國 立 交 通 大 學

企業管理碩士學位學程

碩 士 論 文

輕資產策略與競爭優勢個案研究－德州儀器

Asset-Light Strategy and Competitive Advantage: A Case Study of Texas Instruments

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碩 士 論 文

A Thesis
Submitted to Master Degree Program of Global Business Administration
College of Management
National Chiao Tung University
In partial Fulfillment of the Requirements
For the Degree of
Master
in

Business Administration

September 18th 2013

Hsinchu, Taiwan, Republic of China

民國 102 年 9 月

English Abstract

This study focuses on Texas Instruments deployment of its fab-light-strategy. This strategy is equivalent to the name Light-asset strategy wherein this is a new business model for the IDM firms where they try to focus on their core competency in which it is believe that it give its firm a competitive advantage over others. Competitive advantage is defined as the ability of a firm to generate returns above its normal return, therefore higher competitive advantage the higher one firms profit is.

Reports and news are stating that TI or abbreviation for Texas Instruments success in implementing its fab-lite strategy is influencing other IDM to follow their steps and thus it is a fact now due to numerous firm announces its pursue in this new business model. However, there is no measurement given by report and news telling how success is TI is on that chosen strategy.

This paper tries to have in-depth analysis of TI asset-light strategy, using quantitative case analysis, S&P Compustat database and numerous literatures to justify the success of the said firm. The quantitative case study provides several insights such as (a) How much in US$ is this light-asset strategy contributed to TI (b) If this strategy can give competitive advantage to one firm, this paper shows how big it is and its sustainability in long run. And (c) If one firms is pursuing this strategy, some pointers in the implementations.

Chinese Abstract

這份文件是針對德州儀器的輕晶圓生產策略所做的研究。這個策略基本上和輕資產策略是如出一轍的。二者都是整合元件製造商藉此將專注力全心放在他們的核心技術上，相較於其它的公司，能獲得更大的競爭優勢。競爭優勢在此的定義特別指的是，使公司獲得較以往更高利潤的能力，也就是，提升競優勢意味著取得更多利潤。

相關報導指出，德州儀器在輕晶圓生產策略的成功，已經迫使其它整合元件造商跟進。事實上的確有很多公司都發表聲明，正在朝這個方向努力。然而，從相關報導中，並沒有明確的數字來量化德州儀器在此一策略上所獲得的成功。

本篇論文便是透過量化的專案分析，S&P Compustat 資料庫，及豐富的文章來驗證，試圖對德州儀器在輕資產策略上所獲得的成功，做更深入的分析。這份量化的個案研究將透過以下幾個觀察的重點來呈現。

(a) 輕資產策略對於德州儀器有多少美金的貢獻

(b) 假設此一策略真能帶給公司競爭優勢，本篇論文將指出，這樣的優勢能有多大，以及長期發展性。

(c) 假設有一個公司正試圖採行此一策略，在過程中需要注意的相關事項。

Acknowledgement

First and above all, I praise God, the almighty for providing me this opportunity and granting me the capability to proceed successfully.

This thesis appears in its current form due to the assistance and guidance of several people. I would like to acknowledge my professors in National Chiao-tung University (NCTU) in the GMBA course starting with my thesis adviser Ms. Fen-May Liou who I first learned about Asset-light which is part of her September 2010 financial management class presentation material subject title “Note 05 Ratio Analysis” in page 32 to be specific which spark my curiosity to use it in my current workplace Texas Instruments. I want also to say a big thanks to Professor Jinsu Kang for I spend 47.06% of the entire MBA program courses under her, thus I can say that 47.06% of what I know today in terms of business and strategy came from her. She also try to influenced us to constantly read a book (didn’t work for me, yet ☺). I want also to say thank you to Professor Anthony Han and Professor Edwin Tang for GMBA program that they directed during my stay.

Last but not the least I just want to say thanks to my wife, Cynthia for her encouragement for my own fulfillment to go to school as my way to maximize my stay in Taiwan. Few spouses will agree their significant half to spend $NT 221,500 tuition and credit fees for 2 years just because I felt that I have a lot of idle time. I wish my children Nina Angelique and Ernes Demarcus will also spoiled me as what their mother did.

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I. Issues and Background

The asset light strategy was popularized in late 90s by an energy company from US, when they determined that heavy assets like pipelines, which were expensive to build, buy and maintain, were no longer a competitive advantage. Semiconductor industry tends to follow this concept by either being a Fabless type or from being asset intensive to fab-lite type. An asset-light doesn't mean asset free. The point is to be selective about the purchase it made.

Traditionally, semiconductor companies controlled the entire production process, from design, marketing to manufacture. Yet many chip makers are now delegating more and more production to others in the industry. Foundry companies, whose sole business is manufacturing, have recently come to the fore, providing attractive outsourcing options. In addition to foundries, the ranks of increasingly specialized designers and chip testers are starting to swell. Chip companies are emerging leaner and more efficient.

Texas Instruments has currently embraced a "fab-lite" manufacturing strategy for its semiconductor division that has proved to be quite successful so far. According to the Fabless Semiconductor Association, a "fab-lite" company is one that outsources 40% - 50% of its production. Doing so enables a company to significantly lower its "CapEx" or capital expenditures by letting foundries with the existing machinery to do the actual manufacturing of the chips. TI outsources about 25% of its total wafer production to these foundries, whose sole job is manufacturing. These foundries include TSMC (Taiwan Semiconductor), UMC (United Microelectronics), and Chartered Semiconductor all of which TI uses to outsource its semiconductor fabrication. By doing this, TI hedges itself against the down cycles of the semiconductor industry, although it does sacrifice some of the "potential margin upside" during up cycles.

The issue that this paper wants to pursue is that more IDM semiconductor companies are now considering on changing their strategy from being an asset-intensive type of company going to asset-light which several companies announces their intention to do so as summarized by IC insights in Table 1.1 (2010) showing Top 10 IDM's that pursuing Fab/Asset-Lite Strategies.

Fab/Asset-Lite Rank	2010 IC Sales Rank	Company	Region	Strategy Announced	Capex/Sales Ratios	Current Strategy & Objectives
1	4	TI	U.S.	2000 initially, expanded in 2007	2007-10: 9.9% — 1997-06: 15.4%	About 25% of total wafers are now outsourced, including 60% of advanced CMOS in 2010.
2	6	Toshiba	Japan	Dec. 2010	FY08-11: 18.7% — FY98-07: 17.3%	Aims to outsource 50% of SoC in 2011 and 80% by 2013.
3	7	Renesas*	Japan	July 2010	FY09-11: 6.3% — FY05-08: 11.5%	Will outsource all ICs made with 28nm and below processes.
4	9	ST	Europe	2006	2007-10: 9.2% — 1997-06: 23.4%	Aims to make 80% of its wafers overall and outsource about two-thirds of advanced CMOS processes.
5	14	Sony	Japan	2007	FY08-11: 9.9% — FY98-07: 28.3%	At least 30% of ICs are now outsourced compared to 10% in 1998.
6	16	Infineon*	Europe	2005	FY07-10: 8.9% — FY97-06: 23.6%	Foundries handled 6-7% of its wafers in 2010 and are expected to reach 10% in the long term.
7	17	Fujitsu	Japan	2009	FY08-11: 13.3% — FY98-07: 22.2%	Continue making LSI logic down to 45nm feature sizes.
8	18	Freescale*	U.S.	1998 initially but reset several times	2007-10: 5.0% — 1997-06: 14.6%	Foundry wafers were 25% of its total in 2010, up from 15% in 2007.
9	26	NXP*	Europe	2007	2007-10: 6.3% — 1997-06: 12.9%	About 25% of its producton was outsourced in 2010.
10	33	Atmel	U.S.	2006	2007-11: 3.9% — 1997-06: 21.2%	In 2010, 32% of its production was outsourced compared to 12% in 2009 and 5% in 2006.

**Capex/sales ratios include historical data prior to spinoffs of Infineon by Siemens in 1999, NXP by Philips in 2006, and Freescale by Motorola in 2003 and merger of NEC Electronics and Renesas Technology to form Renesas Electronics in 2010.*

Source: Companies, IC Insights

Table 1.1: IC Insights Research Bulletin for Top 10 IDMs Pursuing Fab/Asset-Lite Strategies

Source: IC Insights

With overwhelmed respond from IDM which perceived this light-asset strategy to have great potentials, the research motivations of the author on doing this paper are the following.

a. To do a case study benchmarking Texas Instruments fab-light strategy and using the asset-light valuation model that formulated by Tang, Liou and Huang, 2008; Liou, 2011 as a quantitative analyses of this newly explore IDM business model (Kohn, 1997).
b. This research is motivated to quantified competitive advantage of Texas Instruments asset-light strategy thru Valuation of Intangible assets wherein as per Maly and Paler (2002) that asset-light refers to all intangible assets that create additional net benefits beyond the book value.

This case study is a retrospective review of Texas Instruments adapting to fab-lite model. How light is there asset in a year to year indicator as well as in comparison with other asset intensive and those with less asset type of semiconductor companies which is also called fabless? And then we will move forward in time to see the outcome of this strategy.

The study will show comparison between top 6 semiconductor companies (in terms of revenue) between fabless companies versus IDM companies (or those with fab) and show the Degree of Lightness between these companies.

The proposed research tries to provide readers of the following questions:

a. How Asset-light strategy does generate competitive advantage in semiconductor industry?
b. How big is the competitive advantage? and
c. How sustainable does its competitive advantage is?

The research will be organized as follows (Figure 1.1).

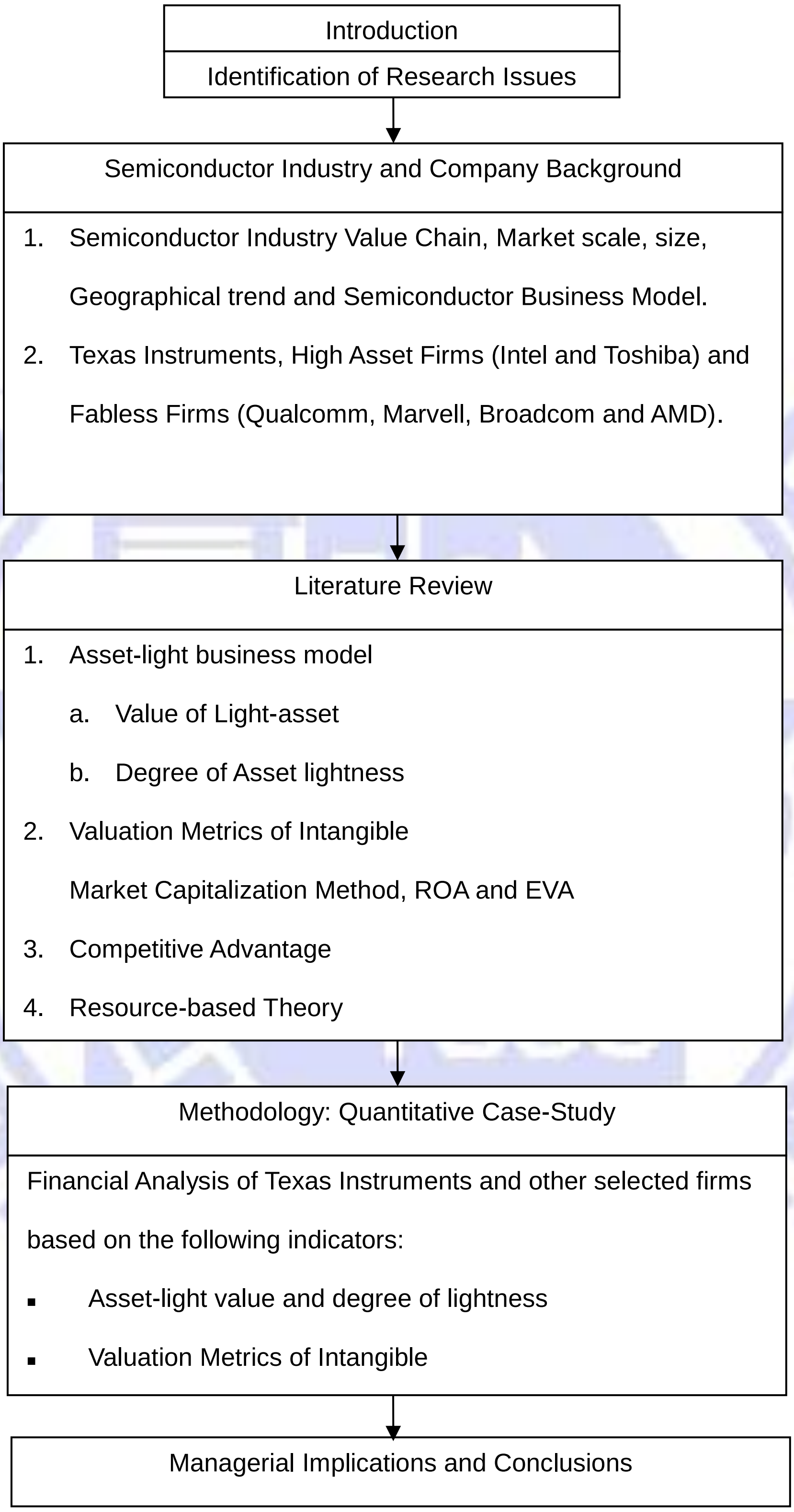

Figure 1.1: Research Framework

II. Industry and Company Overview

2.1. Industry Overview

Since the transistor was invented in 1950s, semiconductor industry comes a long way in transforming its downstream industries, which include computer, control, consumer electronics and communications etc. Before 1990's, semiconductor industry is dominated by IDM's (Integrated Design Manufacture), a company that performs every step of the chip-making process, design, manufacture, test and packaging (ex. Intel and TI). Due to the scale of economy, boom-bust cycle (alternating periods of economic growth and contraction) and the productivity gain realized from Moore's law (number of transistors doubles every 18 months as observed by Gordon Moore, Intel co-founder). Semiconductor itself has been experiencing a major change in industry structure for the last ten years. This change is mainly because of the emergence of pure-play (company that focuses exclusively on a particular product or service) semiconductor foundry and fabless firms. Current industry value chain is showed in figure 2.1.

