Microsoft with Xbox provided. But no data moments and graphs per moment.		performance and Market performance per subera measured.	the focal firms (over time) should be measured.
	SB report Dreamcast vs. GameCube vs. Playstation vs. Xbox	--	Appropriability strategy, Timing of entry, Marketing communications, Distribution strategy, Commitment	Financial data with respect to the sales and market share of video consoles	

***BE= Business ecosystem, TP= Technology Patterns, SB=Standards Battle**

APPENDIX 4: OVERVIEW OF CASE STUDIES (MOT9592, YEAR 2010)

Table 22: Analysis of the cases for MOT9592, year 2010

MOT9592 2010					
Case		**Remarks on Content**			**Important Findings**
		Network(- position)	**Strategy**	**Performance**	
1.	**Boeing 747 vs McD DC10** *SB part*	3 stages defined: Stage I: past – 1969 Stage II: 1969 – 1970 Stage III: 1970 – 1976	• Standard support strategy per stage	--	Overview using van de Kaa's framework for factors for standard dominance.
	BE part	Boeing as focal firm and BE of Boeing is shown: 3 time frames: 1964-1969, 1970-1975, 1976-1980	Timing of entry, mass market strategy	• Financial performance of Boeing between 1963 and 1980(no data for '74 and '75) • Technical performance of both Bes compared. • Patent data, market share	Time frames chosen instead of data moments. More information about strategies needed.
2.	**IBM PC vsApple's Macintosh**	Only Actors of the IBM PC BE in the early 1980's, mid 1980's and end 1980's mapped. Overview of IBM partnerships from 1980-1990 provided.	• IBM's strategy of adopting an open architecture • Standard supporter strategy	--	• No focus on Apple's Macintosh BE. • Incomplete analysis: no performance data, no comparison table of the 3 chosen data moments.
3.	**LCD vs Plasma TV**	BE of LCD TV is discussed. 2 data moments: • 1995: DTI as main player(joint-venture IBM and Toshiba)	• appropriability strategy of the firms investing in LCD. • Strategies of the main players per	• No performance data for 1995. • 2004: market share, sales growth.	• Inconsistent analysis • Table for BE doesn't show 1995 and 2004 as

MOT9592 2010					
Case		**Remarks on Content**			**Important Findings**
		Network(- position)	**Strategy**	**Performance**	
		• 2004: S-LCD (joint- venture Samsung and Sony), LG Philips LCD (joint-venture LG and Phillips).	data moment. (Mass market strategy, wait-and-see strategy, time of entry etc.)		data moments. • The data moments are not chosen correctly, since DTI is only analyzed for 1995, not for the other data moment and same goes for S-LCD and LG Philips LCD. • Using DTI, S-LCD and LG Phillips LCD as focal firms requires looking at BE of these firms and their network positions over time and strategies used during each data moment; these things are missing in this report.
4.	**MP3 players-Apple's iPod vs Microsoft's Zune**	Apple's BE 3 data moments: 2001, 2004, 2007.	appropriability strategy, pricing & marketing strategies of Apple. "Wait-and-see" strategy	Market dominance of Apple (market share)	• Complete analysis for Apple. Per data moment, network position, strategies and performance provided. • Microsoft's BE missing.
5.	**SACD vs DVD-A**	SACD BE : main player Sony(and Phillips) DVD-A BE: main player DVD Forum 2 data points: 1998 – 2000 and 2003 - 2006	• Sony: Keystone strategy; early entrant, mass market • DVD Forum: Adapter strategy	Technological performance, technological dominance of standardization and innovation performance per data	• Almost Complete analysis for SACD and DVD-A • Performance data of focal firms

MOT9592 2010					
Case		**Remarks on Content**			**Important Findings**
		Network(- position)	**Strategy**	**Performance**	
			of; late entrant, Mass market strategy	point discussed.	needed. • However there are only 2 data points, which are intervals instead of data moments. • Perhaps it would be also good to look at Phillips as focal company.
6.	**Web browsers**	Microsoft's IE BE vs. Netscape's Netscape Navigator BE 3 data moments: 1995, 1998, 2002	• Netscape: keystone, early entrant, niche market strategy • Microsoft: smart follower, mass market strategy; distribution and pricing strategies	Technology dominance or standardization (market share) used to measure performance	• Microsoft's and Netscape's BE analyzed over time • Almost complete analysis, only performance data of the focal firms is missing.

