

國立交通大學  
企業管理碩士學位學程  
碩士論文

高度競爭下聯盟的策略與競爭優勢

Aligning Strategy with Competitive Advantage in  
Hypercompetitive Environments: A Case Study

研究生：Jacques Stroebel 孫杰克

指導教授：Dr. Edwin Tang 唐瓊璋

中華民國 102 年 7 月

高度競爭下聯盟的策略與競爭優勢

Aligning Strategy with Competitive Advantage in  
Hypercompetitive Environments: A Case Study

研究生：孫杰克 Student: Jacques Stroebel

指導教授：唐瓔璋 Advisor: Dr. Edwin Tang



A Thesis Submitted to Master Degree Program of Global Business Administration

College of Management

National Chiao Tung University

In Partial Fulfilment of the Requirements For the Degree of Master in Business  
Administration

July 2013

Hsinchu, Taiwan, Republic of China

中華民國 102 年 7 月

## Abstract

---

By beginning with a background of the heterogeneity of the field of strategic management, and a discussion of the two main schools of thought relating to competitive advantage, this research set out to determine the merit of adopting a simpler, more dynamic conceptual framework for managers to use in assessing firm evolution. Using Robert A. Burgelman's *strategy diamond* framework and Taiwanese high-technology firm Innodisk Corporation as the case study, the research investigated the alignment of strategy and competitive advantage in extremely dynamic, or hypercompetitive environments with the aim of offering up further evidence for the framework's validity and benefit to the field of strategic management.

Findings from the case study results provide evidence for the framework's value in facilitating strategic mindset within an organization. It offers managers a conceptual picture of the relationships between a firm's stated strategy and strategic action, and between its resource-based competencies and market positioning. In addition, findings demonstrate how specific internal mechanisms of a firm (corporate culture, in the case of our researched firm), can act as a guiding force in aligning strategy and competitive advantage.

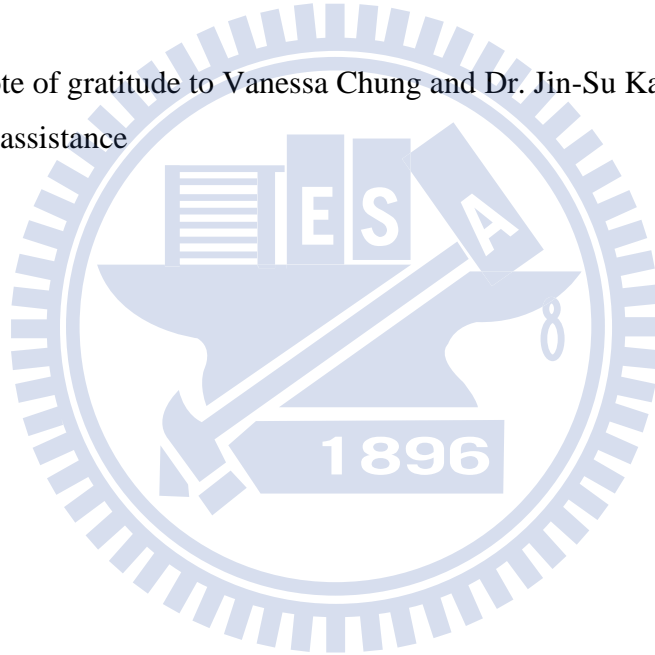
Finally, the case study findings lend support to the framework's usefulness in illustrating areas where management can be more vigilant. The results provide support for the application of the *strategy diamond* framework, and its value as an easy-to-use snapshot of a firm's desired and actual strategic direction, and its intrinsic and relative strengths. The conclusions suggest that the framework has practical value in steering firm evolution in hypercompetitive, high-technology environments.

**Keywords:** *strategy, strategic management, strategy diamond, competitive advantage, dynamic capabilities, hypercompetitive environments*

## Acknowledgments

---

- I wish to express my gratitude and appreciation to Richard Lee, Randy Chien, Michael Wang, Cc Wu and Cynthia Wang at Innodisk Corporation for all their support and kindness
- I would also like to thank my advisor, Dr. Edwin Tang, for his guidance and the many insightful lectures he has given during my time at NCTU
- A special note of gratitude to Vanessa Chung and Dr. Jin-Su Kang for their never-ending support and assistance



# Table of Contents

Abstract.....	i
Acknowledgments.....	ii
Table of Contents.....	iii
List of Tables.....	iv
List of Figures.....	v
List of Appendices.....	vi
I. Background and Problem Statement.....	1
1.1 Background.....	1
1.2 Goals and Objectives of the Research.....	2
II. Strategic Management, the <i>Strategy Diamond</i> , and Dynamic Capabilities.....	3
2.1 Historical and Temporary Context of Strategic Management.....	3
2.2 Burgelman’s <i>Strategy Diamond</i> .....	3
2.2.1 Distinctive Competence of the Firm.....	4
2.2.2 Basis of Competitive Advantage in the Industry.....	5
2.2.3 Official Corporate Strategy.....	5
2.2.4 Strategic Action.....	5
2.2.5 <i>Internal Selection Environment</i> .....	6
2.3 Strategic Management and Dynamic Capabilities.....	7
2.4 Summary.....	7
III. Research Methodology.....	8
3.1 Research Approach.....	8
3.2 Data Collection.....	9
3.3 Research Limitations.....	9
IV. The Case Study: Innodisk Corporation.....	10
V. Findings and Implications.....	18
VI. Summary and Conclusions.....	21
VII. References.....	23
VIII. Appendices.....	26

# List of Tables

---

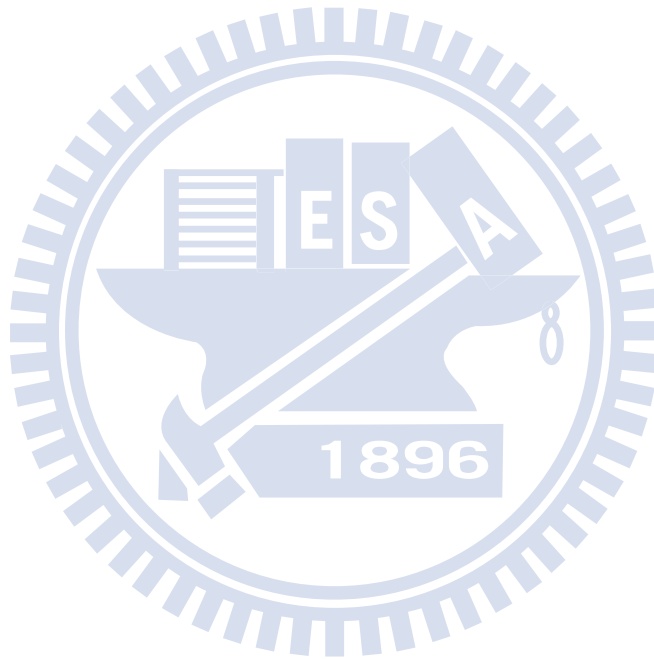
Table 1 Innodisk and the *Strategy Diamond* .....19



# List of Figures

---

Figure 1 Burgelman's *Strategy Diamond* .....4



## List of Appendices

---

Exhibit 1	Segmentation in the Industrial Embedded Flash Memory Market.....	26
Exhibit 2	Customer Types in the Industrial Embedded Flash Memory Market.....	27
Exhibit 3	Innodisk Corporation – Timeline of Major Milestones.....	28
Exhibit 4	Innodisk’s SATADOM® on Intel’s Romley Server Board.....	29
Exhibit 5	Innodisk’s Absolute Service™ Commitment to Customers.....	30
Exhibit 6	Innodisk’s Competitive Advantage vs. Competition.....	32
Exhibit 7	Innodisk’s Competitive Advantages.....	33
Exhibit 8	Innodisk’s Positioning Strategy.....	34
Exhibit 9	Innodisk and Major Competitors.....	35
Exhibit 10	Average selling prices of SSD and HDD, 1998 to 2012.....	36
Exhibit 11	Average selling prices per GB of NAND flash, 2007 to 2012.....	37
Exhibit 12	Innodisk Financials.....	38
Exhibit 13	Comparison of 2012 Key Financial Indicators-Innodisk and Major Competitors...39	
Exhibit 14	Comparison of 2012 Net Profit Margins – Innodisk and Major Competitors.....	40
Exhibit 15	Emerging Non-volatile Memory Market Forecast.....	41
Appendix 1	Case Study Discussion Question.....	42



# I. Background and Problem Statement

## 1.1 Background

At the core of business management literature is the heterogeneous field of strategic management. It is perhaps no wonder that Henry Mintzberg and authors called their strategy “safari” a guided tour through the “wilds” of strategic management. Managers on this bumpy ride must choose from ten schools of strategic management in which to shape their strategic formulations (Mintzberg et al., 1998). Sanchez et al.’s review of strategy theory suggests that “increasing polarization and fragmentation of strategy theory has progressively limited its applicability to the actual practice of strategic management” (Sanchez et al., 1997). Nag et al. take a more positive outlook, arguing that despite having “multiple perspectives”, the field of strategic management maintains a “coherent distinctiveness” (Nag et al., 2007). Regardless as to the cohesiveness of the field, one thing most scholars seem to agree on is that firms must create competitive advantage over other firms. How firms create this competitive edge, Teece et al. propose, is the “fundamental question in the field of strategic management” (Teece et al., 1997).

Many firms today combine Michael Porter’s positional view of cost or differentiation advantage with Jay Barney’s resource-based view (RBV) of competitive advantage developed in the early 90s (Grant, 2008). The problem arises as to the distinction and relationships between these competencies, and to the extent that they affect strategic actions and outcomes. At question are the processes and structures involved in linking strategy with internal capabilities and external product-market positioning. Robert A. Burgelman, in his 1994 paper *Fading Memories: A Process Theory of Strategic Business Exit in Dynamic Environment*, noted that theory about “firm level distinctive competence and the industry-level sources of competitive advantage remains underdeveloped in strategic management” (Burgelman, 1994).