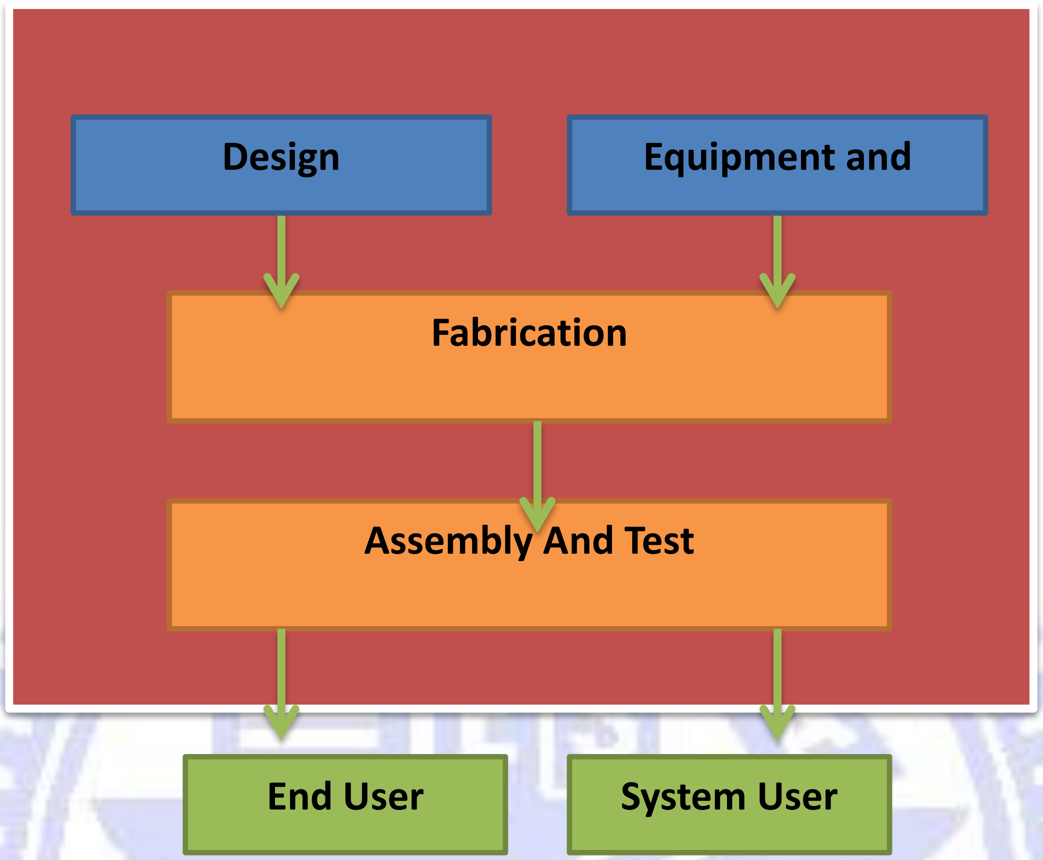

Figure 2.1 Semiconductor Industry Value Chain

Source: Compiled by case writer from Macher et al, 2002

Macher et al (2002) note that the semiconductor industry is characterized by rapid rates of technological change involving frequent new product introductions, whilst business managers also have to deal with rising costs of production and capacity. The worldwide semiconductor market is divided into four sectors: America, Europe, Japan and Asia Pacific. Based on World Semiconductor Trade Statistics (WSTS), the semiconductor industry is previously a US$26B industry way back 1986 and America and Japan hold 32.28% and 39.65% of the production. But in present time 2011, semiconductor industry sale worth is already at US$299.5B in which Asia pacific (consists of China, Taiwan, Korea, Malaysia, Singapore) have 54.76% while America, Europe (centered in France, Scotland and Germany) and Japan have 18.43%, 12.48% and 14.32%. Details can be seen in figure 2.2 below.

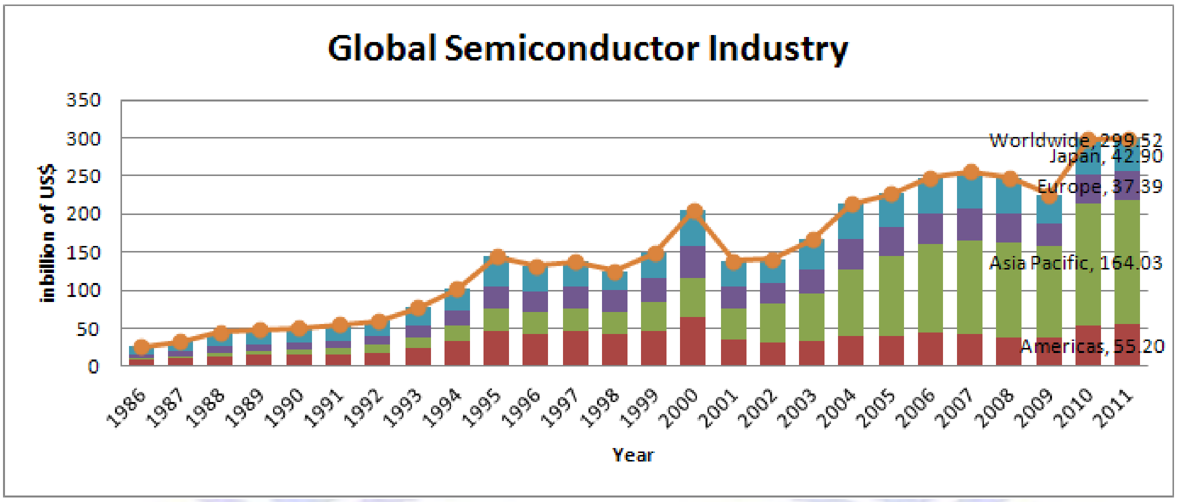

Figure 2.2 Global Semiconductor Industries – Market Trend

Source: Compiled by case writer based on WSTS World Semiconductor Trade Statistics

Figure 2.3 shows the geographic dispersion of semiconductor fabrication (manufacture) since 1986 and shows significant shift away from manufacture in North America and Japan with production increasing in Asia Pacific.

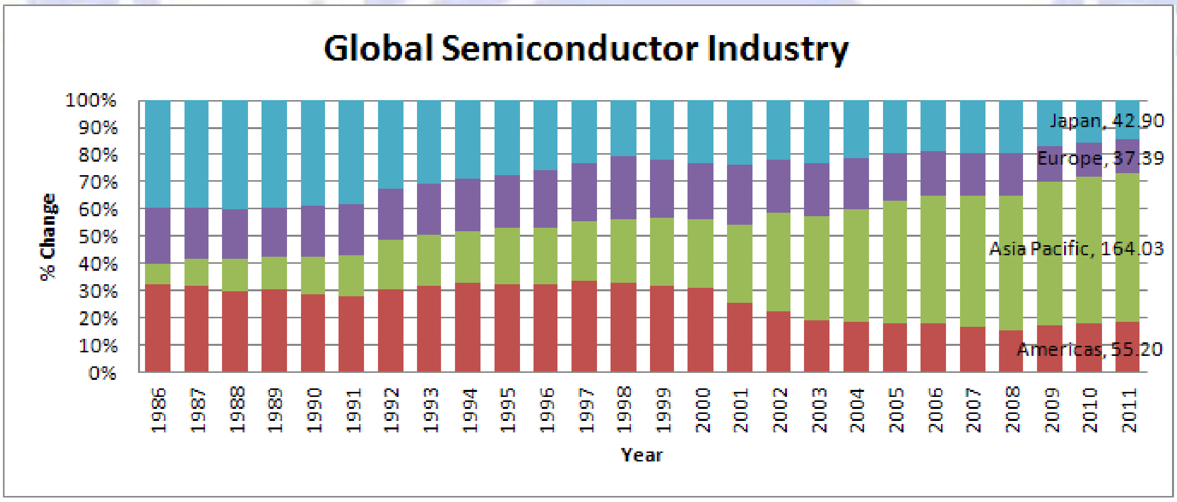

Figure 2.3 Global Semiconductor Industries – Manufacturing Trend

Source: Compiled by case writer based on WSTS World Semiconductor Trade Statistics

Despite the trend shown in figure 2.3, this has not led to a general decline in the financial health of the semiconductor industry as a whole in North America, with the decrease in North America manufacturing representing the development of regional specializations. This trend is a significant change in the structure of the industry. Interpreting this in Porter's value chain model, it could be perhaps being termed as focusing on core capabilities.

The industry has evolved from large integrated companies (IDM) that provided all processes involved in the semiconductor industry (including design, manufacture and service and even electronic equipment manufacturer) to a vertical disintegrated module, with North American companies focusing on the design and marketing of chips. Fab on the other hand or factories making chips which cost between $US 1 billion to $US 2.5 billion were being established in a specialist chip foundries in more appropriate geographic locations to exploit opportunities for cost savings. And due to this creation of foundries, these reduce the barriers to entry in semiconductor industry and increase the competitive pressures on the existing manufacturers. And thus sometimes in 1990 to 1995, specialized semiconductor firms emerged drastically using a fabless business model to compete with IDM firms for a chunk in the semiconductor market share. And sometime year 2000 due to the huge economics of scale required justifying capital investment in building a new fab. IDM is gradually reducing their investment in fab and this business model is called fab-lite, see figure 2.4 for emerging semiconductor business model.

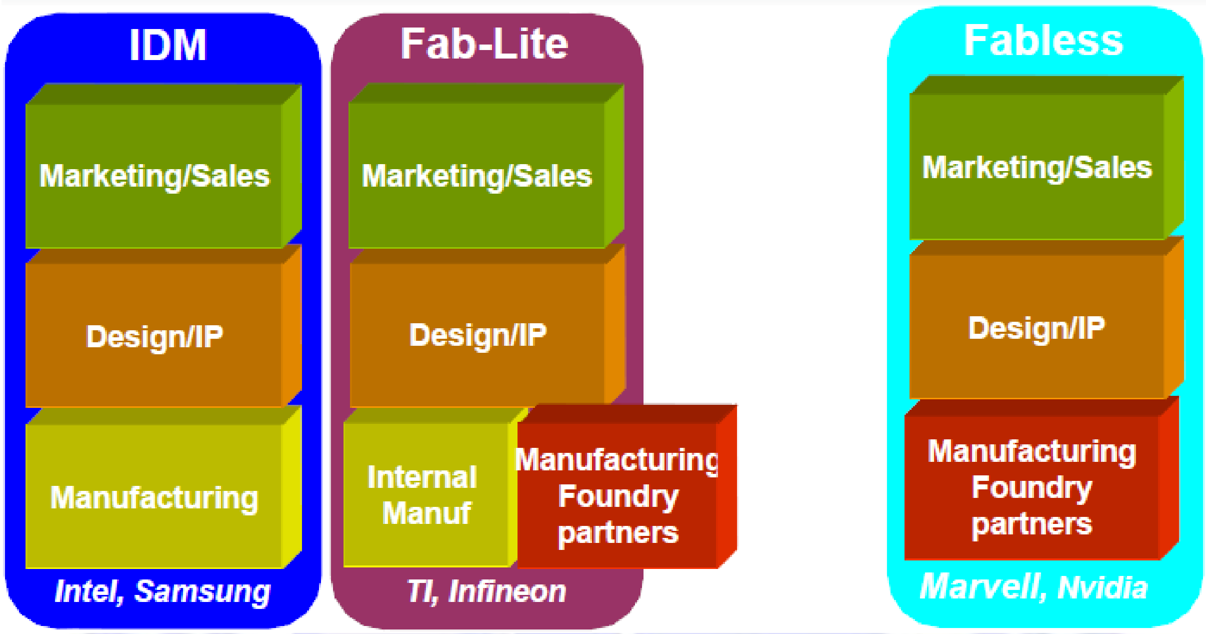

Figure 2.4 Semiconductor Business Model

Source: Marvell Fabless Business Model

Semiconductor manufacturing begins with a sequence of photo-lithographic and chemical processing steps that fabricate a number of semiconductor devices on a thin silicon wafer. Each device on the wafer is tested and the wafer is cut into pieces called chips. Each chip is assembled in to a package that then is usually retested. The entire process typically requires between 12 and 18 weeks and takes place in highly specialized facilities.

2.2. Texas Instrument Company Overview

Texas Instruments is an 80-year old 1930-2010, 10 billion dollar, multi-national company with over 40,000 employees in 30 countries (TI 2010 Financial Statement). As per 2010, TI is the world’s fourth largest semiconductor company as measured in revenue, according to preliminary estimates from an external source.

TI’s portfolio consists in four segments as of 2010 (and its revenue percent): Analog (43%), Embedded Processing (15%), Wireless (21%) and other (21%). As per forecast, Analog and Embedded Processing will be the primary growth engines in the years ahead and therefore resources will be focus on those two segments.

TI own and operate semiconductor manufacturing in North America, Asia and Europe. These include both high-volume wafer fabrication and assembly/test facilities. The facilities require substantial investment to construct and are largely fixed-cost assets once in operation. Because TI owns much of manufacturing capacity, a significant portion of operating cost is fixed. In general, these fixed costs do not decline with reductions in customer demand or utilization of capacity, potentially hurting profit margins. Conversely, as product demand rises and factory utilization increases, the fixed costs are spread over increased output, potentially benefitting profit margins.