***BE= Business ecosystem, SB= Standards Battle**

APPENDIX 5: OVERVIEW OF CASE STUDIES (MOT1431, YEAR 2010)

Table 23: Analysis of the cases for MOT1431, year 2010

MOT1431 2010				
Case		**Content of:**		**Important Findings**
		SB Report (Assignment A)	**BE Report(Assignment B)**	
1.	**Airbus A380 vs Boeing 787**	• Competition between the companies Airbus & Boeingin the long-haul market. • History of Aircraft Market & Boeing/Airbus • Role of network effects • Factors for standard dominance • TLC analysis • Boundaries of the Firm • Regulation • Innovation strategy of Airbus & Boeing • Hallmarks	• Analysis of the competitive advantage of Airbus Company. • Core activities of Airbus in the value chain; most valuable resources and core capabilities • Airbus value network; main players • Airbus' innovation system and innovation process. • Analysis of Business evolution • Analysis of performance impact of technology strategy	• Airbus' role in the innovation network around the A380 platform has been analyzed: first follower than shaping strategy. • Market share of Airbus from 1996 to 2005 given. • Financial performance of E.A.D.S. N.V is analyzed, not of Airbus.

2.	**Boeing 747 vs McD DC10**	• Standards battle between Boeing's Boeing 747 and Mc Donnell Douglass' DC-10in the commercial airplane market.
		• History of Boeing/McD Douglass
		• Role of network effects
		• TLC analysis
		• Factors for standard dominance mentioned: firm level and environmental level
		• Hallmarks
			• Analysis of the competitive advantage of Boeing Company.
			• External Analysis of Boeing's Value Network using Porter's Five Force Model
			• Innovation Systems and Collaboration Strategies
			• Analysis of Business evolution: evolution of Boeing, Boeing's business model.
			• Analysis of Performance impact of technology strategy:
			  • financial analysis of Boeing: 1999-2008
			  • Characteristics of a "living company"
				• Strategies:
				  • 2 managerial strategies mentioned: Enterprise project management (EPM) and the Global Enterprise Technology Systems (GTES)
				  • Shaping strategy
				  • outsource strategies

3.	**Flash memory**	• Standards battle between	• Analysis of the competitive	• The company's

MOT1431 2010				
Case		**Content of:**		**Important Findings**
		SB Report (Assignment A)	**BE Report(Assignment B)**	

		CF, (supported by Sandisk), MS (by Sony), SD card (by Toshiba, Sandisk & Matsushita/Panasonic), SM (by Toshiba) and MMC (by Siemens and Sandisk) in the flash memory market.
		• History of Flash Memory Market
		• Environmental factors
		• Role of network effects
		• Main actors
		• TLC analysis
		• Factors for standard dominance mentioned: firm level and environmental level
		• Boundaries
		• Hallmarks
			advantage of SanDisk Company.
			• Core activities and environmental factors forming SanDisk's strategy
			• SanDisk's value network; main players
			• innovation system and collaboration strategies used by SanDisk
			• Analysis of business evolution
			• Analysis of performance impact of strategy:
			  • Financial analysis from 1999 to 2008.
			  • Characteristics of a "living company"
				position in the value net is a fragile one
				• SanDisk applies a shaper strategy in the innovation network of the SD technology; first keystone then dominator; exploitation strategies.