Debate exists as to how we even begin to measure a firm’s competitive capabilities. RBV, for example, might include resources that are “tacit, diffused throughout the organization, or socially embedded” (Godfrey et al., 1995). Following this, we might ask how then do we link these competitive competencies in the larger context of strategy and firm evolution. Managers, Burgelman argues, require a tool to “explore more generally how coevolution and adaptation at the

firm level come about”. Without placing on them the burden of “extraordinary foresight and a grand strategy” (Burgelman, 1994), *what simple framework can we provide decision makers to gauge the effectiveness of their strategic vision and action?*

## **1.2 Goals and Objectives of the Research**

This research focuses on strategic choices firms make in hypercompetitive, high-technology business environments. Although strategic management of technology and innovation are not confined to high-technology firms – an apparel brand, for example, might increase efficiency by implementing a new IT infrastructure, or upgrading manufacturing technologies – this research, however, aims to assess a dynamic theory of strategy in relation to high-technology firms faced with issues such as shrinking profit margins and average selling prices, increasingly shortened product life-cycles, the frenetic pace of industry and market transformation, and complex alignments with stakeholders in the business ecosystem.

In these firms, technology – defined as “physical or operational products or processes which require specific design or procedure” (Frankel, 1990) – and strategy are not secondary level sources of profit maximization, but are at the very core of the firm’s evolution and survival. “Technology is a resource of paramount importance to many organizations; managing this resource for competitive advantage entails integrating it with the firm’s strategy” (Burgelman et al., 1994). The strategic management of technology and innovation, the authors contend, is a “young field” and the “domains of different, partly overlapping concepts are still somewhat in flux” (Burgelman et al., 1994).

This research makes use of Burgelman’s *strategy diamond* (see **Figure 1**) to assess what internal mechanisms are at play in linking strategy with competitive advantage. By analyzing the linkages in the *strategy diamond*, determinations are made regarding management’s ability to steer firm evolution. The research asks:

- *How can high-technology companies align strategy and competitive advantage to achieve market share and profit maximization in hypercompetitive environments?*

## II. Strategic Management, the *Strategy Diamond*, and Dynamic Capabilities

### 2.1 Historical and Temporary Context of Strategic Management

Roughly beginning around the end of World War II, the “accelerated application of science and technology to the process of management” began to put a premium on the “ability to anticipate change, to take advantage of new opportunities, and to take timely action in avoiding threats to the firm” (Bracker, 1980). Jeffrey Bracker, in his 1980 paper *The Historical Development of the Strategic Management Concept*, provides for us a useful definition of strategic management: it entails “the analysis of internal and external environments of a firm to maximize the utilization of *resources* in relation to *objectives*” (Bracker, 1980).

The idea of firm capabilities – strengths, advantages, competencies – in relation to strategic management is extensive in the literature. The terms *internal* and *external* are commonly used, yet there is little consensus as to which set of competitive advantages has the most relevance to the strategic management of an organization. Hoskisson et al. (1999) analyzed the “pendulum-like swings in the field’s emphasis on firms’ external environments and internal resources” (Nag et al., 2007). And despite Mintzberg’s classification of as many as ten schools of thought in strategic management, the field largely seems to focus on the internal and external strengths of firms in relation to strategic decision making, arguably because of the directly measurable results they provide. The two pioneering schools of thought here are Porter’s five-forces framework of competitive advantage, the positional view; and Barney’s idea of internal, intrinsic resources and competencies, the resource-based view, from which the idea of *dynamic capabilities* evolved. These elements of strategy and internal or external competitive advantages and capabilities are brought together under a simple conceptual framework in Burgelman’s *strategy diamond* (see **Figure 1**).

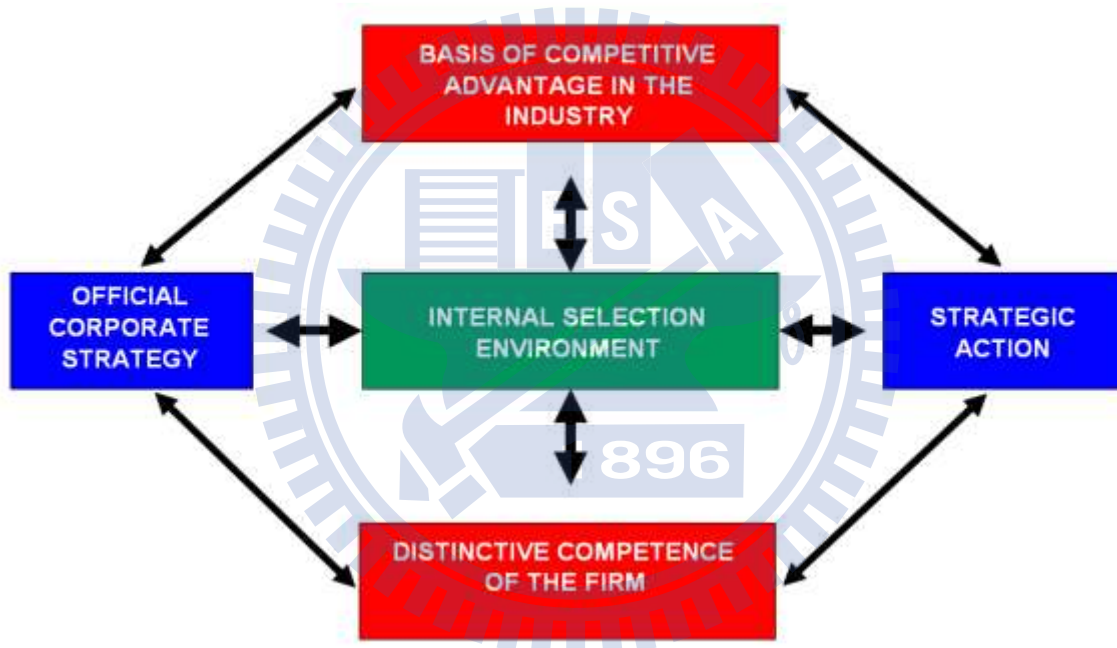
### 2.2 Burgelman’s *Strategy Diamond*

Burgelman’s first use of the *strategy diamond* in 1994 was in formulating a business-exit strategy for high-technology firms in fast-paced business environments. His research looked at Intel’s core business model and analyzed the company’s shift from DRAM memory to microprocessors. In

2008, Burgelman revisited his *strategy diamond*, this time evaluating four more high-technology companies. Burgelman’s goal in this paper was to formulate a generic “jargon-free” tool for instilling “strategic mentality” into organizations, and his conclusions were that managers must dynamically evaluate and align strategy with competitive advantages for strategic discipline within organizations.

Following is an examination of the five forces in Burgelman’s *strategy diamond* (see **Figure 1**):

**Figure 1** Burgelman’s *Strategy Diamond*



Source: Burgelman, 2008

### 2.2.1 Distinctive Competence of the Firm

In the resource-based view (RBV), competitive advantage is gained through a firm’s “distinctive competencies”. These can be, among others, technical, managerial, commercial or cultural in nature. At this level, the firm “excels to create customer value relative to competitors” (Burgelman,

2008). Burgelman uses the term “distinctive competencies” rather than “core competencies” to highlight the fact that these firm competencies are a result of an “evolutionary learning process”.

Robert Grant’s 1991 paper on firm resources and strategic management points out the reasons why this school of thought in strategic management cannot be underestimated:

The reasons are not difficult to find: international competition, technological change, and diversification by firms across industry boundaries have meant that industries which were once cozy havens for making easy profits are now subject to vigorous competition.

Despite RBV’s obvious relevance to the field, many still prefer to link strategy to Porter’s external environment:

### **2.2.2 Basis of Competitive Advantage in the Industry**

The positional view, also referred to as product-market positioning, or the industrial organization perspective, was Porter and others’ work on determining a firm’s competitive advantage by assessing its place in the market. Price and differentiation in the positional view are key areas where firms can strive for a competitive edge over other firms.

Burgelman does not argue for a preference for the resource-based view over the positional view (or vice versa), but rather a marriage of the two. The two competitive advantage perspectives form the first two chains in his strategy diamond. The next two deal with strategy:

### **2.2.3 Official Corporate Strategy**

This leg of the *strategy diamond* is viewed as a firm’s mission statement, or its formulation of strategy. Burgelman defines a firm’s official corporate strategy as “the scope of the business it wants to be a winner in and its intended competitive advantage” (Burgelman, 2008). A firm’s official corporate strategy sets the foundation, along with competitive advantage and the *internal* selection environment, for the next force in the *strategy diamond*, strategic action:

### **2.2.4 Strategic Action**

This linkage deals with the implementation of strategy. Here a firm “actually uses its product-market position and distinctive competence to achieve competitive advantage” and is where management must “commit the venture in a strategic direction” (Burgelman, 2008). Strategic action, Burgelman says, is “not easily reversed”. An organization must ask itself which product, technology, etc. it chooses to allocate most of its resources to. Evaluation of strategic action can include market share, market share growth, geographical strengths, customer satisfaction measurement, and industry awards and recognitions for technology, product, or innovation.

### **2.2.5 Internal Selection Environment**

This last force in Burgelman’s *strategy diamond* helps to regulate, or integrate, the strategic and competitive advantage forces. *Internal* selection environment “comprises the corporate contextual elements that help maintain alignment of the other four forces”, and can include organization structure, planning and control systems, measurement and reward systems, values and norms (Burgelman, 2008). Burgelman argues that the quality of a company’s *internal* selection environment is an “important determinant of its capacity to cope with the challenges posed by the *external* selection environment.”

The *external* selection environment are the “non-market forces (technological change, government regulation), and general economic conditions (booms and busts)” (Burgelman, 2008). Ernst Frankel, in his book *Management of Technological Change*, provides a comprehensive list of the external factors affecting technological change that are “outside the control of decision makers”:

- institutional structures or organizations
- regulatory and other constraints or incentives
- cultural contexts
- government policy and role (type of government)
- government ownership and control (obtrusive or non-obtrusive)
- political climate including political risk
- labor role, relations, and organization
- industrial or global position

- ecology
- prestige and expectations; and
- technology transfer controls

### 2.3 Strategic Management and Dynamic Capabilities

The study of a firm's *dynamic capabilities* evolved out of the resource-based view of competitive advantage. Whereas the dominant theory in the 1980s was Porter's industry-level forces of competitive advantage through product-market price leadership or differentiation, dynamic capabilities sought to move capabilities back to firm-level competitiveness (Teece et al., 1997).