The cost and lifespan of the equipment and processes use to manufacture semiconductor vary by product. Analog and most of Embedded Processing products can be manufactured using older, less expensive equipment than is needed for manufacturing advanced logic products, such as Wireless products. Advanced logic wafer manufacturing continually requires new and expensive processes and equipment. In contrast, the processes and equipment required for manufacturing Analog and most of Embedded Processing products do not have this requirement.

To supplement the internal wafer fabrication capacity and maximize TI's responsiveness to customer demand and return on capital, its wafer manufacturing strategy utilizes the capacity of outside suppliers, commonly known as foundries. TI outsources about 25 percent of wafers from external foundries with the vast majority of this outsourcing being for advanced logic wafers. In 2010, external foundries provided 60 percent of the fabricated wafers for advanced logic manufacturing needs. TI expects the proportion of its advanced logic wafers provided by foundries will increase over time and it also expected that TI will maintain internal wafer fabrication capacity to meet the vast majority of it analog production needs (see Figure 2.5, right side is the note for that outsourcing details). In addition to using foundries to supplement its wafer fabrication capacity, it also selectively uses subcontractors to supplement assembly/test capacity. TI generally use subcontractor for assembly/test of products that would be less cost-efficient to complete in-house (e.g. relatively low-volume products that are unlikely to keep internal equipment fully utilized), or when demand temporarily exceeds its internal capacity. There is cost advantage from maintaining internal assembly/test capacity. External/internal manufacturing strategy reduces the level of required capital expenditures, and thereby reduces subsequent levels of depreciation below what it would be if we sourced all manufacturing internally. Based on experience less fluctuation in TI profit margins due to changing product demand, and lower cash requirements for expanding and updating manufacturing capabilities.

2.3. Heavy Asset IDM Firms (Intel and Toshiba)

2.3.1. Intel

Intel design and manufacture advanced integrated digital technology platforms. A platform consists of a microprocessor and chipset, and may be enhanced by additional hardware, software and services. As of December 31, 2011 (EDGAR Intel 10-K report, 2012), 78% of wafer fabrication, including microprocessors and chipsets, was conducted within the U.S. at facilities in Arizona, New Mexico, Oregon, and Massachusetts. The remaining 22% of wafer fabrication was conducted outside the U.S. at facilities in Ireland, China and Israel. Intel process technology composes of 22nm, 32nm and 45nm with 300mm wafer size for microprocessor and for chipsets the company has 65nm, 90nm and 130nm with 200mm and

300mm wafer size. To augment capacity, Intel use subcontractors to perform assembly of certain products, primarily chipsets and networking and communication products. In addition, Intel uses subcontractors to perform assembly and test for mobile phone components. The NAND flash memory products are manufactured by IMFT and IMFS using 20nm, 25nm, 34nm, or 50nm process technology, and assembly and test of these products is performed by Micron Technology, Inc. and other external subcontractors.

Intel has 2 distinct Strategic Business Units, Microprocessor manufacturing and Chipset Manufacturing. From the perspective of the Microprocessor SBU (Strategic Business Unit), only true competitor remains, Advanced Micro Devices or AMD. The outlook for the Chipset SBU is somewhat similar. With only one real competitor which is VIA Technologies, a critical partner with AMD who manufacturers Athlon-compatible chipsets

2.3.2. Toshiba

Toshiba is a diversified electric/electronic manufacturer and provides a wide range of products and services on a global basis in four domains: Digital Products (LCD, HDD and PC), Electronic devices (semiconductor), Social Infrastructure (elevator, heavy equipment) and business expansion (Home appliances segment). As of March 2011 Toshiba financial statements (2011), electronic devices segment or also called LSI (Large scale integration) where semiconductor belongs to garners 20.41% of Toshiba sales. But its semiconductor segment capital expenditures almost have 40% of its overall company capital expenditures while another 40% from social infrastructure. Its R&D as well has 42.45% shares together with social infrastructure of 30%.

Toshiba semiconductor memory segment are position as number 2 in global market share

(Toshiba financial statement, March 2011) with focus on NAND flash memory with silicon process technology on 24 nm (from august 2010) and 19 nm (pioneering in April 2011). The LSI segment of Toshiba is further divided into business unit into 2: (a) Logic LSI division and (b) Analog and Imaging IC division. The Logic LSI division which is focus on cutting-edge LSI was already subjected to asset-lite strategy and thus Toshiba will focus on design and development and will use foundries as expansion. The Analog and Imaging IC division will make the most of the existing fabrication facilities.

2.4. Fabless Semiconductor Firms (Qualcomm, Marvell, AMD and Broadcom)

2.4.1. Qualcomm

Qualcomm were established in 1985 and in 1989 they publicly commercialized wireless communication applications for CDMA technology or also called Code Division Multiple Access which is primarily used in Global System for Mobile Communications or GSM which used to transmit wireless device user's voice or data over radio waves using a public cellular wireless network. Its main customers based on their revenues are Samsung which have 10% of their revenues from 2009 to 2011 and HTC which a significant portion of 10% in fiscal year 2011.

Its product and service segment compose majority of: (a) Qualcomm CDMA Technologies segment QCT (b) Qualcomm Technology Licensing Segment QTL and (c) Qualcomm Wireless and Internet Segment (QWI).

Qualcomm CDMA Technologies segment or QCT - with revenues share of 59%, 61% and 59% from 2011, 2010 and 2009 respectively, QCT utilizes a fabless production business model, which means that they do not own or operate foundries for the production of silicon wafers from which its integrated circuits are made. Qualcomm employ both turnkey and two-stage manufacturing business models to purchase its integrated circuits. Turnkey is when foundry suppliers are responsible for delivering fully assembled and tested integrated circuits. Under the two-stage manufacturing business model, it was purchase wafers and die from semiconductor manufacturing foundries and contract with separate third-party manufacturers for probe, assembly and final test services. This is referring to two-stage manufacturing business model as Integrated Fabless Manufacturing (IFM).

Qualcomm Technology Licensing Segment (QTL) - QTL grants licenses or otherwise provides rights to use portions of our intellectual property portfolio. Revenues generated from royalties comprised 36%, 33% and 35% of total consolidated revenues in fiscal 2011, 2010 and 2009, respectively.

Qualcomm Wireless and Internet Segment (QWI) - QWI revenues comprised 4%, 6% and 6% of total consolidated revenues in fiscal 2011, 2010 and 2009, respectively. This division offers a set of software products and content enablement services to support and accelerate the growth and advancement of wireless data products and services. The QIS division develops and sells business-to-business products and services through a sales and marketing team headquartered in San Diego, California with offices worldwide.

Starting from 2007, Qualcomm total assets increases significantly due to acquisitions, licenses and legal proceedings of other companies as explain at their financial statement under intangibles and other assets.

2.4.2. Marvell

Marvell is one of the world's largest fabless semiconductor providers of high-performance application-specific standard products (ASSP). Its core strength of expertise is the development of complex System-on-a-Chip ("SoC") devices, leveraging its extensive technology portfolio of intellectual property in the areas of analog, mixed-signal, digital signal processing and embedded and standalone ARM-based microprocessor integrated circuits. Its broad product portfolio includes devices for data storage, enterprise-class Ethernet data switching, Ethernet physical-layer transceivers ("PHY"), mobile handsets and other consumer electronics, wireless networking, personal area networking, Ethernet-based PC connectivity, control plane communications controllers, video-image processing and power management solutions.

When the company began, its core technologies were initially focused on the storage market, where it provide high-performance products to storage companies for traditional HDD to companies such as Hitachi Ltd., Samsung Semiconductor, Seagate Technology, Toshiba Corporation and Western Digital Corporation. Over the past few years, it expanded on core storage technologies by developing solid state flash drive ("SSD") controllers, which are currently sold to flash providers who are building drives based on SSD, such as Micron, SanDisk, Toshiba, and others. The storage end markets continue to drive approximately 46% of its revenues on an annual basis.

As the company developed, it applied its technology to the networking market, which provide industry-leading PHY (physical layer) devices and wired and wireless Ethernet-switching solutions, which enable high-speed transmission between communications systems, that are sold by manufacturers of networking and wireless equipment, such as Alcatel, Brocade Communication Systems, Inc., Cisco Systems, Inc., Dell Inc., Sony Ericsson, Hewlett Packard Company, Huawei Technologies Co., Ltd., Intel Corporation, Juniper Networks, Inc., and ZTE Corporation. Its networking segment contributes 21% of its revenue.

Marvell wireless technology has a variety of uses in consumer electronic devices, including enabling applications such as wireless access routers, gaming devices, streaming audio, video, Voice over Internet Protocol ("VoIP") and wireless printing, for products offered by companies such as Cisco Systems, Hewlett Packard Company, Microsoft Corporation and Sony Corporation. It provides communications and applications processor products for cellular and handheld solutions to customers, such as Research in Motion Limited, Huawei, Motorola, Samsung, Lenovo, Vizio and ZTE Corporation. This Mobile and wireless product segments contribute at 29% of revenue.

Lastly, it provides printer SoC and system level solutions for both inkjet and laser jet printer systems for companies such as Hewlett Packard Company which contribute at 4% revenue. The vast majority of its integrated circuits are substantially fabricated using widely available CMOS processes currently outsource in a substantial percentage manufacturing to Taiwan Semiconductor Manufacturing Company.

2.4.3. Broadcom

Irvine-based (California) Broadcom Corp Company, buoyed by strong growth in the wireless and mobile market, which currently operate to serve three markets: Broadband Communications, Mobile & Wireless and Infrastructure and networking. With revenue shared from 2011 as 28%, 47% and 27% respectively.

Broadband Communications (Solutions for the Home) — Complete solutions for cable, xDSL, fiber, satellite and IP broadband networks to enable the connected home, including set-top-boxes and media servers, residential modems and gateways and wired home networking solutions.

Mobile & Wireless (Solutions for the Hand) — Low-power, high-performance and highly integrated solutions powering the mobile and wireless ecosystem, including Wi-Fi and Bluetooth, cellular modems, personal navigation and global positioning, near field communications (NFC), Voice over IP (VoIP), multimedia and application processing, and mobile power management solutions.

Infrastructure & Networking (Solutions for Infrastructure) — Highly integrated solutions for carriers, service providers, enterprises, small-to-medium businesses and data centers for network infrastructure needs, including switches, physical layer (PHY) and microwave devices for local, metropolitan, wide area and storage networking; switch fabric solutions, high-speed Ethernet controllers, security and embedded processors.

Its Wafer Fabrication depends on multiple foundry subcontractors located in Asia to manufacture a majority of its products. Its key silicon foundries are TSMC (Taiwan), Global foundries (Singapore), SMIC (China) and UMC (Singapore and Taiwan). By subcontracting manufacturing, it focuses resources on design and test applications where it believe it can have greater competitive advantages. Approximately 61.3% of its products are currently manufactured in 65 nanometers. And it's still designing most new products in 40 nanometers and 28 nanometers, and is beginning to evaluate 20 nanometers.

2.4.4. Advanced Micro Devices (AMD)

AMD offers 2 product segment particular in microprocessors or computing solutions which contributed in 2011 revenues of 76% and the rest for is there graphics segments.

Its microprocessor product segment consists of CPU, APU (combination of CPU and GPU for graphics processing unit), chipsets and platforms. AMD design, develop and sell microprocessor products for servers, desktop PCs and mobile devices, including mobile PCs and tablets. HP is the main customers for this segment contributing to 56% in its revenue. For customers use of graphics solutions is to increase the speed of rendering images and to improve image resolution and color definition. AMD develop its graphic products for use in desktop and mobile PCs, professional workstations, servers and gaming consoles. For this product segment there are 5 OEM companies that contribute for its 55% revenue.

Global foundries Inc is AMD third party wafer foundry facilities, together with other 2 investment company which finances this foundry as part of joint ventures and produces technology of 45nmn and 32nm wafers. For assembly and test plants, AMD have assembly and test at Malaysia, in China and Test plant in Singapore.

Regarding total asset, from 2005 to 2006, an increase seen in their total asset due to acquisition of ATI for their graphic segment and falls under goodwill intangible assets. And starting 2006, its total asset starts to decline to divesture of their digital television business in 2008 and impairment or reduction in a company's stated capital.

2.5. Manufacturing Wafer Process Technology Evolution

Figure 2.5 is the progress of miniaturization of semiconductor manufacturing process node.

As per Taiwan Semiconductor Manufacturing Corporation or TSMC website, it can offer technology ranges from 90nm, 65nm, 55nm and its leading edge technology at 40nm and 28nm while Intel already have 32nm and 22nm and currently at their roadmap is 14nm. The right portion of the figure listed Texas Instruments outsourcing strategy in terms with third party foundries.