4.	**Game consoles 6G**	• Standards battle of the 6th Generation Game Console: Sega's Dreamcast, Sony's PS2, Microsoft's XBOX and Nintendo's GameCube in the video gaming industry. • Brief History of the Consoles. • Environmental factors • Role of network effects • Main actors • TLC analysis • Factors for standard dominance mentioned: firm level and environmental level • Boundaries • Hallmarks	• Analysis of the competitive advantage of Sega Corporation. • Sega's Activities in Value Chain; most valuable resources and core capabilities • Value Net; dominant group of players • Sega's Innovation System and Collaboration Strategies • Analysis of Business evolution: Sega's main business development initiatives over past 5-10 years; Sega's business model (2005) • Analysis of performance impact of strategy: • financial analysis of Sega- Sammy Holding Inc. from	• Role of Sega's in the Innovation network: follower (esp. towards the console manufacturer) • In 2001 Sega withdrew from Gaming Console business; In 2004 Sega Sammy Holdings, Inc. established.

MOT1431 2010				
Case		**Content of:**		**Important Findings**
		SB Report (Assignment A)	**BE Report(Assignment B)**	
			2006-2009; • Financial performance of Sega from 2000-2010 (graphs). • Characteristics of a "living company"	
5.	**Game consoles 7G**	• Standards battle of the 7th Generation Game Consoles: Nintendo's Wii, Sony's Play station 3 and Microsoft's Xbox360 in the video gaming industry. • Brief History of the industry, market and Consoles. • Environmental factors • Role of network effects • Main actors • TLC analysis • Factors for standard dominance mentioned: firm level and environmental level • Boundaries • Hallmarks	• Analysis of the competitive advantage of Nintendo Corporation. • Nintendo's Activities in Value Chain; most valuable resources and core capabilities • Main players in Nintendo's value net. • Nintendo's Innovation System and Collaboration Strategies over the last 10 years. • Analysis of Business evolution: Nintendo's main business development initiatives over past 5-10 years; value drivers; business model characteristics. • Analysis of performance impact of strategy: • Nintendo's financial performance(2002-2008) • operational cash flow development (2002-2008) • Characteristics of a "living company"	• Important role of Strategic maneuvering: • Timing of entry • pricing strategies • Nintendo aims to focus their strategy on differentiation and efficiency. In practice the strategy changes frequently over time. Therefore, strategic direction seems to be unstable. • Nintendo: shaper strategy; Dominator; exploitation strategy.
6.	**HD-DVD vs Blu-ray**	• Standards battle between HD-DVD and Blu-Ray • Sony initiated the development of Blu-ray under the Blu-ray Disc	• Analysis of the competitive advantage of Sony. • Sony's Activities in Value Chain; most valuable resources and core	• BE of HD-VD and BE of Blu-ray are mapped for 3 periods: 2004-2005;2006-2007 and Period 2008 (SB report)

MOT1431 2010				
Case		**Content of:**		**Important Findings**
		SB Report (Assignment A)	**BE Report(Assignment B)**	

		Association (BDA); Toshiba and NEC developed the HD-DVD format under the HD-DVD Promotion group.
		• Mapping of actors within both HD-DVD and Blu-ray network.
		• Environmental factors
		• Role of network effects
		• TLC analysis
		• Factors for standard dominance mentioned: firm level and environmental level
		• Boundaries
		• Hallmarks
			capabilities
			• Dominant players
			• Sony's Innovation System and Collaboration Strategies (1997-2008)
			• Analysis of Business evolution; Sony's business model: financial aspects.
			• Analysis of performance impact of strategy:
			  • Sony's financial performance criteria: growth, Net profit, EBIT (2000-2009);
			  • Operational Cash Flow Analysis
			  • Characteristics of a "living company"
			  • Sony's innovation performance
				• Sony's shaper strategy; from keystone(1st phase) to dominator(now)

7.	**IBM PC vs Apple Macintosh**	• Standards battle between IBM PC and Apple Macintosh in the PC industry. • Role of network effects • TLC analysis for IBM & Apple • Factors for standard dominance mentioned • Boundaries • Hallmarks	• Analysis of the competitive advantage of Apple • Apple's Activities in Value Chain; most valuable resources and core capabilities; main players • Apple's Innovation System and Collaboration Strategies • Analysis of Business evolution; business model; Value creating resources; financial aspects(Mac unit sales 2005-2010, iPod unit sales 2004-2010,Iphone unit sales 2007-2010) • Analysis of performance impact of strategy: - Gross Profit of Apple; Employee Growth;Long and Short Term Assets; Administrative and R&D expenses (2003-	• Apple is pursuing a broad differentiation strategy and differentiates by offering high-quality, exceptional design, and personalized service • Apple employs a differential pricing strategy