Burgelman suggests his *strategy diamond* framework may serve as a tool for "examining the micro-foundations of *dynamic capabilities*". He argues that firms that rely too heavily on either of the two sources of competitive advantage – distinctive competencies or positional advantage – face the possibility of falling into either a "competence trap" or a "position trap". The *strategy diamond* framework, Burgelman suggests, helps to produce "a sort of "strategic paranoia" in managers that is healthy and needed in extremely dynamic environments (Burgelman, 2008). The *strategy diamond*, Burgelman says, helps to bring in the human factor in decision making:

Capabilities in and of themselves only constitute a "potential." Examining dynamic capabilities in the framework of the strategy diamond may thus help top management appreciate better that in the end strategy is only as good as strategic action (execution); and that while strategy without capabilities is powerless, capabilities without strategy are aimless.

### 2.4 Summary

Burgelman views his *strategy diamond*, his linking of market position competitive advantage and distinctive competencies, or resources, and the linking of official corporate strategy and strategic action as "helpful in diagnosing more clearly different underlying causes of the strategic issues and problems that a company may face as it evolves" (Burgelman, 2008). It recognizes the "dynamic

reciprocal relationship” between strategy logic and strategy execution in highly dynamic environments.

The *strategy diamond* framework determines “how the internal selection environment may help a company to dynamically align strategic action with stated strategy and distinctive competence with the basis of competition (given its product-market position) in the face of changes in the external selection environment and/or in response to its own strategic moves.” (Burgelman, 2008). It helps to establish longer-term maximum winning games such as becoming a highly valuable established growth company.

### III. Research Methodology

#### 3.1 Research Approach

A **case study** approach was used. This was deemed appropriate given the holistic nature of the study, in terms of gaining current, real-life insight into corporate strategy and firm evolution through a more dynamic yet simple, conceptual framework. The research does not take as its focal point specific, exhaustive data on each of the forces in the *strategy diamond* (see **Figure 1**), namely corporate strategy versus corporate action, distinctive competencies versus product-market positioning, and the internal mechanisms to connect them, but rather aims to provide an easily recognizable tool for managers making strategic choices in rapidly changing business ecosystems.

The **case** subject is Innodisk Corporation, a global leader in industrial embedded flash storage solutions. Due to the fiercely competitive and dynamic nature of the industry Innodisk operates in, where technology and strategy are interwoven elements of market and resource positioning, Innodisk was considered an ideal candidate for field research.

This case study adds to the body of field research conducted by Robert Burgelman using his *strategy diamond* conceptual framework. Burgelman has applied this framework at Intel, General Electric, Matrix Semiconductor, Pixim, Weave Innovations and StubHub.



### **3.2 Data Collection**

Interview data and archival data collection methods were used. Interviews were conducted in-person on and off Innodisk premises with key decision makers, including the CEO, and the director of engineering (the central player with regard to the key technology issues of the case). Interviews were open-ended, semi-structured, and were recorded, then transcribed. A small portion of the interview data came from email correspondence.

Archival data was collected from a wide range of sources. A significant portion of archival data was made available from Innodisk's company resources, including the company's website, marketing collateral, documents relating to the company's rebranding campaign, technical documents available on the company's database, and others. The remaining industry and technology related data was collected from external sources.

### **3.3 Research Limitations**

One of the most common dangers of field research is bias from either the researcher or the research targets. The researcher ensured that his personal opinions and relationships with the case subject individuals, the company, and the industry as a whole did not affect the integrity of the case research and findings.

Data integrity was treated with the utmost care. Special care was taken in accurately transcribing interviews. The researcher consciously avoided including non-relevant information in hopes of focusing the reader to the main issues of technology, strategy, strategic management, and competitive advantage in dynamic environments.

As with all case study research, it must be stated that direct theories, implications and findings of this research cannot be extrapolated to the general body of knowledge and truth as a whole. A much larger data set and more exhaustive analysis is needed to draw general conclusions.

## IV. The Case Study: Innodisk Corporation

### Innodisk Corporation

*- Decisions are based on a company's future and necessities. After these decisions are solidified, then the planning starts.*

*- The market is changing rapidly, and more competitors are emerging. Competition gets fiercer all the time. So internally we must be able to quickly adapt to external forces.*

– Randy Chien, President, and Chief Executive Officer  
Innodisk Corporation

Richard Lee finally had a chance to sit down and relax. The future of the company he had founded eight years ago looked bright. Chinese New Year celebrations for 2013, the Year of the Snake, had been a hard-earned reward for the grueling past nine months of analysis, deliberation, and implementation of Innodisk's rebranding campaign. After much debate as to Innodisk's core value proposition to customers, the message to stakeholders was now clear – Innodisk was a “service-driven provider of industrial embedded flash and DRAM storage products and technologies, with a focus on the enterprise, industrial, aerospace, and defense industries”. A full in-house manufacturing solution consisting of a dedicated firmware team, a purpose-built factory, and intellectual property was the foundation of a company priding itself on its ability to add that extra human touch. With service now a branded part of corporate culture and business operations, Lee was confident in continued growth and success for the young enterprise. Lee felt a sense of accomplishment as he viewed the slick, shiny brochures displayed neatly on his desk and the glowing emails from partners and customers. But he remained anxious.

With his company's official corporate strategy solidified, Lee wondered if this would be enough to fend off an ever increasing list of competitors from different segments of the embedded flash memory industry. The industry involved different segmentation depending on volume, customization needs, specification and sector, and opportunities always existed for new entrants and already established players to capture market share (see **Exhibits 1** and **2**). While still not as fierce as the consumer flash memory market, where only those firms with strong consumer branding and economy of scale could compete, the industrial flash segment saw increasing

competition with the continual drop in solid-state drive (SSD) prices versus hard disk drive (HDD) prices, and decreasing NAND flash prices.

Was Innodisk optimally positioned to take full advantage of a wide range of vertical business opportunities, not only in the existing commercial, industrial, and aerospace and defense sectors, but in the trend toward a cloud model of the industrial PC (IPC) and non-consumer flash storage sectors? Was the new corporate communication policy of service, technology and solution enough to secure market share in chosen segments, or would new entrants capture territory where Innodisk did not maintain a leading position? With a dizzying network of technologies, products, sub-products, solutions, customizations, and customer types and segments, in an industry changing rapidly, would 2014, the Year of the Horse, be as enjoyable to Lee as the festivities the week before?

### SURVIVING IN THE BEGINNING: 2005 to 2007

In March 2005, Innodisk set up operations in a small office in Neihu Technology Park in Taiwan. Lee and his six-person team offered consumer and industrial flash memory products to the market, but it was the consumer side that gave the fledgling business the cash flow to survive (see **Exhibit 3** for a timeline of major company milestones). Randy Chien, President and CEO, said of the earlier years:

We had planned on focusing on the industrial segment all along, but companies need to survive in the beginning. The average industry player needs about 2 to 3 years to establish itself. The consumer market traditionally sees immediate gains compared to the industrial B2B sector. Our group was quite familiar and experienced with the consumer segment at the outset. We knew who our clients were. This short-term strategy gave us the income needed to survive as a business.

After about two years, Innodisk saw itself faced with the decision to shift resources away from the volatile consumer flash market into the industrial, embedded sector. Chien's thoughts on the transition to industrial flash memory:

There are several points to mention here. Long-term survival in the general electronics and IC market, if you take the retail market for instance, apart from PCs, mobile phones, etc, it's hard to stand out and make your mark. The consumer market is too volatile. However, if we look at the global IPC market, 60 to 70% of the companies come from Taiwan. The technology has accumulated in Taiwan, there is an IPC cluster here, a know-how. Also, our founder, Richard, came from a background of industrial flash, and created the IP we needed. A company's success can be divided in phases. After surviving phase 1, we needed to determine what Innodisk's core business and core value was, and were we could deliver winning games over our competitors. We had to think of the company's long-term plan. Many businesses fail in phase 1, in the survival phase. The industry has certain conditions. A company must earn the trust of its clients. Especially in the industrial flash memory segment, your clients want to know that you are committed, that you can survive. Your clients must feel that you have a foundation, that you're stable. During this stage, round 2006/2007, we committed to the industrial flash memory market. Round 2007, we acquired several small, pure-play industrial memory companies. A number of employees came from those acquisitions.

## A SHIFT IN CORPORATE STRATEGY

Shifting corporate strategy at Innodisk to a focus on the industrial embedded flash sector involved several key elements:

### **Knowledge and Expertise**

Innodisk saw itself as possessing a keen insight and know-how of the sector, backed up with industry-leading intellectual property which saw the company filing roughly five to six patent applications a year. Chien commented on the sector:

The IPC industry - military, rugged, embedded, point-of-sale (POS), automation etc...this sector is diverse, apart from PCs, cell phones... everything else, the system you use to swipe your train card at the train station, for example, that involves industrial flash memory. Taiwanese companies specialize in a system...military, medical, etc, but they all require storage, they all require flash memory storage. Our team had know-how in flash storage, so we continued in this field.

One of Innodisk's key innovations in flash storage would be their Pin 7 device-to-host connection technology which reduced SSD size and eliminated the need for power cables. This allowed Innodisk to engineer the Serial ATA Disk on Module (SATADOM®), the world's smallest form-factor memory storage solution. Certified for use on Intel's Romley server boards, SATADOM® (see **Exhibit 4**) was widely adopted by other industrial and embedded system integrators around the world.