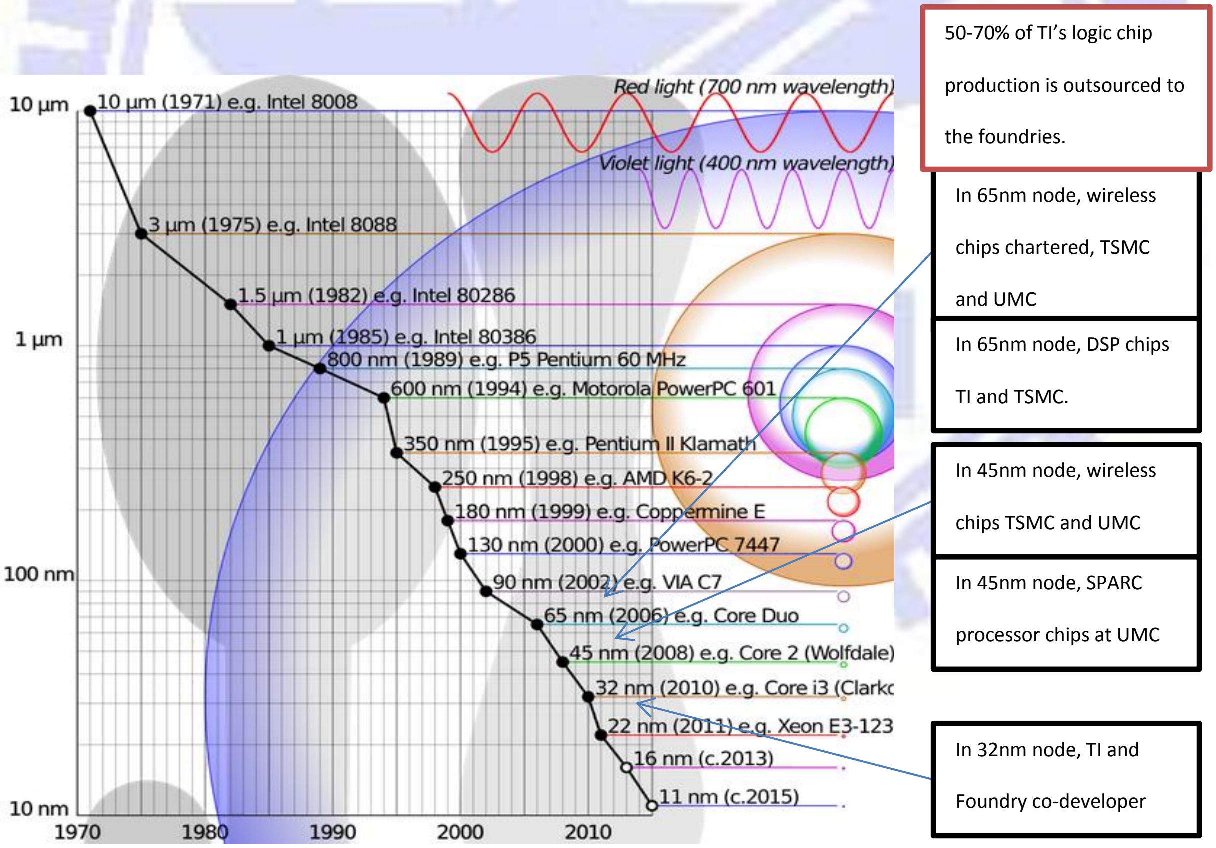

Figure 2.5 Semiconductor Process Nodes

Source: Compiled by case writer using Wikipedia website (March 2012) and EE Times Asia

III. Literature Review

3.1. Asset-light Valuation Model

There are 2 Asset-light valuation model described in the paper "The effects of asset-light strategy on competitive advantage" (Liou, 2011) concerning asset-light operations.

a. The value of light assets

b. Degree of asset lightness

3.1.1. The value of light assets and Degree of Asset lightness

The value of light assets, expressed in monetary value, indicates the firm's total value including both tangible physical assets and intangible assets generated by the firm's unique resources and capabilities. Degree of lightness (DAL) is a ratio wherein it measures the firm's ability to generate intangible value with the physical assets in place.

The term "asset-light" implies a high ratio of intangible strategic resources (light assets) relative to tangible (heavy) assets. While asset-light strategy pursues capital efficiency focusing on equity investment in areas that attain the best return for investors. (Maly and Palter 2002).

Intangibles resources are not usually valued on accounting books because they are considered non-market goods. On the other hand, tangible assets are defined in firm's financial statements and its total value theoretically if liquidated will be the total value of the company that shareholders will received. This total value is also called Book Value.

Since firm's book value fails to reveal all firm resources. And intangibles resources have been individually recognized as important contributions to the competitive advantage of firms

(Collins, Maydew and Weiss, 1997; Lev and Zarowin, 1999). The normal rate of return would be lower than the book rate of return if intangibles assets are incorporated into the total assets.

The present study uses return in invested capital or ROIC as the book value rate of return since this is an important measure of earnings efficiency and represents management's ability to advance and sustain shareholder value (Cao, Jiang, and Koller 2006). ROIC also indicates the presence or absence of a firm's competitive advantage (Tang and Liou 2010). It is calculated as the net operating profit less adjusted taxes (NOPLAT) divided by the invested capital (IC). NOPLAT is company's potential earnings if its capitalization were unleveraged or if it had no debt.

Equation (1):

$$ROIC = \left(\frac{NOPLAT}{IC}\right)$$

Where:

$$NOPLAT = EBIT\ x\ (1-t) + \ deferred\ income\ tax\ (if\ it\ exists)$$

$$IC = Net\ fixed\ assets + net\ working\ capital + other\ assets$$

$$IC = total\ assets - non\ interest\ bearing\ short\ term\ debt$$

Now, if firm's have certain amount of cash and it's uses that cash to a certain projects or investments in an additional asset, the result of that venture can be measured by ROIC. However, what about if the firm selected a different investment other than the one they choose? The difference in return between the chosen investment and the one that is necessarily passed up is called opportunity cost and weighted average cost of capital or WACC plus the risk-free return denotes the opportunity cost of resources deployed to generate future returns. We can therefore conclude if ROIC is greater than WACC plus the risk-free return, then the decision the firms made is the correct one since excess returns is earned and thus the firm perform well.

Thus, ROIC – WACC – r denotes the benefits created by unique resources and capabilities accumulated from the firm's previous investment in intangible assets. Since we will call these accumulated intangible resources and capabilities "light-assets" to distinguish them from the tangible or heavy-assets on the balance sheet. Diverse levels of excess returns across an industry signify heterogeneity of light-assets, and can explain why some firms outperform others as a result of competitive advantage.

Going back to firm investment going either depositing its money to receive a risk-free interest rate (r), or it can invest in heavy and asset light-assets to earn a return of ROIC. If it chooses the latter course, the ROIC (output) of its firm investment must be greater than the input cost plus the risk-free rate. If we assume that the firm has an infinite life with a fixed annual rate of return, then the firm value, estimated by its excess returns on heavy and light assets should not be less than the total book value of the fixed annual deposits. That is,

Equation (2):

Real value of the deployed assets → $$\frac{ICA}{(ROIC - WACC)} \geq \left(\frac{ICB}{r}\right)$$ ← Book value of the deployed assets

Where:

$$IC = total\ assets - (account\ payable + other\ current\ liabilites)$$

$$ICB = total\ assets - intangibles\ assets\ on\ the\ balance\ sheet$$

WACC is the minimum return that a firm must earn on existing invested capital. It can be calculated by multiplying the cost of each capital component by a weight reflecting the proportions of various funding sources (common equity, straight debt, warrants and stock options) used by the component. Therefore,

Equation (3):

$$WACC = \left(\frac{Debt}{Debt + Equity}\right) \times \; R_d \, x \; (1 - t) + \left(\frac{Debt}{Debt + Equity}\right) \times R_e$$

Where:

$$R_d \; = cost\ of\ debt = \left(\frac{interest\ expenses}{short\ term\ debts + long\ term\ debts}\right)$$

$$R_e \; = cost\ of\ equity = Riskfree\ interest\ rate + Beta \times Risk\ Premium$$

$$t = income\ tax\ rate \; = \frac{tax\ expense}{pretax\ income}$$

Rearranging Equation (2), the real value of the invested capital can be obtained by

Equation (4):

$$ICA \geq \left(\frac{ROIC - WACC}{r}\right) \times \; ICB$$

Or equivalently to Equation (5):

$$ICA \geq \left(\frac{1}{r}\right) \times \; (ROIC - WACC) \times ICB$$

Equations (4) and (5) reveal that as ratio of excess return to the risk-free rate increases, so does the real value of the invested resources. The theoretical rate of return of an investment with zero risk, the risk-free rate represents the interest an investor would expect from an absolutely risk-free investment over a specified period of time.

Equation (6) gives a lower bound for superior performance:

$$ICA - ICB = \left(\frac{1}{r}\right) \times \; (ROIC - WACC) \times ICB - ICB$$

Light-asset is the difference between the real value and the book value.

Equation (7)

$$LA = ICA - ICB = \frac{ICB \times (ROIC - WACC - r)}{r}$$

Where LA denotes the value of the light-assets and (ROIC – WACC – r) is the rate of return on light-assets (ROLA). Adding goodwill (GW) and intangibles (IA) on books to equation (7),

Equation (8)

$$LA = ICA - ICB = \frac{1}{r} \times ICB \times (ROIC - WACC - r) + GW + LA$$

The book value of assets (ICB) is the invested capital (IC). This measure includes only tangible assets, goodwill, and the intangible assets on the balance sheet. It excludes the value of firm's unique resources, and any capabilities accumulated form past operations that continue contributing to the net profits of the firm. Consider a synthetic definition of total assets that includes both physical assets on the balance sheet and light-assets, ICB + LA. The rate of return on these synthetic total assets is the intrinsic return or also called intrinsic value of a company based on perception of its value in terms of both tangible and intangible assets (based on Investopedia definition). Hereafter we name this concept the shadow return (SR).

Equation (9)

$$SR = \left(\frac{NOPLAT}{ICB + LA}\right)$$

If the book value of assets (ICB) is equal to the invested capital (IC) or IC = ICB, then if LA > 0, it follows that (ICB + LA) is greater than IC, and that ROIC is > SR. On the other hand, if LA < 0 then (ICB + LA) is less than IC and ROIC is less than SR. Since competitive advantage is defined as having abnormal returns, the excess return on competitive advantage (CA) can be measured as the difference between the book rate of return and SR:

$$CA = ROIC - SR = \frac{NOPLAT}{IC} - \frac{NOPLAT}{ICB + LA}$$

$$CA = NOPLAT\left(\frac{ICB + LA}{IC(ICB + LA)} - \frac{IC}{IC(ICB + LA)}\right)$$

$$CA = ROIC\left(\frac{ICB + LA - IC}{ICB + LA}\right)$$

Assuming that IC = ICB (i.e. the goodwill and intangibles on the balance sheet are negligible), this equation can be written as follows:

Equation (10)

$$CA = ROIC - SR = ROIC \times \left(\frac{LA}{ICB + LA}\right)$$

Dividing Equation (10) by ROIC, we obtain a relationship between light-assets, ROIC, and SR:

$$1 - \frac{SR}{ROIC} = \frac{LA}{ICB + LA}$$

$$\frac{SR}{ROIC} = 1 - \frac{LA}{ICB + LA} = \frac{ICB}{ICB + LA}$$

$$\frac{ROIC}{SR} = \frac{ICB + LA}{ICB}$$

$$ROIC = \left(1 + \frac{LA}{ICB}\right) \times SR$$

Equation (11)

$$ROIC = SR(1 + DAL)$$

Equation (11) illustrates that the ratio of light-assets to tangible assets (DAL, the degree of asset-lightness) is positively related to ROIC. Thus, for a given shadow of rate of return, firms that are more asset-light tend to have more competitive advantage.

By re-writing Equation (11) as Equation (12), we obtain one more relationship: at a fixed shadow of return, firms with a larger proportion of light assets require fewer tangible assets to produce the same net profit.

$$NOPLAT = (ICB + LA) \times SR$$

Equation (12)

$$LA = \frac{NOPLAT}{SR} - ICB$$

Furthermore, since ROIC ignores LA from the denominator, it is greater than SR should LA be positive. The difference between ROIC and SR quantifies superior performance (competitive advantage) from an asset-light strategy. Equation (13) states that ROIC equals SR plus an abnormal return from the degree of asset-lightness (DAL).

$$ROIC = SR(1 + DAL)$$

Equation (13)

$$ROIC - SR = SR \times DAL$$

3.2. Resource based Theory and Competitive Advantage

During the 1990s, the focus of strategy analysis shifted from the sources of profit in the external environment to the sources of profit within the firm. Increasingly the resources and capabilities of the firm became regarded as the main source of competitive advantage and the primary basis for formulating strategy (Grant, 1991; Collis and Montgomery, 1995). This emphasis on what has been called the resource-based view of the firm represented a substantial shift in thinking of strategy (Grant, 2010).

3.2.1. Definition of Resource Based-Theory

The resource-based view emphasizes the uniqueness of each company and suggests that the key to profitability is not through doing the same as other firms but rather through exploiting differences.

Articles from Barney (1991), Conner (1991), Powell (1992a; 1992b) emphasized the contribution of resources to sustainable advantage for single-business firms by examining how or why resources contribute to the advantage of one firm over another in a particular product/market.

The RBV emphasizes that abnormal returns are sourced from within-firm features (Silverman, 2002). Conceiving firms as a bundle of resources and capabilities (Silverman, 2002), the RBV asserts that firms are heterogeneous due to market imperfection for strategic factors (Penrose, 1959). The imperfection example is the scarcities of strategic resources attribute that fact that some firms outperform than others and enjoy abnormal returns (Peteraf, 1993).

It is important to distinguish between the resources and the capabilities of the firm (Grant, 2010).

Resources are inputs into the production process – they are the basic unit of analysis. The individual resources of the firm include items of capital equipment, skills of individual employee, patents, brand names, finance, and so on. But, on their own, few resources are productive. Productive activity requires the cooperation and coordination of teams of resources.

A capability is the capacity for a team of resources to perform some task or activity. While resources are the source of a firm's capabilities, capabilities are the main source of its competitive advantage.

3.2.2. Definition of Competitive Advantage

Competitive advantage is defined as one firm having returns over a competitor or group of competitors in a given market, strategic group or industry (Kay, 1993). It is also defined as systematically gaining above average returns to the firm (Schoemaker, 1990). Competitive advantages comes up with a firm's distinctive competence (Day and Wensley, 1998), which consists of a superior production system, a lower level of wages and salaries or an ability to deliver superior customer services (Day and Wensley, 1998). In specific, the focus of advantage in the market place and position of advantage are generally regarded as being differentiation or lower delivered cost or both (Porter, 1985, Gilbert and Strebel, 1991). Sustainable competitive advantage leads to superior market-based performance and financial-based performance (Bharadwaj, Varadarajan and Fahy, 1993; Hunt and Morgan, 1995).