MOT1431 2010				
Case		**Content of:**		**Important Findings**
		SB Report (Assignment A)	**BE Report(Assignment B)**	
			2009) - Characteristics of a "living company"	

8.	**Instant messaging (IM)**	• Standards Battle for IM between IM companies like America Online, Yahoo! and Microsoft
		• History of IM
		• Market of IM
		• No particular promoting member of an IM standard
		• TLC Analysis
		• Factors for standard dominance mentioned
		• Boundaries
		• Hallmarks
			• Analysis of Yahoo!
			• Yahoo!'s activities, resources and capabilities; recent changes; environment
			• Yahoo!'s Innovation System and Collaboration Strategies; entities, relations between entities
			• Analysis of Business evolution; business model characteristics and evolution matrix
			• Analysis of performance impact of strategy:
			  • standard financial performance of Yahoo! using data like NET PROFIT and EBIT, ROE in %, Profit Margin, Asset Turnover and Financial Leverage from 2000-2008.
			  • Operational Cash Flow Development.
			  • Innovation performance
				• Yahoo!: shaper strategy; follower
				• Financial performance of Yahoo! is unstable

9.	**Java vs dotNet**	• Standards Battle between Sun Microsystems'a Java and Microsoft's .Net • History: market; Sun and Java language; Microsoft's actions. • Hallmarks • Milestones in the process of technological dominance • Factors for standard dominance mentioned: firm and environmental level	• Analysis of the competitive advantage of Microsoft • Microsoft's core Activities in Value Chain; most valuable resources and core capabilities • Microsoft's Innovation System and Collaboration Strategies: innovation process characteristics, entities, innovation collaboration role	• In 2000, Microsoft was one of the main partners of Sun in the development in Java and had a follower strategy. Now Microsoft uses a shaper strategy

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Case		**Content of:**		**Important Findings**
		SB Report (Assignment A)	**BE Report(Assignment B)**	

		• Boundaries	• Business evolution of Microsoft from 2000-2010
			• Analysis of performance impact of strategy:
			  • standard financial performance of Microsoft using data like net profit, EBIT and EBITDA from 2000-2010; ROI, ROE and ROA in % from 2000-2010.
			  • Operational Cash Flow Development.
			  • Innovation performance
			  • Characteristics of a "living company"	

10.	**LCD TV vs Plasma TV**	• Standards Battle between LCD TV and Plasma TV in the display industry • History: Plasma Technology, LCD Technology • Role of network effects • Standard promoters • TLC Analysis • Factors for standard dominance mentioned • Boundaries • Hallmarks	• Analysis of the competitive advantage of S harp Corporation • Sharp's core Activities in Value Chain; most valuable resources and core capabilities; changes over the past 5-10 years • Sharp's value net; dominant players • Sharp's Innovation System and Collaboration Strategies: innovation process characteristics, entities, innovation collaboration role • Sharp's business evolution: 2002-2008; business model • Analysis of performance impact of strategy: • Standard financial performance of Sharp using data like net profit, EBIT and EBITDA from 1999-	• Sharp's "onlyone" and "spiral" strategy • LCD' s BE mapped • Sharp's role in the LCD BE: when Sharp introduced the LCD TV to the market originally: dominator role; As the market moved toward perfect competition:Keystone • Financial crisis explains Sharp's financial losses in 2009 • Sharp's business evolution strategy is to differentiate. However Sharp's financial strategy is efficiency and lesser differentiation.