### **Controlling Production and Quality**

Building an industrial-grade factory with a surface mount technology (SMT) line, proprietary memory production and testing systems, and advanced machinery and equipment would be another important element of Innodisk's new business model. In November of 2007, Innodisk completed the setup of its SMT line. Chien commented:

Industrial flash memory market is 'low quantity, more variety'. So outsourcing was not a good fit. Also, for in-house quality control, it's vital to have your own SMT and factory line. Also, you need the flexibility it provides. Outsourcing can't do this effectively.

### **Creating Firmware**

Having a dedicated firmware team, Chien noted, would prove to be Innodisk's biggest

advantage: “This is the hardest thing to do”. Cc Wu, director of the embedded flash division at Innodisk commented:

I have a background in computer science and when Innodisk started out, I had a big passion for firmware. I proposed that we build our firmware capabilities. Firmware is the most important technology in flash storage. Possessing expertise in firmware enabled us to get ahead over other embedded flash businesses. Proving to our customers that we had this skill was an important part of building trust. Our industrial customers knew they could rely on us for support. We first needed to prove that we could create firmware. After that, we could plan for scaling up. We marshaled resources and created a firmware team. We first made sure we were well-prepared.

### **It’s all about the Team**

Managing with a more collaborative, open-door style would prove to be another element of success for Innodisk. Chien remembers the change in management attitude as the company transitioned from a pure office to production and testing, and how executive decisions were made as a team. All member of the organization were consulted, and opinions were openly voiced: “Innodisk’s culture is like this. It’s one of our strengths”.

### **Adding that Personal Touch**

Instilling a flexible, ‘no-job-too-small’ attitude within the company that sought to build the trust and respect it needed from partners and clients would be the extra ingredient Innodisk needed. Innodisk’s Absolute Service™ commitment to its customers (see **Exhibit 5**) would see Innodisk positioned as a ‘personalized care’, boutique-style partner for system integrators and end users in the industry. Industry surveys noted “accepting any order”, “responsive service”, and “good people” as some of the reviews on Innodisk (see **Exhibits 6 and 7** for a more comprehensive overview of Innodisk’s competitive advantages). Chien: “Service is hard to do. We have weekly meetings on the service side of Innodisk’s business model”.

## POSITIONING FOR THE FUTURE

COMPUTEX TAIPEI 2013, Asia's largest computer exhibition and the second largest in the world, was just around the corner. Management at Innodisk were excited to show the IPC industry that the company had successfully rebranded and strengthened its position as a service-driven provider of industrial embedded flash memory (see **Exhibit 8** for overview of Innodisk's positioning strategy). Several other local industrial flash memory providers would also be setting up a booth at the exhibition (see **Exhibit 9** for Innodisk's major competitors), and this would be a chance for Innodisk to communicate its corporate focus to partners and clients. Despite being excited about the upcoming exhibition, Wu, Chien, Lee and the rest of the Innodisk management team had their thoughts on a bigger issue – was Innodisk doing all it could do to position itself for the future?

### Challenges Ahead

The biggest challenge to the flash memory sector, as with the general semiconductor industry as a whole, is the ever increasing number of transistors that can be fitted on to an integrated circuit (IC). This is known as Moore's law, which states that the capacity will double every 18 months. Wu's comments:

Because each node gets smaller in the manufacturing process, 19nm might move down to 15 or 10nm, technology keeps evolving. Flash lifespans are getting shorter and heat dissipation becomes a problem to handle. We have to design for these limitations...heat pads, for example.

NAND flash itself has inherent weaknesses. Due to the increasingly excessive loads placed on flash modules by read/write/erase instructions, and the way in which data is written to memory blocks and erased, issues such as data retention and data consistency, and lifespans of flash chips were a major part of a firm's technological expertise in this sector. Chien's comments:

As prices drop, and more players get into the industry, it becomes more crucial to innovate technologically. Not only to combat growing competition, but also to offset the inherent weaknesses in the NAND flash chips used in SSD storage. Our R&D is constantly working on this problem.

Another problem the sector faced was that of NAND flash supply shortages. Apple Inc.'s iPhones and iPads had almost completely sapped the supply of NAND flash memory in the late 2000s, and the increasing use of mobile connected devices such as smartphones and tablets was putting a strain on supply. With the increasing number of new entrants, it was crucial for flash memory companies to build strong relationships with NAND flash manufacturers. Occasional supply shortages resulted in companies having to scramble to find alternative sources of supply. A sudden supply stoppage would be disastrous to any firm with sizeable, global operations.

There was also a fine balance between a firm's level of output, its gross margins, and SSD and NAND flash prices. Falling SSD and NAND flash prices (see **Exhibits 10** and **11**) were good and bad for embedded flash memory providers depending on their size, scope and vertical business ecosystem. The loss in profit from shrinking SSD selling prices obviously meant lower gross margins, but this was offset by an increase in quantity sold, as more system integrators and end users opted for increasingly cheaper SSD storage. The performance benefits of SSD – more energy efficient, lighter and more compact, more robust and better suited for industrial embedded applications – were fueling the shift toward SSD. The majority of users, however, especially in enterprise storage, were still using HDD solutions, so there was huge potential for SSD market growth over the next several years.

Dropping NAND flash prices were good for the sector as it lowered operating costs. Embedded flash providers sourced their NAND flash from one of the five giant memory manufactures Samsung, Micron, SK Hynix, Toshiba and SanDisk, and occasional price spikes did place strains on the sector.



## The Future is Now

Innodisk's market position and financial strength looked solid. Revenues had increased significantly over the last several years (see **Exhibits 12-14** for financial information on Innodisk and competitors), and management along with R&D and engineering departments kept a close eye on key developments in the industry, ensuring Innodisk was well placed to react to any major technological trends. One issue taking place was the need for increased space optimization in Ultrabooks and other connected devices in order to increase the amount of SSD storage capacity. Intel's Next Generation Form Factor (NGFF) was an improvement over the current mSATA standard. Innodisk had already engineered the required adjustments to accommodate the NGFF form-factor size, and would be unveiling the new form-factor at the upcoming Computex.

The sector was increasingly excited about cloud computing business opportunities for SSD technology. Innodisk had acquired US-based ACTICA Inc. in 2011 which had given them inroads into the SSD server memory and storage segment. Together with ACTICA Inc., Innodisk could offer clients a vertically integrated server storage solution complete with DRAM memory modules and SSD storage. Competitors Fusion-io and Violin Memory had already made significant traction in the brand-conscious, large-scale SSD data server market, while management at Innodisk saw potential in server SSD storage for the infrastructure and telecommunications segment. Chien's comments:

We want to expand revenues as well and grow the business. This requires investment in resources. We want to stand out from competitors in the commercial flash segment with high-end solutions. Looking into the future, maybe 5 years down the line, we see more focus on cloud applications. This is an interesting development. Speed and energy consumption are key issues here. Cloud applications can be broken down into different segments. First is the general use...Google, Yahoo, etc...user platform, basically, this is not what Taiwan is doing. Another is infrastructure...telecom, etc, you need storage...servers, here we have two – data server and communication server. All servers need cache...as in DRAM...and storage. So the future for us is in industrial flash and cloud applications

But there were broader questions on the horizon. NAND flash was quickly approaching its technological limits. With layers now just a few atoms thick, it was becoming increasingly difficult to engineer smaller semiconductor geometries at the nanometer scale while maintaining control of the flow of electrons. Large memory manufacturers such as Micron and Samsung were already looking toward the next technology.

One advancement was 3D NAND flash which allowed for stacking of cells, thereby overcoming NAND flash scaling limits. But many in the industry were looking still further ahead, to completely new technologies that would replace NAND flash. These emerging non-volatile memory (NVM) technologies were projected to experience robust growth over the next several years with estimates of \$209 million in 2012 to \$2 billion in 2018 (see **Exhibit 15**).

Still, this was only a tiny percentage of the \$20.8 billion NAND flash market in 2012, and industrial embedded flash providers were jostling for positions based on the current business and technology ecosystem.

“I believe NAND will be the major storage solution for the next 10 years. NAND is a very low price solution for storage” – Cc Wu.

“It’s hard to say for certain what will happen in the long run in this industry. But for the next 3 to 5 years, our current corporate strategy is to focus on industrial embedded flash storage and cloud applications” – Randy Chien.

## **V. Findings and Implications**

Burgelman reminds us that his five forces are “are simultaneously at work in an interactive fashion at any given time” and that no particular order should be visualized when discussing the *strategy diamond’s* implications. With that in mind, we examine the five forces of Burgelman’s *strategy diamond* in relation to our case subject, Innodisk Corporation, in the table below.