3.3. The Valuation Metrics for Intangibles

Strategic management and marketing management experts denote the balance sheet tangible assets as "asset-heavy" or "balance-sheet assets", while "asset-light" refers to all intangible assets (both on and off the balance sheet) that create additional net benefits beyond the book value (Maly and Palter, 2002). The asset-light strategy echoes the viewpoint of Resource-based Theory (RBT) related perspectives in terms of focus (intangibles) and of the focal point of the competitive advantage of firms (core competence).

As per Sveiby (2010) proposal on measuring Intangible assets which will used on this paper to evaluate the effectiveness of an asset-light strategy are Market capitalization method (MCM), Return on assets methods (ROA) and Cash-flow method. The methods mention offered $-valuations useful for stock market valuations, comparisons between companies within the same industry and they are good for illustrating the financial value of Intangible assets, a feature, which tends to get attention of the top management. The selections of the three intangibles metrics also were based in terms of organization level (or internal) as stated in Sveiby (2010) Intangible Assets Measuring Models.

Selecting two internal intangibles indicator more than industry intangible indicator also conformed to Resource based View of shifting the sources of profit in the external environment to the sources of profit within the firm. And according to Grant (1991); Collis and Montgomery (1995) the increasingly the resources and capabilities of the firm became regarded as the main source of competitive advantage and the primary basis for formulating strategy.

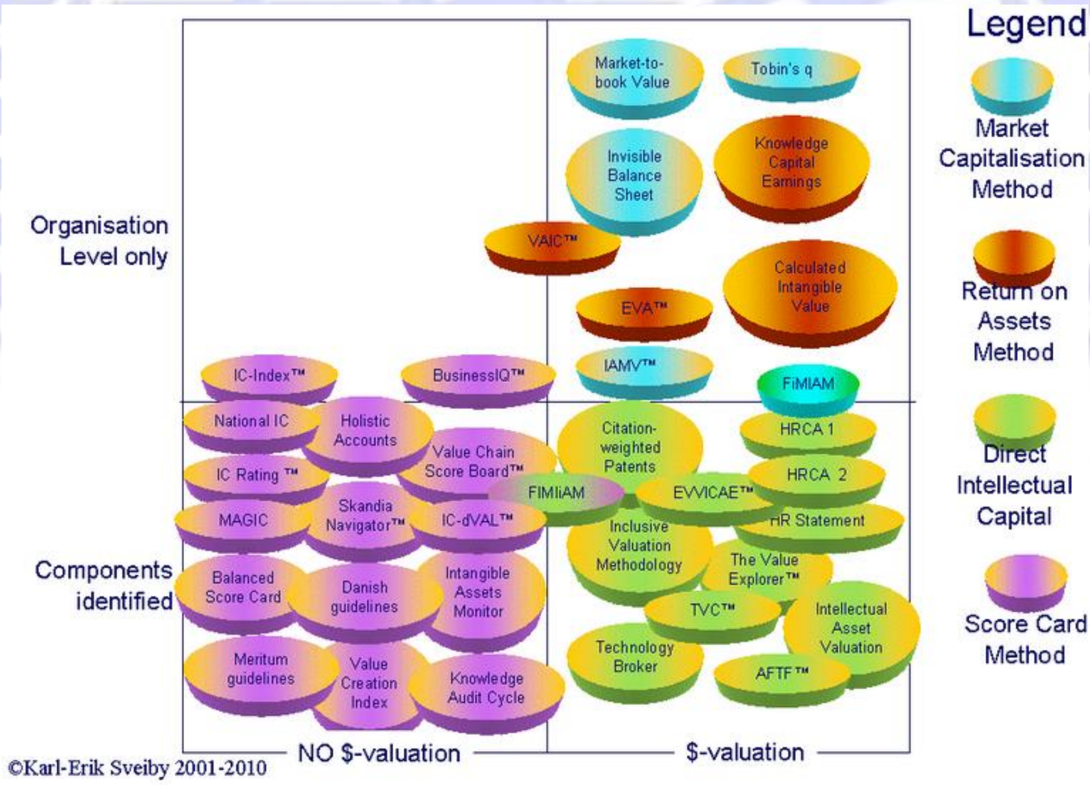

Figure 3.1 Intangible Assets Measuring Models

Source: Sveiby April 12, 2010 website

The valuation metrics for intangibles can be used to evaluate the effectiveness of an asset-light strategy. Sveiby (2004) categorize intangibles measurement into four:

a. Market capitalization methods (MCM) – calculate the difference between a company's market capitalization and its stockholders' equity as the value of its intellectual capital or intangible assets.
b. Return on assets methods (ROA) – average pre-tax earnings of a company for a period of time are divided by the average tangible assets of the company. The result is a company ROA that is then compared with its industry average. The difference is multiplied by the company's average tangible assets to calculate average annual earnings from the intangibles. Dividing the above-average earnings by the company's average cost of capital or an interest rate, one can derive an estimate of the value of its intangible assets or intellectual capital.
c. Direct intellectual capital methods (DIC) – estimate the $ value of intangible assets by identifying its various components. Once these components are identified, they can be directly evaluated, either individually or as aggregated coefficient.
d. Scorecard Methods (SC) –The various components of intangible assets or intellectual capital are identified and indicators and indices are generated and reported in scorecards or as graphs.

Marketing specialists concentrate on the Market capitalization methods (MCM) and Return on assets methods (ROA) to evaluate market-based assets or marketing productivity (e.g., Barwise, Marsh, and Wensley, 1989; Day and Fahey, 1988; Srivastava, Shervani, and Fahey, 1998; Rust, Ambler, Carpenter, Kumar and Srivastava, 2004).

3.3.1. **Market-to-book ratio** (internal)

Market/book ratio, sometimes called price-to-book ratio, is a way of measuring the relative value of a company compared to its stock price or market value. It is useful way of measuring the company's performance and making quick comparisons with competitors. It is an essential figure because it provides a simple way of judging whether a company is under or overvalued.

The fact that markets pay price premiums in excess of book values for a firm implies that a substantial portion of the firm value is in intangible assets (Capraro and Srivastava, 1997; Rappaport, 1986; Simon and Sullivan, 1993; Steward, 1997). These intangible assets are "advantage resources" created from internal organizational structure. Therefore, a high market-to-book ratio denotes the percentage of the firm's market value (versus its book Equity) that is made up of high portion of "advantage resources".

Valuation of intangible assets is the product of price per share and the outstanding shares, the result will then be divided with the difference of total assets and total liabilities. Or price to book ratio is computed by dividing the market price per share by the current book value of equity per share.

$$\frac{market\ value}{book\ value} = \frac{(price\ per\ share\ x\ oustanding\ shares)}{(total\ assets - total\ liabilites)}$$

3.3.2. **Return on Assets - Excess Earning Method** (industry)

This method sometimes known as the "formula method", an approach that may used in determining the fair market value of intangible assets of a business. The excess earning valuation method presumes a company's earnings are created by assets. To the extent a company's earnings are greater than might be expected to be earned on its tangible assets, the company is presumed to have "excess earnings" created by intangible assets (or goodwill). The valuation methodology is to identify and value tangible assets and to collectively value intangible assets by capitalizing excess earnings.

A percentage return on the average annual value of the tangible assets used in a business I determined, using a period of years (in the excel created it is three years) immediately prior to the valuation date. The amount of the percentage return on tangible assets, thus determined, is deducted from the average earning of the business for such period and the remainder, if any, is considered to be the amount of the average annual earnings from the intangible assets of the business for the period. This amount (considered as the average annual earnings from the intangibles), capitalized at a percentage of say, 15 to 20 percent, is the value of the intangible assets determined under the "formula" approach.

$$ROA = \left(\frac{E}{A_T}\right)$$

$$CIV = \frac{(ROA - ROA_I)xA_T}{cost\ of\ capital}$$

Where:

$$CIV : Calculated\ Intangible\ Assets$$

$$excess\ earning : (ROA - ROA_I)xA_T$$

$$E : average\ pretax\ earnings\ for\ the\ past\ 3\ years$$

$$A_T : net\ tangible\ assets$$

$$ROA : average\ return\ on\ net\ tangible\ assets$$

$$ROA_I : industry's\ average\ return\ on\ assets\ for\ the\ past\ 3\ years$$

$$t : income\ tax\ rate$$

3.3.3. **Economic Value Added** (internal)

Economic profit or economic value, which measures the excess return earned on capital invested in existing investments. It added is a measure of dollar surplus value added by a firm or project and is measured by doing the following:

$$EVA = (NOPLAT) - (capital \times cost\ of\ capital)$$

The return of capital is measured using “adjusted” operating income, where the adjustments eliminate items that are unrelated to existing investments, and the capital investment is based on the book value of capital but is designed to measure the capital invested in existing assets. Firms with have positive EVA are firms that are creating surplus value, and firms with negative EVA are destroying value. (Damodaran, 2011).

IV. Case Study

4.1. Company Selection Process

Six public companies were selected with the Securities and Exchange Commission SIC codes of 3674 description Semiconductor, Related Device and one public company under SIC 3600 with description ELECTR, OTH ELEC EQ, EX CMP. It total seven companies are selected based on “Final Worldwide Revenue Ranking for the Top-25 Semiconductor Suppliers in 2010” (See Figure 4.1 2010 Isuppli Top-25 Semiconductor Suppliers) based on their revenue in millions of U.S. dollars.

Final Worldwide Revenue Ranking for the Top-25 Semiconductor Suppliers in 2010
(Ranking by Revenue in Millions of U.S. Dollars)

2009 Rank	2010 Rank	Company Name	2009 Revenue	2010 Revenue	Percent Change	Percent of Total	Cumulative Percent
1	1	Intel	$32,187	$40,394	25.5%	13.3%	13.3%
2	2	Samsung Electronics	$17,496	$27,834	59.1%	9.2%	22.4%
3	3	Toshiba	$10,319	$13,010	26.1%	4.3%	26.7%
4	4	Texas Instruments	$9,671	$12,994	34.4%	4.3%	31.0%
9	5	Renesas Electronics Corporation	$5,153	$11,893	130.8%	3.9%	34.9%
7	6	Hynix	$6,246	$10,380	66.2%	3.4%	38.3%
5	7	STMicroelectronics	$8,510	$10,346	21.6%	3.4%	41.7%
13	8	Micron Technology	$4,293	$8,876	106.8%	2.9%	44.6%
6	9	Qualcomm	$6,409	$7,204	12.4%	2.4%	47.0%
14	10	Broadcom	$4,278	$6,682	56.2%	2.2%	49.2%
15	11	Elpida Memory	$3,948	$6,446	63.3%	2.1%	51.3%
8	12	Advanced Micro Devices (AMD)	$5,207	$6,345	21.9%	2.1%	53.4%
11	13	Infineon Technologies	$4,456	$6,319	41.8%	2.1%	55.5%
10	14	Sony	$4,468	$5,224	16.9%	1.7%	57.2%
18	15	Panasonic Corporation	$3,243	$4,946	52.5%	1.6%	58.8%
17	16	Freescale Semiconductor	$3,402	$4,357	28.1%	1.4%	60.3%
19	17	NXP	$3,240	$4,028	24.3%	1.3%	61.6%
23	18	Marvell Technology Group	$2,572	$3,633	41.3%	1.2%	62.8%
16	19	MediaTek	$3,551	$3,553	0.1%	1.2%	64.0%
20	20	nVidia	$2,826	$3,196	13.1%	1.1%	65.0%
21	21	ROHM Semiconductor	$2,586	$3,118	20.6%	1.0%	66.0%
22	22	Fujitsu Semiconductor Limited	$2,574	$3,090	20.0%	1.0%	67.0%
24	23	Analog Devices	$2,091	$2,862	36.9%	0.9%	68.0%
30	24	Maxim Integrated Products	$1,657	$2,367	42.8%	0.8%	68.8%
29	25	Xilinx	$1,699	$2,311	36.0%	0.8%	69.5%
		All Others	$78,112	$92,667	18.6%	30.5%	
		Total Semiconductor	**$230,194**	**$304,075**	**32.1%**	**100.0%**	

Source: IHS iSuppli April 2011

Figure 4.1 2010 Isuppli Top-25 Semiconductor Suppliers

And based on that revenue table, companies further categorized as company with fab capability and those fabless type. Those semiconductor companies selected under category with fab capabilities are Intel, Texas Instruments and Toshiba. On the other hand Fabless semiconductor companies are Qualcomm, Broadcom, AMD and Marvell.

Those seven companies are selected because they show top sales performance in the semiconductor industry. As per chapter 1 Table 1.1 IC Insights Research Bulletin for Top 10 IDMs Pursuing Fab/Asset-Lite Strategies, two of the companies were selected as those top semiconductor companies pursuing or will pursue light-asset strategy by outsourcing there wafer fab into certain foundry companies. These 2 companies are Texas Instrument (TI) and Toshiba. The other four companies are listed as fabless companies with highest grosser in terms of sales for Figure 4.2 2011 Top 25 Fabless IC Suppliers are Qualcomm, Broadcom, AMD and Marvell.