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Case		**Content of:**		**Important Findings**
		SB Report (Assignment A)	**BE Report(Assignment B)**	
			2009; ROI, ROE and ROA in % from 1999-2009 • Operational Cash Flow Development. • Innovation performance 1999-2009 • Characteristics of a "living company"	
11.	**MP3**	• Standards Battle in the MP3-player market • Case description with Timeline of events; environmental factors • Analysis of TLC • Factors for standard dominance • Boundaries • Hallmarks	• Investigation of Apple's sustained competitive advantage • Apple's core Activities in Value Chain; most valuable resources and core capabilities; change of operation over past 10 yrs • Apple's value net; dominant players and interactions • Apple's Innovation System and Collaboration Strategies: innovation process, entities, collaborations, Apple's contribution to, gain from and role within the innovation network • Business evolution of Apple analyzed for the time span 2000-2009: business model, evolution matrix • Analysis of performance impact of strategy: • Apple's Profitability, or Return on Equity, of 2000-2009 and its relation to Research and Development (R&D) and Knowledge Productivity.	• Apple has a strong focus on innovation • Apple has a central role within the network associated with their platforms; controlling and shaping how actors within the business ecosystem of Apple interact with each other; shaper strategy

MOT1431 2010				
Case		**Content of:**		**Important Findings**
		SB Report (Assignment A)	**BE Report(Assignment B)**	
			• Operational Cash Flow Development. • Innovation performance 2000-2009 • Characteristics of a "living company" • Apple's strategic direction	

12.	**Photoshop**	• Standards battle between Adobe's Photoshop and Corell's Paint Shop Pro in the digital image editing market.
		• Brief history of Adobe Photoshop and Paint Shop Pro; Market;
		• Timeline of the image editing market
		• Analysis of TLC
		• Factors for standard dominance
		• Boundaries
		• Technology and Innovation strategies of Adobe
			• Technology & Strategy Analysis of Adobe Systems, Inc.
			• Adobe's internal and external environment analysis: activities in the value chain, resources, capabilities; value net, dominant players
			• Adobe's Innovation System and Collaboration Strategies: innovation system and collaborations.
			• Business evolution analyzed for 2003-2009: business development, evolution matrix, characteristics of the business model
			• Analysis of performance impact of strategy:
			  • Adobe's financial performance: Net profit 8 EBIT 2000-2009
			  • Operational Cash Flow Development.
			  • Characteristics of a "living company"
			  • Innovation performance: R&D Investments 2000-2009and Knowledge Productivity
				• Adobe : first mover; niche market strategy; innovation strategies
				• Adobe's innovation network position is to get others to collaborate with Adobe to make their software platform independent and to increase both its speed and improve its security.
				• Differentiation and performance are improved by strongly focusing on innovation

MOT1431 2010				
Case		**Content of:**		**Important Findings**
		SB Report (Assignment A)	**BE Report(Assignment B)**	
			Development 2000-2008.	

13.	**SACD vs DVD-A**	• Standards battle between Sony and Philips's SACD and DVD Forum's DVD-A in the Hi-fi digital audio market.
		• Brief history of the technologies, Market, battle, promoting members
		• Analysis of TLC
		• Factors for standard dominance
		• Boundaries
		• Timelines for SACD and DVD-A
			• Analysis of Philips
			• Phillips's activities in the value chain, resources, capabilities; environment, dominant players
			• Phillip's Innovation System and Collaboration Strategies: innovation system and collaborations.
			• Business evolution analyzed for past 5-10 yrs: evolution matrix.
			• Analysis of performance impact of strategy:
			  • Phillip's financial performance: Net profit ,Gross Profit, EBIT, EBITDA and ratio analysis:ROE, ROA, ROEC 1999-2008
			  • Operational Cash Flow Development.
			  • Characteristics of a "living company"
			  • Innovation performance: R&D indicators, Knowledge Productivity and ROE for 1999-2008 and knowledge productivity development 1999-2008.
				• Phillip' innovation system is a combination of mainly demand---pull and technology push
				• The position of Philips in the value system has changed(less suppliers now)

***TLC=Technology Life Cycle, BE= Business Ecosystem**