**Table 1: Innodisk and the *Strategy Diamond***

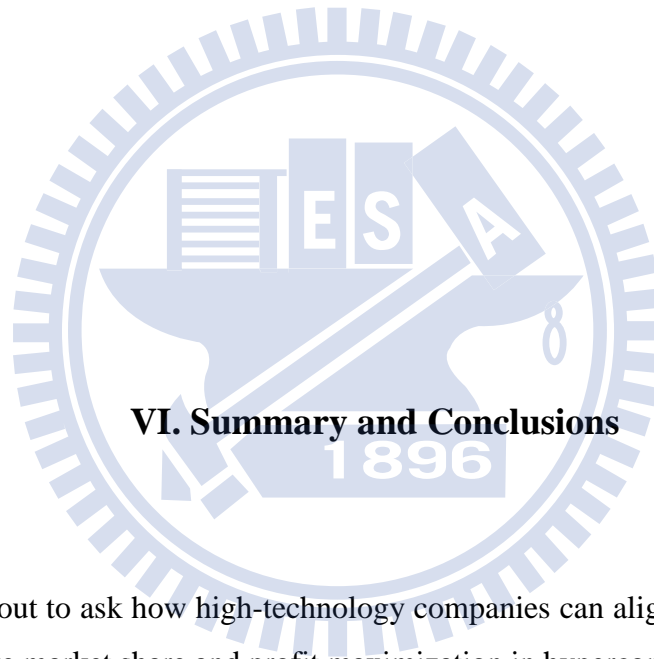
<p>Official Corporate Strategy</p>	<p>Innodisk’s corporate introduction states that the company is a “<b>service-driven provider of industrial embedded flash and DRAM storage products and technologies</b>, with a focus on the <b>enterprise, industrial, aerospace, and defense industries</b>”. The CEO desires Innodisk to <b>stand out from competitors</b> in the <b>commercial flash</b> segment with <b>high-end solutions</b>. He sees <b>industrial flash and cloud applications</b> as the future of the company.</p>
<p>Product Market Position (Basis of Competitive Advantage in an Industry)</p>	<p>Innodisk positions itself at <b>the low-volume, customization segment of the market</b>. It <b>differentiates through customization, innovation, flexible order sizes, short lead times, responsive service and a wide range of product offerings</b>.</p>
<p>Distinctive Competence of Firm</p>	<p>Innodisk’s dedicated <b>firmware team, in-house factory, and intellectual property</b> form the basis of the company’s distinctive competencies. Most notably in <b>IP strength</b> is the company’s <b>SATADOM® form-factor SSD storage solution</b> widely accepted in the industry. A <b>service-oriented, friendly culture</b> also forms an integral part of the company’s distinctive competencies.</p>
<p>Strategic Action</p>	<p>Innodisk <b>shifted resources to industrial embedded flash</b> in the earlier years. Later on, the company <b>acquired</b> a server storage provider in the US to <b>penetrate the enterprise SSD storage</b> segment of the market. More recently, the company <b>aggressively embarked on a rebranding campaign</b> to solidify its position as a technology, service, and solution provider in the industrial embedded storage segment. All <b>corporate communications, marketing collateral, product catalogues, technical documents, the website, and other brand related areas</b> were <b>reworked and revamped</b>.</p>
<p>Internal Selection Environment</p>	<p><b>Team-spirit</b> and an <b>open-door policy</b> formed a <b>corporate culture</b> that <b>encouraged debate and discussion</b> between <b>all members</b> of the organization. <b>Collaborative top management decisions</b>. All <b>in-house, close proximity</b> between SMT factory, and administration, and open platform to hear concerns from sales staff, factory workers, product managers, and others in the organization.</p>

We can make several interesting observations about Innodisk's strategic direction from the tabulated five forces above. See **Figure 1** for a useful, visual tool to conceptualize the connections between the forces of the *strategy diamond* in relation to firm evolution and strategic decision making.

- Management desires to increase market share in the high-end commercial SSD storage sector. This is in line with Innodisk's current product-market positioning in low-volume customization, notably in the industrial embedded and aerospace and defense segments. However, one of the strategic actions taken by the firm was to acquire SSD server storage provider ACTICA Inc. in the US with the goal of focusing on cloud applications for data and communication servers in the infrastructure and telecommunications sector. This sector might typically be for high-volume customization markets, with lower price points, and would require a more aggressive, larger-scale effort on Innodisk's part. The linkages between *official corporate strategy* (high-end commercial, service-centered, industrial embedded cloud), *basis of competitive advantage (product-market position)* (low-volume customization, flexible) and *strategic action* (acquiring enterprise SSD storage firm), could be "stretched" and forming a sort of "strategic dissonance" in this case.
- One *strategic action*, rebranding the firm as a service-driven, flexible, responsive partner in the industry, created "strategic harmony" between the firm's *official corporate strategy* and *basis of competitive advantage (product-market position)*.
- The company's healthy *internal selection environment* centered on an open communication platform and collaborative management style is a key factor in re-aligning any potential strategic dissonance the company might face. This internal mechanism provides Innodisk a tool in making quicker, more focused decisions in fast-paced environments, as strategic actions are not easily reversed or adjusted in extremely dynamic environments.
- The firm has *distinctive competencies* in firmware and intellectual property. Management can ensure a significant amount of company resources is allotted to R&D and engineering.

Overall, Innodisk's alignments between strategy and competitive advantage are clear and well organized by the firm's internal corporate culture. Rebranding was executed in a way consistent with the firm's vision. Firmware, manufacturing, and intellectual property strengths are in tune with the company's low-volume, high-end customization target market with service a key component of core value.

Based on the findings above, management might benefit from frequent inspection and evaluation of its strategic moves into server storage, cloud applications, and any consequences this might have for its already well-established position in low-volume customization. Management might also schedule regular assessments of the amount of company resources going toward R&D and engineering.

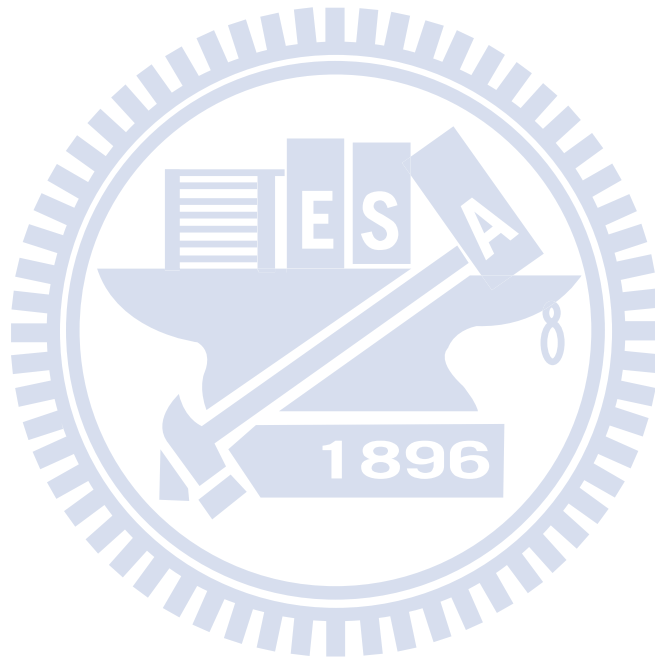


## **VI. Summary and Conclusions**

This research set out to ask how high-technology companies can align strategy and competitive advantage to achieve market share and profit maximization in hypercompetitive environments. By recognizing fragmentations in the field of strategic management, the author adopted a simple, conceptual framework with which to facilitate strategic mindset in an organization. Robert Burgelman's *strategy diamond* framework formed the basis of an investigation into Taiwan's Innodisk Corporation, a high-technology partner in the industrial embedded flash storage sector. This research adds substance to Burgelman's growing list of high-technology firms already assessed within the *strategy diamond* framework.

The researcher is impressed by the simple yet effective outcome of the analysis. A conceptual picture of the firm's capabilities and strategic direction, and a snapshot of its current and desired

position in the business ecosystem were immediately evident on tabulation of the five forces. The framework is insightful and easy to recognize. What do we do? What are we good at? What do we have? These are questions that diffuse strategic thinking throughout an organization. In hypercompetitive, high-technology environments, this strategic attitude creates competitive edge and steers firm evolution.



## VII. References

Actica Incorporated (2013). Company Profile. Available online:

<http://www.acticainc.com/profile.php>

Bracker, J. (1980). The Historical Development Of The Strategic Management Concept.

Academy Of Management Review 5.2: 219-224. Business Source Complete. Web. 5 May 2013.

Burgelman, R., Christensen, C., and Wheelwright, S. (2004). Strategic Management of Technology and Innovation (4 ed.). McGraw-Hill/Irwin.

Burgelman, R. A., & Siegel, R. E. (2008). Cutting the strategy diamond in high-technology ventures. *California Management Review*, 50(3), 140.

Burgelman, R. A. (1994). Fading memories: A process theory of strategic business exit in dynamic environments. *Administrative Science Quarterly*, 24-56.

Charentenay, Y. (2013). Yole Development. Emerging Non-Volatile Memories. Market and technology report. Available online: <http://www.i-micronews.com>

Frankel, E. (1990). Management of Technological Change. Kluwer Academic Publishers. Dordrecht.

Godfrey, P. & Hill, C. (1995). The problem of unobservables in strategic management research. *Strategic Management Journal*. Volume 16, Issue 7, pages 519-533.

Grant, R. M. (1991). The Resource-Based Theory of Competitive Advantage: Implications for Strategy Formulation. *California Management Review*, 33(3), 114-135

Grant M. R, (2008b). Contemporary Strategy Analysis. Sixth Edition. Blackwell Publishing, UK, P. 482

Halfacree, G. (2012). Intel working on Next Generation Form Factor SSDs. Available online:  
<http://www.bit-tech.net/news/hardware/2012/08/06/intel-ngff/1>

Innodisk Corporated. (2013). 5289 TWO. Finance and Stocks. Available online:  
<http://www.reuters.com/finance/stocks/overview?symbol=5289.TWO>

Ko, H. (2013). 2013: Next-generation 3-D NAND flash technology. Available online:  
<http://www.electroiq.com/articles/sst/2013/01/2013-next-generation-3d-nand-flash-technology.html>

Leibson, S. (2010). The End of NAND Flash as we Know It: Micron's Dean Klein and Samsung's Tony Kim Look at Life After Flash. Available online:  
<http://www.denali.com/wordpress/index.php/dmr/2010/01/21/the-end-of-nand-flash-as-we-know-it-micr>

Mearian, L. (2011). HP set to release NAND flash replacement in 18 months. Available online:  
[http://www.computerworld.com/s/article/9220652/HP\\_set\\_to\\_release\\_NAND\\_flash\\_replacement\\_in\\_18\\_months](http://www.computerworld.com/s/article/9220652/HP_set_to_release_NAND_flash_replacement_in_18_months)

Mintzberg H, Ahlstrand B and Lampel J, 1998. Strategy Safari: A Guided Tour through the Wilds of Strategic Management. The Free Press, USA, ISBN 0-684-84743-4

Murray, M. (2012). IDF: NGFF and mSATA Vie for Ultra-Thin Storage Supremacy. Available online: <http://www.pcmag.com/article2/0,2817,2409710,00.asp>

Nag, R., Hambrick, D. C., & Chen, M. (2007). What is strategic management, really? Inductive derivation of a consensus definition of the field. *Strategic Management Journal*, 28(9), 935-955.