2011 Top 25 Fabless IC Suppliers ($M)

2011 Rank	2010 Rank	2009 Rank	Company	Headquarters	2009 ($M)	2010 ($M)	% Change	2011 ($M)	% Change
1	1	1	Qualcomm	U.S.	6,409	7,204	12%	9,910	38%
2	2	3	Broadcom	U.S.	4,271	6,589	54%	7,160	9%
3	3	2	AMD	U.S.	5,403	6,494	20%	6,568	1%
4	6	5	Nvidia	U.S.	3,151	3,575	13%	3,939	10%
5	4	6	Marvell	U.S.	2,690	3,592	34%	3,445	-4%
6	5	4	MediaTek	Taiwan	3,500	3,590	3%	2,969	-17%
7	7	7	Xilinx	U.S.	1,699	2,311	36%	2,269	-2%
8	8	10	Altera	U.S.	1,196	1,954	63%	2,064	6%
9	9	8	LSI Corp.	U.S.	1,422	1,616	14%	2,042	26%
10	10	11	Avago	Singapore	858	1,187	38%	1,341	13%
11	13	12	MStar	Taiwan	838	1,065	27%	1,220	15%
12	11	13	Novatek	Taiwan	819	1,149	40%	1,198	4%
13	15	16	CSR	Europe	601	801	33%	845	5%
14	12	9	ST-Ericsson*	Europe	1,263	1,146	-9%	825	-28%
15	16	15	Realtek	Taiwan	615	706	15%	742	5%
16	17	17	HiSilicon	China	572	652	14%	710	9%
17	27	67	Spreadtrum	China	105	346	230%	674	95%
18	19	19	PMC-Sierra	U.S.	496	635	28%	654	3%
19	18	14	Himax	Taiwan	693	643	-7%	633	-2%
20	21	—	Lantiq	Europe	0	550	N/A	540	-2%
21	33	30	Dialog	Europe	218	297	36%	527	77%
22	22	21	Silicon Labs	U.S.	441	494	12%	492	0%
23	29	20	MegaChips	Japan	445	337	-24%	456	35%
24	23	24	Semtech	U.S.	254	403	59%	438	9%
25	24	23	SMSC	U.S.	283	397	40%	415	5%
Top 25 Total			—	—	38,242	47,733	25%	52,076	9%
Non-Top 25 Fabless			—	—	11,091	14,781	33%	12,811	-13%
Total Fabless			—	—	49,333	62,514	27%	64,887	4%

*Represents the 50% share not accounted for by ST.

Source: Company reports, IC Insights' *Strategic Reviews Database*

Figure 4.2 Top 25 Sales leaders for Fabless Companies

Source: IC Insights

4.2. Texas Instruments and Fab-Lite Strategy

Out of the seven companies selected from previous chapter, Texas Instruments and Toshiba are pursuing on fab lite strategy. However, Texas Instruments started way back 2000 while Toshiba started late, in 2010 to be specific. So why did TI pursue asset-light strategy?

a. According to IC Insights report, nearly all IDMs today (excluding Intel and memory makers) are now aiming to keep capital spending at or below 10% of annual sales compared to the IC industry's average of more than 20% in the last decade. Figure 4.3 shows Texas Instruments Capital Expenditures Trend from 2000 to 2010, it shows that 10 years ago TI capital expenditures have around 20% of its sales and starting 2002 where there is a short period of severe market downturn capital expenditures were reduced in average of 10% annually.

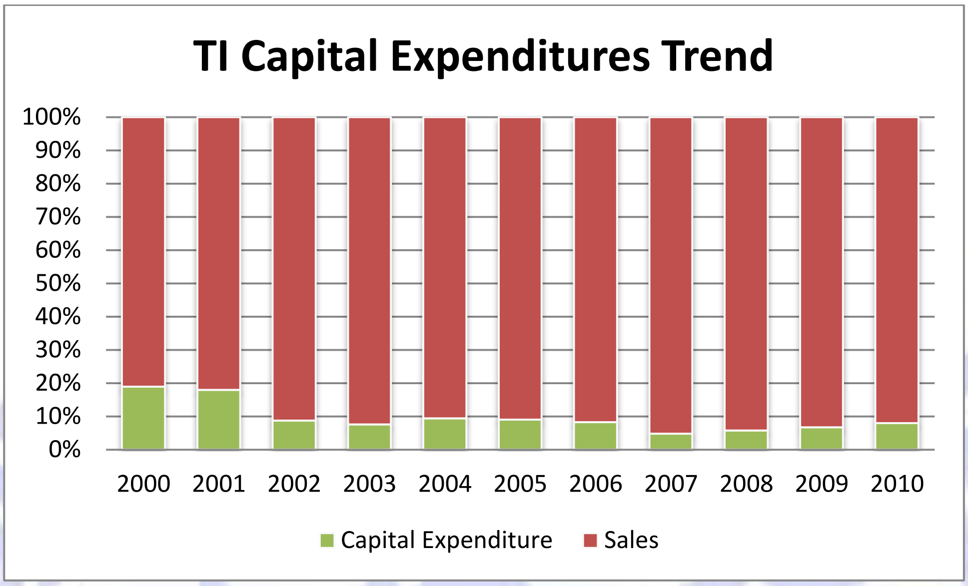

Figure 4.3 TI Capital Expenditures Trend

Source: Compiled by case writer

b. Few can afford to compete on the technology frontier created by Moore's law. And growth is concentrating only in segments such as smart phones and mobile computing. One piece of the industry has been free from Moore's law punishing investment implications: the analog segment which same as micro controllers are using old technology has historically been stable and profitable (McKinsey, 2011). The effect of Moore's law on the global semiconductor market is declining, leading-edge nodes now present (2010) 14% of total demand for logic chips and micro components, making access to manufacturing technology less important.

c. Light-asset creates value by generating economic profit. TI implements operational-improvement programs for product lines that can hit acceptable targets for return on invested capital (ROIC) plus a lower levels of capital expenditures as earlier mention at “a”. Although income statement shows a number of profitable firms in the semiconductor industry, companies must thrive to optimize for ROIC rather than share or gross margin.

d. Proactively managing product portfolios, investing in market segments that are growing and divesting segments in which growth or margins are low. TI actively evolves their portfolios as markets mature or become less attractive. Rather than engaging in a price war to increase their share of a stagnating market.

Going fab lite or implementing Asset-light strategy is a tool use by Texas Instruments to achieve impact and its main indicator is ROIC or Return in Invested Capital. For ROIC to have a good number 3 factors are needed and these are (a) Revenue (b) Cost and (c) Capital. Asset-light direct affect the capital factors as it reduces its capital expenditures from 20% to 10% of their sales. For cost factor, the strategy effect the fixed cost since its old technology fab focus for analog devices improve throughput and drive lean operations. And lastly in revenue factor, it’s a tactical decision on investing in key accounts and still competes with other portfolios via outsourcing such as wireless segment.

Wireless portfolio by TI was subjected for asset-light strategy as part of overall corporate strategy to differentiate their wireless portfolio instead of fighting a price war with big wireless firms with high market share. Instead of adding capital expenditures for buying assets, TI strategy for this product lines are to invest in fixed cost R&D for innovative products that are differentiated with what current market is offering.

4.3. Study Design

4.3.1. Light-Asset Valuation Model

This case investigates how asset-light operations generate competitive advantage in selected top earner semiconductor companies. And the valuation measures can be divided into 2 parts: (a) asset-light valuation models and (b) Valuation of Intangible Assets.

Following Liou, Tang and Huang (2008) asset-light business model, we measured 2 major asset-light valuation models.

c. The value of light assets

$$LA = ICA - ICB = \frac{1}{r} \times ICB \times (ROIC - WACC - r) + GW + LA$$

d. Degree of asset lightness

$$DAL = \frac{LA}{ICB}$$

Where	*Definition*	*Compustat Equivalent*
LA	The value of Light-asset in $US	
ICA	Firm or Real Value	
ICB	Book Value	Total Asset – Intangible Assets
*IC**	Invested Capital	Total Asset – (Account Payable + other Current Liabilities)
*ROIC**	Return in Invested Capital	
*NOPLAT**	Net Operating Profit Less adjusted Tax	
EBIT	Earnings before Interest and Tax	EBIT

t	Income Taxes	Total Taxes/Pretax Income
*WACC**	Cost of Capital	
EBITDA	Earnings before interest, tax depreciation and amortization	EBITDA
Debts	Debts	(Debts/EBITDA) x EBITDA
Equity	Equity	Total Stockholders' Equity
Interest Expense	Interest Expense	Interest Expense
Short-term debts	Short-term debts	Debts – Total Long Term Debt
*Rd**	Cost of Debt	
*r***	Risk-free Interest Rate	
Beta	Firm Beta	Beta
*Risk Premium****	Risk Premium	
*Re**	Cost of Equity	

Legend: * Expanded formula definition can be seen in Literature Review

** 20 Years of US Treasury Bills

*** Based on Damodaran 2000-2010 histretSP.xls

4.3.2. Valuation of Intangible Assets

For Valuation of Intangible Assets, we have the following valuation (a) Market-to-book ratio (b) Excess earnings return on assets over reasonable rate method and (c) EVA or Economic Value Added.

These three valuations are chosen based on Sveiby's (2010) "Intangible Assets Measuring Models" (see figure 3.1 p.37) wherein Market-to-book ratio is under Market Capitalization method. ROA and EVA are under Return on Assets Method. All three's are in "Organization Level" and "$ valuation". Excess earnings return on assets over reasonable rate method was also been selected under ROA method so we can have valid valuation that is based on its industry, semiconductor industry.

a. Market-to-book ratio (Market Capitalization Method)

$$\frac{market\ value}{book\ value} = \frac{(price\ per\ share\ x\ oustanding\ shares)}{(total\ assets - total\ liabilites)}$$

b. Excess earnings return on assets over reasonable rate method (Return on Assets Methods)

$$CIV\ = \frac{(ROA - ROA_I)xA_T}{cost\ of\ capital}$$

c. Economic Value Added or EVA (Cash Flow Method)

$$EVA\ = (NOPLAT) - (capital\ \times cost\ of\ capital)$$

Where	*Definition*	*Compustat Equivalent*
Market- to-book ratio	Market value / book value	Price to book
E	Average pre-tax earnings for past 3 years	Pretax Income (average of the past 3 years)
ROA_I	Industry's average ROA for the past 3 years	ROA for all 151 companies with SIC # 3674 (average of the past 3 years)
A_T	Net tangible assets	Total Asset – Intangible Assets
ROA	E/A_T	

4.4. Data

All data are extracted at S&P Research Insights or also called Compustat with version v.8.4.1. Selected fiscal year from 2000 to 2010 and were exported into Microsoft Excel 2007 and created macro programming mostly using “INDIRECT” function capabilities. However there are some critical numbers or data that are missing from Compustat. Data such as company’s beta, risk-free interest rate, and risk premium.

For annual firm’s beta wherein it was found out that most of the available beta are from fiscal year 2006 to 2010 only. The early missing beta’s from 2000 to 2005 are manually computed using 2 variables, closing prices of the firms which can be downloaded using Compustat and under the description of “Monthly Close Price” and closing prices or values for S&P 500 which are taken from Google finance historical prices with quote as INDEXSP:.INX. Base on these 2 variables, calculated beta for CAPM for the company using regression tool and the =SLOPE function in excel 2007.

To get Risk-free interest rate which is needed in computing Cost of Equity, data were downloaded at U.S. Treasury: Daily Treasury Yield Curve Rates website and get the annual average 20 year bond. Why 20 years? As per Aswath Damodaran research paper in Stern School of Business New York University (December 2008), Risk free rate is the starting point for all expected return models. For an investment to be risk free, it has to meet two conditions. The first is that there can be no risk of default associated with its cash flows. The second is that there can be no reinvestment risk in the investment. Using these criteria, the appropriate risk free rate to use to obtain expected returns should be a default-free (government) zero coupon rate that is matched up to when the cash flow or flows that are being discounted occur. In practice, however, it is usually appropriate to match up the duration of the risk free asset to the duration of the cash flows being analyzed. In corporate finance and valuation, this will lead us towards long-term government bond rates as risk free rates.

Lastly, to get risk premium which is also a vital number needed for Cost of Equity calculation. This can be obtain in Damodaran pre-existing excel file name histretSP.xls or "Historical Risk premium geometric". Under "returns by year" tab, numbers were copy in column with name "Historical Risk Premium" starting from 2000 to 2010 and then simply convert that percentage numbers into decimal format.

4.5. Time Period Selection

Information taken from S&P Compustat is from fiscal years 2000 to 2010. However analyses based on excel 2007 will only shows from 2003 to 2010 omitting 2000 to 2002 data. These was done since some data are computed based on 3 years running average such as average pretax earnings and ROA. The 9 years total from 2003 to 2010 will then be divided into 3 groups of spanning 3 years each. The reason for this is to have 3 types of period wherein Texas Instrument adopted to pursue light-asset strategy, these 3 period will be called (a) Pre-Asset light time line (2003-2004) (b) Light-Asset Timeline (2005-2007) and (c) Post-Asset Light (2008 to 2010). See Table 4.1 Texas Instruments Asset-Light Timeline for clearer picture. Texas Instruments announce implementing Light-asset strategy in 2007 thus we can have clear picture of its indicator thru this timeline division.

		Pre-Asset Light Timeline			Light-Asset Timeline			Post-Asset Light Timeline		
Company	Valuation	2002	2003	2004	2005	2006	2007	2008	2009	2010
TI	LA = Light Assets + Intangible Assets	(32,991.75)	(23,330.62)	(18,246.42)	(1,422.87)	4,137.99	16,623.30	19,254.07	8,948.01	[illegible]
	SR + Shadow Rate of Return	(0.0168)	[illegible]	[illegible]	0.1717	0.1396	0.0893	[illegible]	0.0807	0.0498
	DAL = Degree of Asset Lightness	(2.3810)	(1.5928)	(1.1782)	(0.1013)	0.3225	1.4471	1.7811	0.8172	4.1446

Table 4.1 Texas Instruments Asset-Light Timeline

Source: Compiled by case writer

4.6. The Value of Light Assets

First we need to check the trend in total assets for the seven companies we selected. Texas Instruments started asset-light thru outsourcing of its wafer production up to 25% by third party foundry. TI is targeting up to 60% wafer outsourcing until 2010, including advance CMOS production.

On all seven companies being analyzed, TI is consistently show decrease of their total heavy assets, AMD starting in 2008 on the other hand were seen to increase its asset and then decrease in the succeeding year. This is due to acquisition of ATI in 2006 but the intangibles were overestimated and thus adjusted in year to year basis.