Peteraf, M.A., "Research Complementarities: A Resource-Based View of the Resource Allocation Process Model (and Vice Versa). In Bower (J.L. and Gilbert, C. (eds.), From Resource Allocation to Strategy, Oxford, Oxford University Press, 2005

Porter, M.E. (1980). *Competitive Strategy*, New York, Free Press.

Sanchez et al. (1997). Reinventing strategic management: New theory and practice for competence-based competition. Available online:  
<http://www.sciencedirect.com/science/article/pii/S0263237397000108>

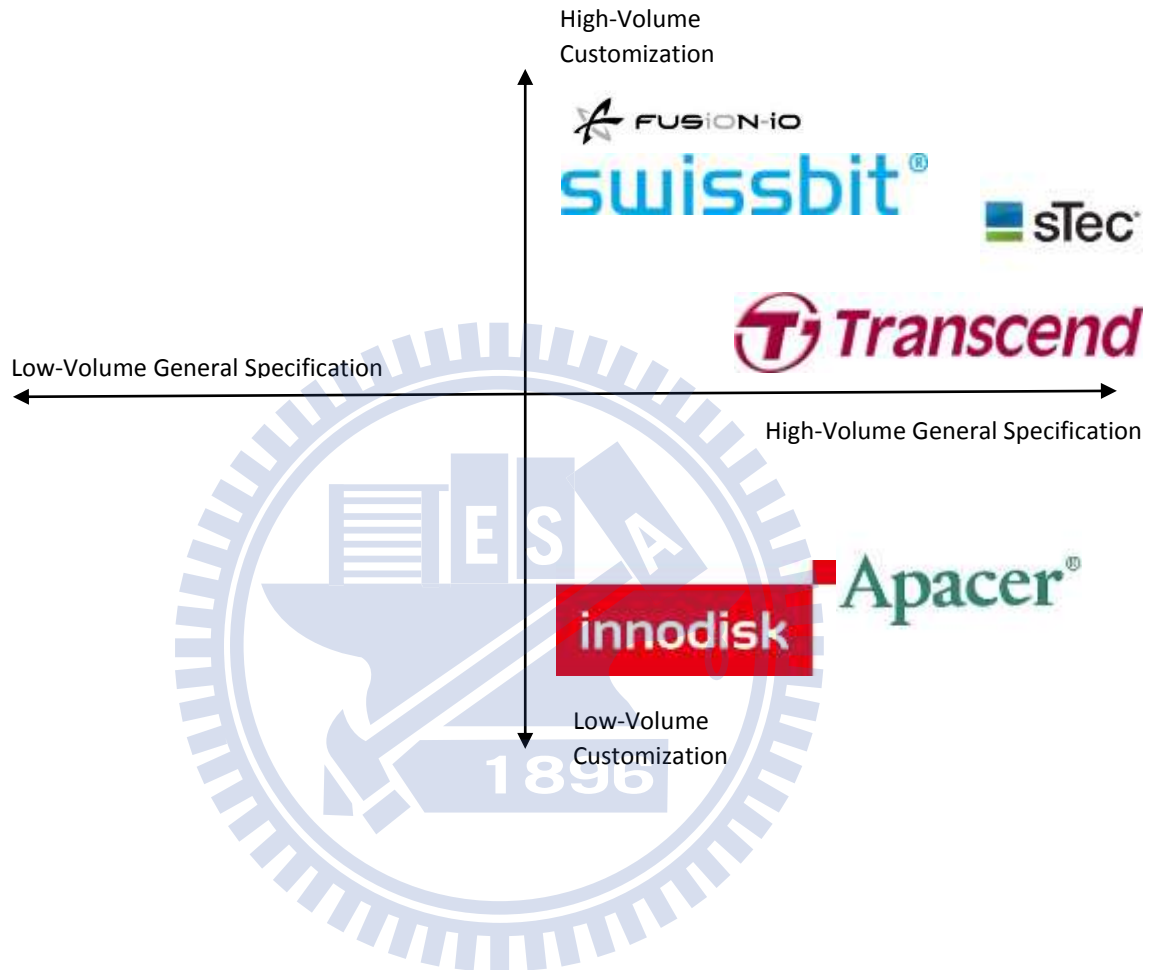
Teece, D. J., Pisano, G., & Shuen, A. (1997). Dynamic capabilities and strategic management. *Strategic management journal*, 18(7), 509-533.

Teece, D.J. "Explicating Dynamic Capabilities: The Nature and Microfoundations of (Sustainable) Enterprise Performance," *Strategic Management Journal*, 28, 2007:1319.

Yang, M. (2012). Total Flash Memory Market Declines Slightly in 2012. Available online:  
<http://www.isuppli.com/Memory-and-Storage/News/Pages/Total-Flash-Memory-Market-Declines-Slightly-in-2012.aspx>

## VIII. Appendices

**Exhibit 1** Segmentation in the Industrial Embedded Flash Memory Market



**Exhibit 2** Customer Types in the Industrial Embedded Flash Memory Market



Source: data prepared by DDG ([www.ddg.com.tw](http://www.ddg.com.tw)). Provided courtesy of Innodisk Corporation



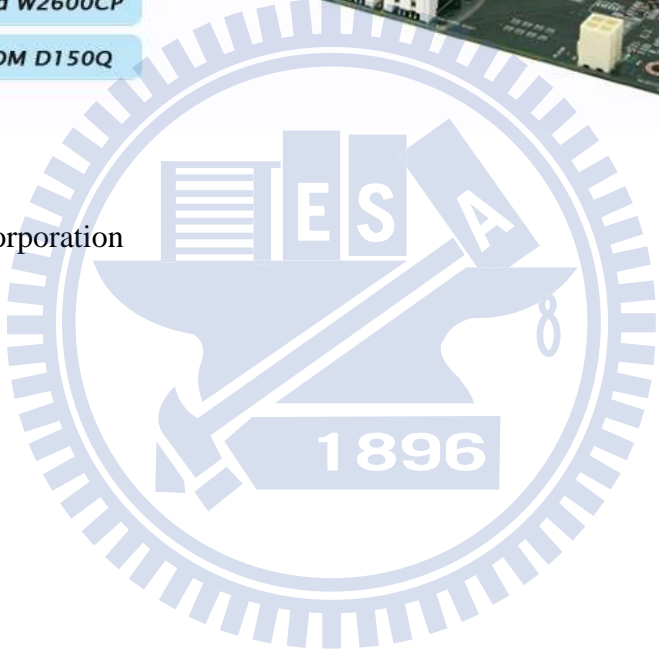
**Exhibit 3 Innodisk Corporation – Timeline of Major Milestones**

<b>2013</b>	October	Registered on Emerging Stock Board
<b>2012</b>	May	Set up branch office in Eindhoven, Netherlands.
<b>2011</b>	April	Acquisition of Actica, Inc
<b>2010</b>	November March	Set up branch office in Shenzhen, China. Set up branch office in Tokyo, Japan.
<b>2009</b>	November	Moved Taipei office and factory to new headquarters in Hsichih.
<b>2008</b>	October	Achieves ISO 9001 certification. Set up branch office in CA, USA.
<b>2007</b>	November June	Set up SMT line for expanding production capacity. Merges Jmau Technology
<b>2006</b>	September May	ERP(Enterprise Resource Planning) system implementation. Moved to Nangang and expands business operations.
<b>2005</b>	March	Innodisk Corp. was founded in eihu Technology Park.

**Exhibit 4** Innodisk's SATADOM® on Intel's Romley Server Board



Source: Innodisk Corporation



## Corporate Culture

---

### **Absolute Service**

**Service is not just what we do. It's who we are.**

Absolute Service is our pledge and our guide. It infuses every thing we do at Innodisk.

Absolute Service is our promise to deliver the most comprehensive service in every situation. It's the philosophy that guides us in all interactions with our customers and business partners. It's the spirit of friendliness and enthusiasm that fills each member of the Innodisk team.

**Absolute Service is our absolute commitment to our customers.**

The Four Pillars of Absolute Service:

#### **1. "Can," not "can't"**

We invite our customers to bring us their biggest challenges, because we *can* find a way to make each one work. This "can-do" attitude permeates every department at Innodisk, from research and development to production to sales and marketing. For our customers and business partners, this means that they can feel free to bring us their wildest ideas or toughest requirements, knowing full well that we can—and will—find a way to get things done.

#### **2. Listen and respond**

Being responsive to our customers is not just important—it's essential. But for us, being responsive is more than just providing on-site service or responding to Web inquiries quickly—it also means actively listening to questions and concerns. This give-and-take and constant communication means that we solve our customers' challenges swiftly and effectively while delivering solutions that meet all their requirements.

#### **3. Stay nimble**

Today's global economy is ever-changing, and we take great pride in being extremely nimble. We respond to new requirements just as quickly as they arise, working as a team with our customers to make changes and modifications. For our customers, this means that they have the freedom and flexibility to focus on their products' designs, confident that we will welcome—and meet—their requests for changes or customization at anytime.

#### **4. Always keep improving**

Improvement and innovation are not just buzzwords to us. They're something we live and breathe every day. We believe that even the best can be better. That's why we're constantly looking for ways to improve our products and processes. It's also why we're always working hard to develop new technologies, like our breakthrough SATADOM® Pin 7 VCC technology and Compact Flash Serial ATA (CF-SATA) module. Our commitment to continuous improvement means our customers always receive the most-advanced products and technologies for their products and systems.



**Exhibit 6** Innodisk’s Competitive Advantage vs. Competition

# Innodisk’s Competitive Advantage vs. Competition

Advantages over industry leaders:



Advantages over new competitors such as Apacer:



General advantages:



Source: data prepared by DDG ([www.ddg.com.tw](http://www.ddg.com.tw)). Provided courtesy of Innodisk Corporation



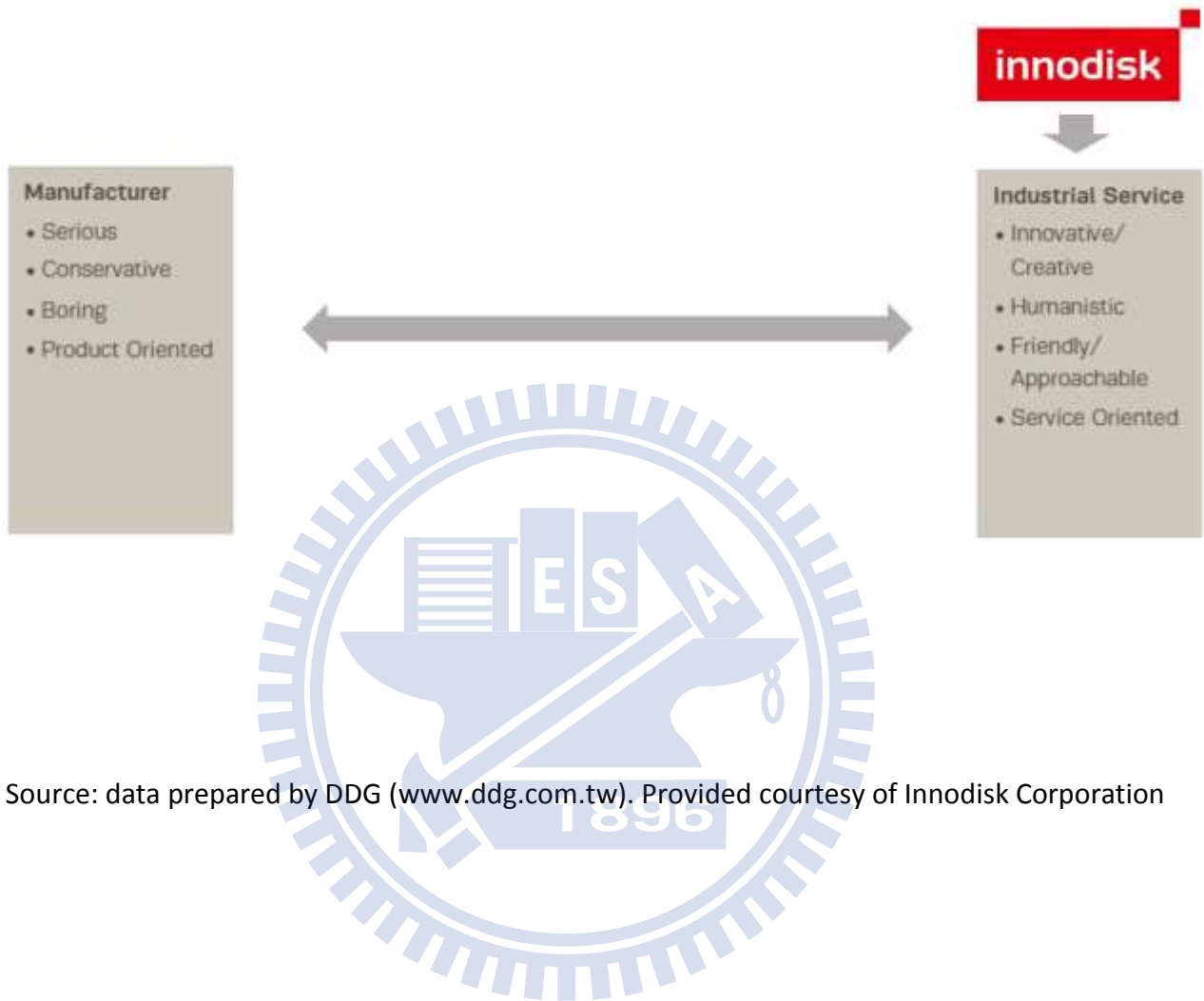
### **Exhibit 7** Innodisk's Competitive Advantages

- Accept any size order
- In-house firmware development
- Customization solution
- Wide product range within industrial application
- Innovative products (Satadom, Evergreen)
- Responsive service
- Long-term commitment/thinking/consistency
- Good people
- Short lead times
- Locked BOM
- First in industry (at this price point)

*Source:* data prepared by DDG ([www.ddg.com.tw](http://www.ddg.com.tw)). Provided courtesy of Innodisk Corporation



**Exhibit 8** Innodisk's Positioning Strategy



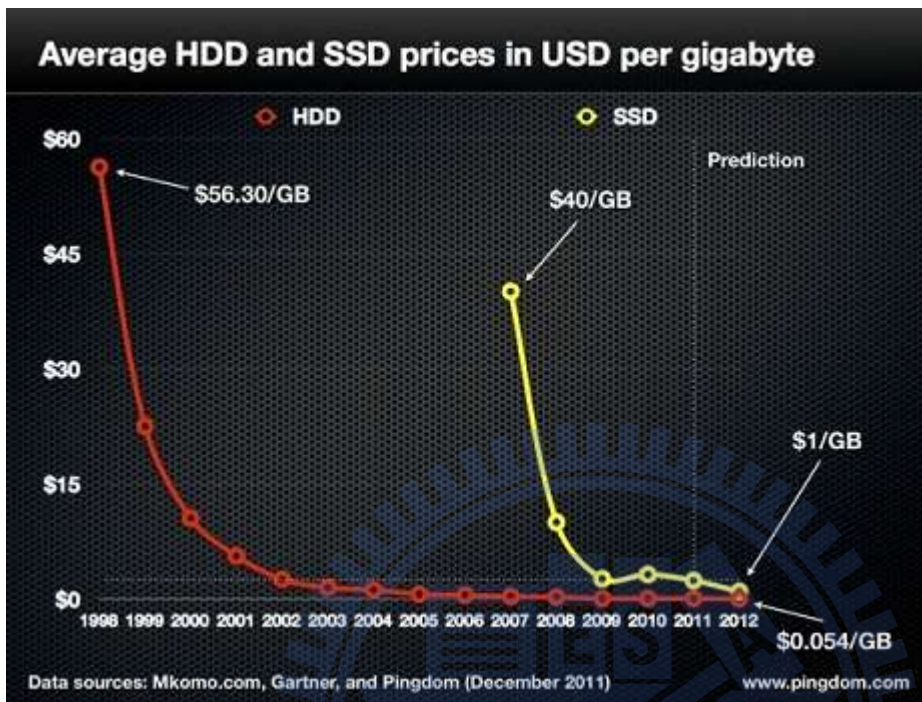
Source: data prepared by DDG ([www.ddg.com.tw](http://www.ddg.com.tw)). Provided courtesy of Innodisk Corporation

**Exhibit 9** Innodisk and Major Competitors



Source: Innodisk Corporation

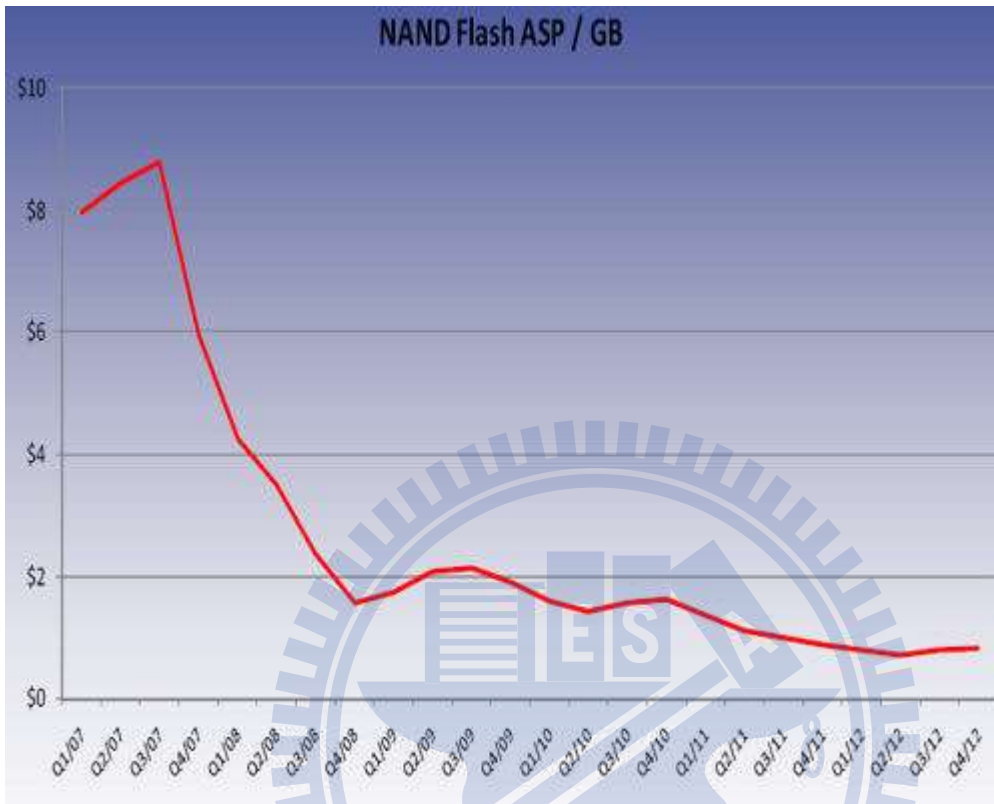
**Exhibit 10** Average selling prices of SSD and HDD, 1998 to 2012



Source: [www.vr-zone.com](http://www.vr-zone.com)



**Exhibit 11** Average selling prices per GB of NAND flash, 2007 to 2012



Source: [www.agitech.com](http://www.agitech.com)