Company	Pre-Asset Light Timeline				Light-Asset Timeline				Post-Asset Light Timeline			
	2002	2003	2004	3Yr Average	2005	2006	2007	3Yr Average	2008	2009	2010	3Yr Average
TI	14.68	15.51	16.30	15.50	15.06	13.93	12.67	13.89	11.92	12.12	13.40	12.48
intel	44.22	47.14	48.14	46.50	48.31	48.37	55.65	50.78	50.72	53.10	63.19	55.67
Marvell	2.10	2.44	2.79	2.44	3.51	4.53	4.55	4.20	4.41	5.17	6.34	5.31
TOSHIBA	43.66	42.10	42.72	42.83	40.40	50.27	59.36	50.01	55.65	58.61	65.00	59.75
QUALCOMM	6.51	8.82	10.82	8.72	12.48	15.21	18.50	15.39	24.56	27.45	30.57	27.53
AMD	5.62	7.09	7.84	6.85	7.29	13.15	11.55	10.66	7.68	9.08	4.96	7.24
BROADCOM A	2.22	2.02	2.89	2.37	3.75	4.88	4.84	4.49	4.39	5.13	7.94	5.82

Legend
Heavy Fab Asset
Medium Fab Asset
Fabless

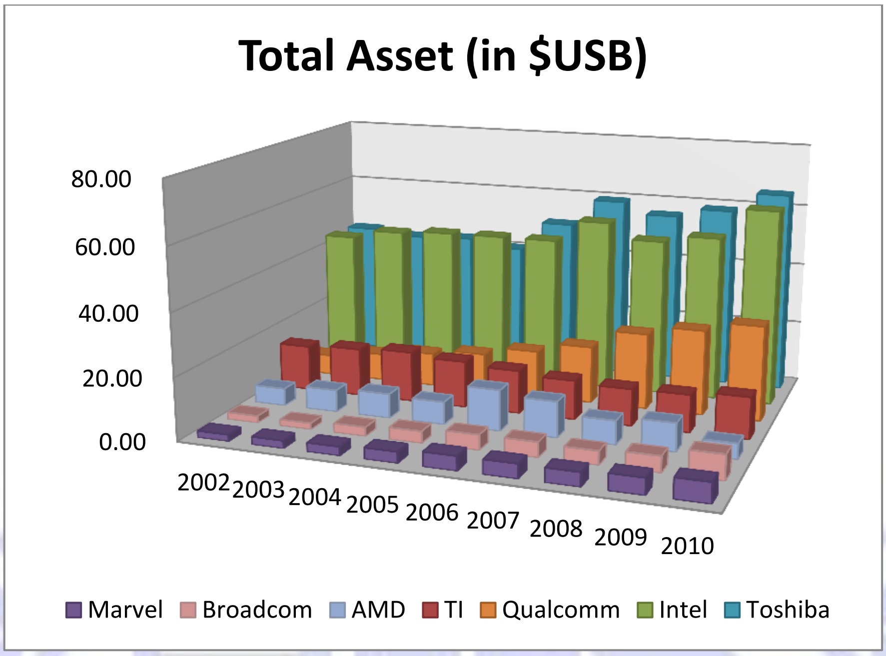

Table 4.2 Seven Selected Firms Total Assets Trend

Source: Compiled by case writer

Out of seven companies selected, only 2 companies in general show positive light-assets while the rest shows negative, see Table 4.3 Light-Asset Results. Powell and Arregle (2007) suggest that firms compete on two axes: the axis of competitive advantage and the axis of errors or competitive disadvantage. Five companies namely Marvell, Toshiba, Qualcomm, AMD and Broadcom are competing on the axis of competitive disadvantage, meaning that they under utilize existing tangible assets for value creation.

	Pre-Asset Light Timeline			3Yr	Light-Asset Timeline			3Yr	Post-Asset Light Timeline			3Yr
LA + IA (US$B)	2002	2003	2004	Average	2005	2006	2007	Average	2008	2009	2010	Average
TI	(32.99)	(23.33)	(18.25)	(24.86)	(1.42)	4.14	16.62	6.45	19.25	8.95	50.55	26.25
intel	(44.87)	(24.88)	(16.21)	(28.66)	22.65	(59.57)	(13.81)	(16.91)	36.54	33.14	144.99	71.55
Marvell	(2.35)	(4.11)	(5.62)	(4.03)	(5.39)	(7.81)	(7.99)	(7.06)	(3.82)	(1.52)	5.36	0.01
TOSHIBA	(14.30)	4.56	(3.26)	(4.34)	28.08	(14.66)	(8.37)	1.68	(329.19)	(184.14)	(51.90)	(188.41)
QUALCOMM	(8.16)	(10.79)	0.42	(6.18)	(3.53)	(9.00)	(2.96)	(5.16)	3.75	(5.40)	(3.89)	(1.85)
AMD	(38.23)	(29.11)	(22.78)	(30.04)	(22.50)	(19.64)	(54.94)	(32.36)	(51.26)	(35.33)	4.29	(27.43)
BROADCOM A	(9.58)	(7.60)	(3.72)	(6.97)	(6.11)	(13.43)	(14.63)	(11.39)	(1.85)	(7.24)	10.44	0.45

Legend
Heavy Fab Asset
Medium Fab Asset
Fabless

Table 4.3 Light-Asset Results

Source: Compiled by case writer

The negative light-asset as seen on Table 4.3 is due to the fact that ROIC is less than the sum of WACC and risk free rate (r). Table 4.4 shows the value of WACC + r, wherein the cell highlighted in red color means the WACC + r is greater than ROIC. And the cell highlighted in green means ROIC is greater than WACC + r. Above table though shows a positive light-asset for Qualcomm in 2004 and 2008, however below table shows all in red, this is due to very minimal differences in value, example in Qualcomm 2004 wherein ROIC is16.27% and WACC + r is equal to 16.30%. Table 4.5 is the ROIC of each firm.

WACC + r (%)	Pre-Asset Light Timeline			3Yr	Light-Asset Timeline			3Yr	Post-Asset Light Timeline			3Yr
	2002	2003	2004	Average	2005	2006	2007	Average	2008	2009	2010	Average
TI	15.88%	16.58%	18.58%	17.01%	18.91%	19.79%	18.55%	19.08%	13.71%	13.09%	12.64%	13.14%
intel	16.80%	19.45%	21.82%	19.36%	20.89%	19.18%	16.86%	18.98%	13.41%	12.77%	12.43%	12.87%
Marvell	38.51%	36.54%	35.93%	36.99%	28.46%	20.88%	20.16%	23.17%	16.15%	15.32%	13.81%	15.10%
TOSHIBA	2.69%	1.70%	5.99%	3.46%	6.41%	9.92%	9.06%	8.46%	8.10%	13.85%	15.34%	12.43%
QUALCOMM	16.61%	18.45%	16.30%	17.12%	18.23%	19.82%	18.11%	18.72%	14.44%	12.16%	12.17%	12.92%
AMD	14.28%	15.50%	18.59%	16.12%	20.77%	19.61%	16.96%	19.11%	11.87%	11.73%	13.36%	12.32%
BROADCOM A	20.62%	25.72%	27.56%	24.63%	29.41%	26.60%	25.80%	27.27%	15.82%	14.63%	13.01%	14.49%

Legend	Note:
Heavy Fab Asset	Cell in this color means ROIC < (WACC + r)
Medium Fab Asset	Cell in this color means ROIC > (WACC + r)
Fabless	wherein: r = riskfree rate

Table 4.4 WACC and Risk free Rate Results

Source: Compiled by case writer

ROIC (%)	Pre-Asset Light Timeline			3Yr	Light-Asset Timeline			3Yr	Post-Asset Light Timeline			3Yr
	2002	2003	2004	Average	2005	2006	2007	Average	2008	2009	2010	Average
TI	2.62%	8.39%	12.37%	7.79%	18.10%	20.98%	25.15%	21.41%	21.02%	16.01%	28.94%	21.99%
intel	9.84%	16.06%	19.44%	15.12%	22.81%	11.78%	15.05%	16.55%	16.43%	15.17%	22.17%	17.92%
Marvell	-1.68%	1.93%	6.42%	2.22%	10.66%	-3.17%	-2.77%	1.58%	3.46%	10.15%	16.89%	10.17%
TOSHIBA	0.91%	2.24%	5.60%	2.92%	9.60%	7.55%	7.68%	8.28%	-21.63%	-1.25%	11.28%	-3.87%
QUALCOMM	9.12%	11.94%	16.27%	12.44%	16.50%	15.88%	16.63%	16.34%	14.25%	10.37%	10.87%	11.83%
AMD	-22.67%	-4.85%	3.94%	-7.86%	6.43%	5.37%	-15.40%	-1.20%	-20.68%	-5.98%	16.81%	-3.29%
BROADCOM A	-40.44%	-9.62%	14.16%	-11.97%	16.40%	6.61%	2.72%	8.58%	11.26%	4.79%	18.74%	11.60%

Table 4.5 ROIC Results

Source: Compiled by case writer

4.7. The Degree of Assets Lightness (DAL)

The ratio of light assets to heavy assets (LA/ICB) (hereafter called the degree of asset lightness, or DAL for short) measures a firm's ability to create intangible value from its tangible assets. A firm with DAL greater than one demonstrates a rate of value creation greater than the tangible assets deployed. From the seven top semiconductor companies selected, only Texas Instruments and Intel demonstrates that rate of which value creation made out of there tangible assets. Texas Instruments have 0.56 times the value it created out of there tangible assets when they started doing the light asset strategy and continuous to increase further during the Post-Asset Light Timeline garnering 2.25 times in average from year 2008 to 2010. This is as well being pointed to have sustainable competitive advantage, wherein it shows positive effect from year 2006 to 2010, and a 5 year sustainable advantage.

DAL (times)	Pre-Asset Light Timeline			3Yr	Light-Asset Timeline			3Yr	Post-Asset Light Timeline			3Yr
	2002	2003	2004	Average	2005	2006	2007	Average	2008	2009	2010	Average
TI	(2.3810)	(1.5928)	(1.1782)	(1.72)	(0.1013)	0.3225	1.4471	0.56	1.7811	0.8172	4.1446	2.25
intel	(1.1488)	(0.5817)	(0.3706)	(0.70)	0.5174	(1.3687)	(0.2720)	(0.37)	0.7942	0.6934	2.5086	1.33
Marvell	(4.4345)	(5.0129)	(4.5788)	(4.68)	(2.9267)	(3.6796)	(3.6120)	(3.41)	(1.8148)	(0.5127)	1.2892	(0.35)
TOSHIBA	(0.3276)	0.1082	(0.0764)	(0.10)	0.7125	(0.3329)	(0.1585)	0.07	(6.6883)	(3.5437)	(0.8911)	(3.71)
QUALCOMM	(1.3229)	(1.2736)	0.0404	(0.85)	(0.3027)	(0.6650)	(0.1794)	(0.38)	0.1880	(0.2359)	(0.1493)	(0.07)
AMD	(6.8038)	(4.1034)	(2.9044)	(4.60)	(3.0880)	(2.3052)	(6.2727)	(3.89)	(7.3631)	(4.2213)	0.9326	(3.55)
BROADCOM A	(9.9409)	(6.4241)	(2.0587)	(6.14)	(2.3557)	(3.6671)	(4.2853)	(3.44)	(0.6054)	(1.9859)	1.7692	(0.27)

Table 4.6 Degree of Asset Lightness

Source: Compiled by case writer

The other remaining companies manage their asset-light operations poorly since DAL shows negative value throughout the time that study was made.

4.8. Valuation of Intangible Assets

Strategic management and marketing experts denote the balance-sheet tangible assets as "asset-heavy" or "balance-sheet assets", while "asset-light" refers to all intangible assets (both on and off the balance sheet) that create additional net benefits beyond the book value (Maly and Paler, 2002). The asset-light logic hypothesizes that the value of intangible assets equals a company's ability to outperform an average competitor that has similar tangible assets. The asset-light strategy echoes the viewpoint of Resource-based related perspective in terms of focus (intangibles) and of the focal point of the competitive advantage of firms (core competence).