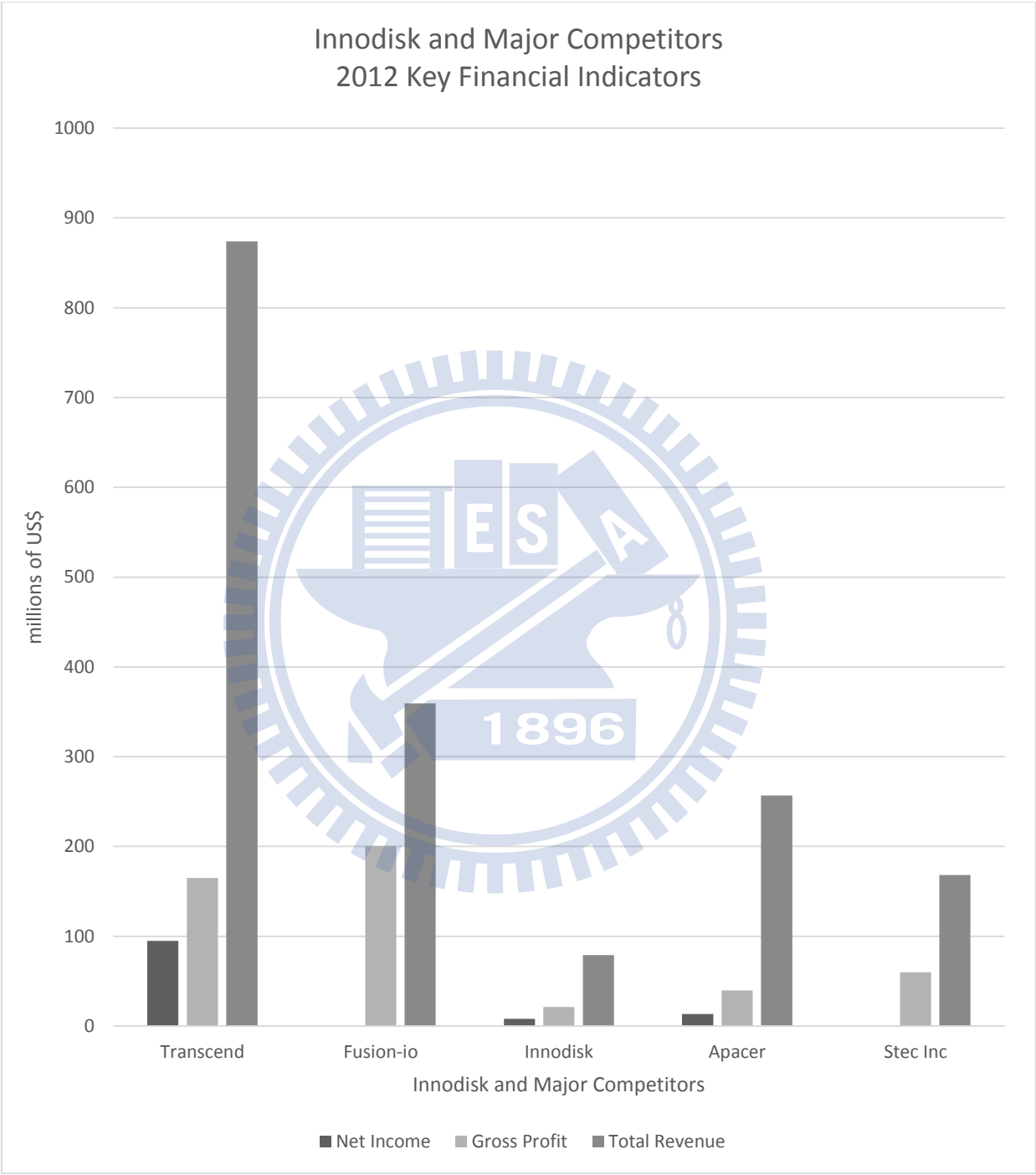
**Exhibit 12 Innodisk Financials**

## Annual Income Statement

	Type of Update	UPD	UPD	UPD
		(TWD Millions) 12Months 31 Dec 09	(TWD Millions) 12Months 31 Dec 10	(TWD Millions) 12Months 31 Dec 11
<b>Total Revenue</b>		864.6	1,430.8	2,094.6
<b>Cost of Revenue, Total</b>		714.1	1,131.2	1,494.8
<b>Gross Profit</b>		150.5	299.6	599.8
<b>Selling/General/Admin. Expenses</b>		63.5	118.1	283.9
Research & Development		20.1	23.6	34.3
Depreciation/Amortization		--	--	--
Interest Expense/Income Net Op.		--	--	--
Unusual Income/Expense		--	--	--
<b>Other Operating Expenses, Total</b>		0.4	1.5	--
<b>Total Operating Expense</b>		798.2	1,274.4	1,813.0
<b>Operating Income</b>		66.5	156.4	281.6
Interest Expense/Income Net Non Op.		--	--	--
Gain/(Loss) on Sale of Assets		(0.3)	(1.8)	0.6
<b>Other, Net</b>		7.3	18.9	29.8
<b>Income Before Tax</b>		68.6	171.8	321.4
Income Tax - Total		12.5	21.3	53.0
<b>Income After Tax</b>		56.1	150.5	268.4
Minority Interest		--	--	1.1
Equity In Affiliates		--	--	--
U.S. GAAP Adjustment		--	--	--
<b>Net Income Before Extra. Items</b>		56.1	150.5	269.5
Accounting Change		--	--	--
Discontinued Operations		--	--	--
Extraordinary Item		--	--	--
Tax on Extraordinary Items		--	--	--
<b>Net Income</b>		56.1	150.5	269.5

Source: Reuters

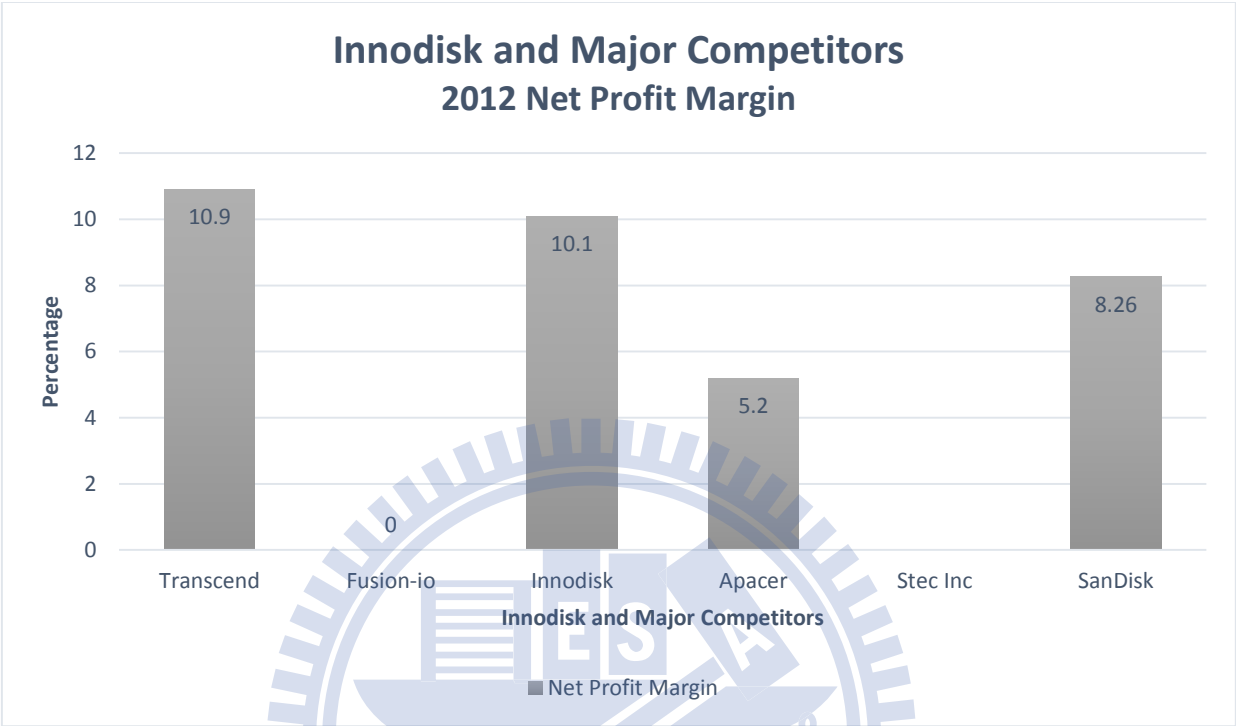
**Exhibit 13** Comparison of 2012 Key Financial Indicators - Innodisk and Major Competitors



Source: investing.businessweek.com

Note: Fusion-io and STEC Inc. had a negative net income in 2012

**Exhibit 14** Comparison of 2012 Net Profit Margins – Innodisk and Major Competitors



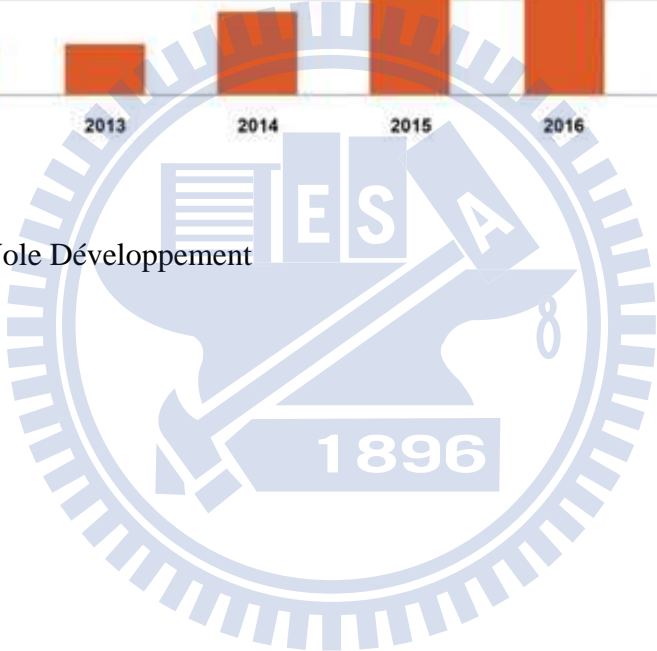
*Note:* Fusion-io and STEC Inc. had a negative net income in 2012



**Exhibit 15** Emerging Non-volatile Memory Market Forecast



Source: Yole Développement



## Appendix 1 Case Study Discussion Question

One issue this case deals with is that of shifting corporate strategy, and how it relates to Innodisk's competitive advantages in firmware and culture, for example. Provide a payoff table for a before and after corporate strategy shift at Innodisk. You can focus on, as well as others, aspects such as price pressure, sales volume, gross margins, technological capabilities such as space saving and energy conservation, and technology trends such as big data, cloud applications.