In this paper, 3 indicators for valuation metrics for intangibles are chosen to evaluate the effectiveness of an asset-light strategy (a) Market-to-book ratio (b) Excess earnings return on assets over reasonable rate method and (c) EVA or Economic Value Added.

a. Market-to-book ratio (Market Capitalization Method)

$$\frac{market\ value}{book\ value} = \frac{(price\ per\ share\ x\ oustanding\ shares)}{(total\ assets - total\ liabilites)}$$

By comparing the market-to-book ratio from Damodaran "The Data Page" (2012) on industry for semiconductor, we can have a sense of what comprises a high, low or average price. Using Damodaran web link under "Data sets" in the category "Price and Value to Sales Ratios and Margins by Industry Sector", this shows the market to book ratio for all semiconductor companies year after year, see Table 4.7 Market-to-book ratio after the legend there's an extra column for Market-to-book ratio based on Damodaran compile data.

a.1. Market-to-book ratio	Pre-Asset Light Timeline			3Yr Running	Light-Asset Timeline			3Yr Running	Post-Asset Light Timeline			3Yr Running
	2002	2003	2004	Average	2005	2006	2007	Average	2008	2009	2010	Average
TI	2.345	4.449	3.299	3.36	4.371	3.553	4.193	4.04	1.993	3.459	3.831	3.09
intel	2.941	5.603	3.872	4.14	4.103	3.334	3.811	3.75	2.096	2.886	2.459	2.48
Marvell	1.116	2.539	3.723	2.46	7.014	3.231	2.128	4.12	1.167	2.652	2.365	2.06
TOSHIBA	@NA	1.416	1.612	1.51	1.296	1.746	1.708	1.58	1.462	2.731	2.192	2.13
QUALCOMM	4.092	4.590	6.952	5.21	7.019	4.620	4.441	5.36	4.191	3.996	3.643	3.94
AMD	0.687	2.275	3.143	2.04	4.157	2.227	1.101	2.50	0.982	(11.404)	9.083	(0.45)
BROADCOM A	0.956	5.977	3.929	3.62	4.827	3.750	3.041	3.87	1.893	3.568	4.006	3.16
Damodaran-P/B	2.46	4.28	3.64	3.46	3.44	3.16	3.28	3.29	1.58	3	3.27	2.62
Heavy Fab Asset												
Medium Fab Asset												
Fabless												

Table 4.7 Market-to-book ratio

Source: (a) Compiled by case writer (b) Damodaran "Price per book ratio by Industry sector"

Based on Table 4.7 Market-to-book ratio, the table shows market-to-book ratio for 9 consecutive years and comparison between the industry averages as compiled by Damodaran shows Texas Instrument market–to-book ratio remain above industry average even with the introduction of their new business model of asset-light. This just means that the market value of equity of TI reflects the market's expectation of the firm's earning power and cash flows.

b. Excess earnings return on assets over reasonable rate method (Return on Assets Methods)

$$CIV = \frac{(ROA - ROA_I) x A_T}{cost\ of\ capital}$$

Return on assets (ROA) represents the opportunity cost and measures how efficiently the firm uses its assets. The calculated intangible value (CIV) is a variant of the ROA applying the "advantage resources" concept. The CIV approach includes the capitalization of earnings model and the excess earnings return on assets over reasonable rate model, which measure intangibles as a premium value over the tangibles.

The assets of company are comprised of both equity and debt. Both of these types of financing are used to fund the operations of the company. The ROAOR figure gives investors an idea how effectively the company is earning more money on less investment. In Table 4.8 Excess Earnings ROA/CoC (in US$M), the companies with consistent year after year increase for ROAOR are Intel, Qualcomm and TI. Toshiba though it has high ROAOR comparable to Intel but the value seems to decrease thru time, a sign that Toshiba earnings is below the capabilities of its assets. Intel a heavy asset intensive company, Qualcomm as fabless company and TI as going for asset-light shows that these companies are profitable in relation to its total assets, this just show that these are well managed companies.

b.1.2. Excess earnings ROA/CoC (CIV)	Pre-Asset Light Timeline			3Yr Running	Light-Asset Timeline			3Yr Running	Post-Asset Light Timeline			3Yr Running
	2002	2003	2004	Average	2005	2006	2007	Average	2008	2009	2010	Average
TI	558.58	594.74	573.01	575.44	422.95	395.97	510.48	443.13	784.09	657.16	659.29	700.18
intel	1,764.00	1,678.45	1,557.51	1,666.65	1,357.08	1,388.40	2,108.62	1,618.03	2,792.18	2,464.24	2,666.31	2,640.91
Marvell	(1.86)	7.62	18.89	8.22	29.58	41.47	50.73	40.59	69.34	88.45	141.14	99.64
TOSHIBA	(5,153.04)	(5,853.46)	20,461.30	3,151.60	6,802.74	2,328.78	4,432.77	4,521.43	5,150.23	1,542.92	1,116.34	2,603.16
QUALCOMM	217.22	319.95	511.52	349.56	389.75	388.57	626.15	468.16	1,094.63	1,217.53	1,105.33	1,139.16
AMD	206.63	258.09	211.70	225.47	118.51	129.32	129.02	125.62	93.40	89.14	57.66	80.07
BROADCOM A	(98.24)	(64.79)	(3.76)	(55.59)	24.52	53.18	65.05	47.58	123.65	116.59	194.97	145.07

Heavy Fab Asset
Medium Fab Asset
Fabless

Table 4.8 Excess Earnings ROA/CoC (in US$M)

Source: Compiled by case writer

To make it clear to see if light-asset thus contributed with firms intangible assets, the CIV values will then be divided with their respected total assets.

Percent of Intangible Assets	Pre-Asset Light Timeline			3Yr Running	Light-Asset Timeline			3Yr Running	Post-Asset Light Timeline			3Yr Running
	2002	2003	2004	Average	2005	2006	2007	Average	2008	2009	2010	Average
TI	3.81%	3.83%	3.52%	3.72%	2.81%	2.84%	4.03%	3.23%	6.58%	5.42%	4.92%	5.64%
intel	3.99%	3.56%	3.24%	3.59%	2.81%	2.87%	3.79%	3.16%	5.51%	4.64%	4.22%	4.79%
Marvell	-0.09%	0.31%	0.68%	0.30%	0.84%	0.92%	1.11%	0.96%	1.57%	1.71%	2.23%	1.84%
TOSHIBA	-11.80%	-13.90%	47.89%	7.39%	16.84%	4.63%	7.47%	9.65%	9.26%	2.63%	1.72%	4.54%
QUALCOMM	3.34%	3.63%	4.73%	3.90%	3.12%	2.56%	3.39%	3.02%	4.46%	4.44%	3.62%	4.17%
AMD	3.68%	3.64%	2.70%	3.34%	1.63%	0.98%	1.12%	1.24%	1.22%	0.98%	1.16%	1.12%
BROADCOM A	-4.43%	-3.21%	-0.13%	-2.59%	0.65%	1.09%	1.34%	1.03%	2.81%	2.27%	2.45%	2.51%

Heavy Fab Asset
Medium Fab Asset
Fabless

Table 4.9 Intangible Assets Value based on Excess Earning ROA/CoC

Source: Compiled by case writer

Table 4.9 Intangible Assets Value based on Excess Earning ROA/CoC above shows the percentage of that excess earning contributed by its companies intangible assets. Texas Instruments shows that its intangible assets contributed the highest in all seven firms during the post asset-light timeline and enjoy better financial returns than other comparable companies.

Note: For Toshiba in 2004, percent of Intangibles of 47.89%. This is because of 3 years average pre-tax income of Toshiba from 2002 to 2004 increases drastically in comparison of earlier year 2001 where it has a negative EBIT.

c. Economic Value Added or EVA (Cash Flow Method) - which measures the excess return earned on capital invested in existing investments can be computed in capital basis

$$EVA = (NOPLAT) - (capital \times cost\ of\ capital)$$

c.2. EVA = Economic	Pre-Asset Light Timeline			3Yr Running	Light-Asset Timeline			3Yr Running	Post-Asset Light Timeline			3Yr Running
Value Added	2002	2003	2004	Average	2005	2006	2007	Average	2008	2009	2010	Average
TI	(957.18)	(408.15)	(160.79)	(508.70)	458.99	697.98	1,149.28	768.75	1,175.44	705.55	2,195.64	1,358.88
intel	(550.70)	605.34	1,019.07	357.90	2,418.63	(902.12)	1,387.54	968.01	2,987.85	2,839.04	7,096.95	4,307.95
Marvell	(680.72)	(631.73)	(597.95)	(636.80)	(392.57)	(680.47)	(673.22)	(582.09)	(322.04)	(46.13)	381.50	4.44
TOSHIBA	498.59	717.94	579.57	598.70	815.48	390.59	607.91	604.66	(3,576.45)	(2,092.48)	(5.81)	(1,891.58)
QUALCOMM	(115.74)	(121.89)	483.17	81.85	321.81	140.80	536.24	332.95	904.81	557.66	664.67	709.05
AMD	(1,227.76)	(792.24)	(513.25)	(844.41)	(447.03)	(827.40)	(2,173.02)	(1,149.15)	(1,358.09)	(845.92)	202.42	(667.20)
BROADCOM A	(842.11)	(393.48)	(185.24)	(473.61)	(239.59)	(582.92)	(684.68)	(502.40)	(6.58)	(202.76)	592.52	127.73
Heavy Fab Asset												
Medium Fab Asset												
Fabless												

Table 4.10 Economic Value Added for the Seven Companies

Source: Compiled by case writer

Table 4.10 EVA shows that Intel, TI and Qualcomm have high between market value versus its book value of capital. One particular observation seen during the process of data for this valuation is both Intel and Qualcomm increase their invested capital continually while TI gradually decease there capital PPE (Plant, property and Equipment) year after year.

To quantify the excess return earned on capital invested. We divided the EVA result with each total asset and see in percentage form. Table 4.11 shows that TI create more value for its stockholder as what can be seen in 3 year average results in Light-asset timeline as well as post asset-light timeline with 5.71% and 10.69% respectively.

c.2. EVA/Total	Pre-Asset Light Timeline			3Yr Running	Light-Asset Timeline			3Yr Running	Post-Asset Light Timeline			3Yr Running
Assets	2002	2003	2004	Average	2005	2006	2007	Average	2008	2009	2010	Average
TI	-6.52%	-2.63%	-0.99%	-3.38%	3.05%	5.01%	9.07%	5.71%	9.86%	5.82%	16.38%	10.69%
intel	-1.25%	1.28%	2.12%	0.72%	5.01%	-1.87%	2.49%	1.88%	5.89%	5.35%	11.23%	7.49%
Marvell	-32.41%	-25.94%	-21.44%	-26.60%	-11.17%	-15.03%	-14.79%	-13.67%	-7.30%	-0.89%	6.02%	-0.72%
TOSHIBA	1.14%	1.71%	1.36%	1.40%	2.02%	0.78%	1.02%	1.27%	-6.43%	-3.57%	-0.01%	-3.34%
QUALCOMM	-1.78%	-1.38%	4.47%	0.44%	2.58%	0.93%	2.90%	2.13%	3.68%	2.03%	2.17%	2.63%
AMD	-21.85%	-11.17%	-6.54%	-13.19%	-6.13%	-6.29%	-18.81%	-10.41%	-17.70%	-9.32%	4.08%	-7.65%
BROADCOM A	-38.00%	-19.50%	-6.42%	-21.31%	-6.39%	-11.95%	-14.15%	-10.83%	-0.15%	-3.95%	7.46%	1.12%
Heavy Fab Asset												
Medium Fab Asset												
Fabless												

Table 4.11 EVA divided by Total Asset

Source: Compiled by case writer

V. Managerial Implications

For a strategy to work, ones must identified it core competencies, its resources and capabilities and design a way to feedback that strategy. This paper research has that entire component to identify if Asset-light strategy thus works.

For Texas Instruments, its core competency or what distinguish them from market place is its semiconductor product. As per Prahalad and Hamel (1990) this competency can underlie business unit in which TI focus its strategy on its Analog devices which bring 43% of their revenue in 2010. Using fab-Light strategy, TI outsource 25% of its wafer manufacturing to foundries and most of that are from advanced logic such as their wireless product lines where it requires new and expensive processes and equipment. In contrast, the processes and equipment required for manufacturing TI's analog products and embedded processing products do not have this requirement and thus TI focus on this product lines and were manufactured internally rather than to outsource. In 2010 the demand for these analog and embedded processing products lines increases 40% each making their factory utilization high, its fixed cost spread over increased output and benefitting its profit margin and cash generation as seen in table 5.1.

TI	2002	2003	2004	2005	2006	2007	2008	2009	2010
EBIT	323.00	1,106.00	2,224.00	2,785.00	3,255.00	3,510.00	2,735.00	2,203.00	4,406.00
tax expenses	(2.00)	52.00	560.00	664.00	987.00	1,051.00	561.00	547.00	1,323.00
pre-tax income	(346.00)	1,250.00	2,421.00	2,988.00	3,625.00	3,692.00	2,481.00	2,017.00	4,551.00
t	0.01	0.04	0.23	0.22	0.27	0.28	0.23	0.27	0.29
NOPLAT	321.13	1,059.99	1,709.57	2,166.11	2,368.74	2,510.81	2,116.57	1,605.56	3,125.15

Table 5.1 Texas Instruments NOPLAT Trend

Source: Compiled by case writer

In accordance with view point of Resource base theory, where it emphasizes that abnormal returns are sourced from within-firm features (Silverman, 2002) and having abnormal returns means the firm have competitive advantage. If a firm is a bundle of resources and capabilities (Silverman, 2002) wherein resources include it assets and capabilities is the capacity performance of that resources then to have abnormal return or competitive advantage, a firm must have high capabilities over its resources or as in financial language wherein it was defined as Return on invested capital (ROIC) is the net operating profit (NOPLAT) divided by invested capital (heavy asset).

Going back to the light-asset valuation as described from last chapter it can be simply interpreted as the performance of the firm's capabilities. If ROIC is higher than the cost of capital and risk-free rate, then the results of that will be the multiplier of the firm resources. Therefore Texas Instruments capabilities greatly improve when they deploy their fab-lite strategy from 2006 to 2010 as shown in light-asset value in table 4.3 from the previous chapters. Now we know its capabilities improved but Peteraf (1993) mentions that the scarcities of strategic resources attribute the fact that some firm outperform than others and enjoy abnormal returns. This means that every firm have a certain volume of resources, others are huge as Intel assets while other can be small like the fabless firms, therefore to properly justified the capabilities of each firm it must be compare with its resources itself and thus this is the interpretation of value of its Degree of Asset-Lightness (DAL) as seen in table 4.6. In that table its shows that TI perform even Intel with its vast resources it have.

In Figure 2.1 of the Industry Overview, it shows the "Semiconductor Industry Value Chain". For an IDM firm which TI, Intel and Toshiba which shows vertical integrated type of which everything from design down to assembly and test are owned and done by this IDMs. On the other hand, fabless type of firm concentrated only on design and marketing which is on the top level only as seen on Figure 2.4. The difference between the 2 value chains is the economies of scale that can be enjoy by those IDM firms, where in tight supply environments, foundries could run out of capacity and leave fabless companies stranded.

As per figure 5.2 below showing that foundry only have around 20% capacity for 8 inch or 200 mm wafers compare to the capacity that IDM can.

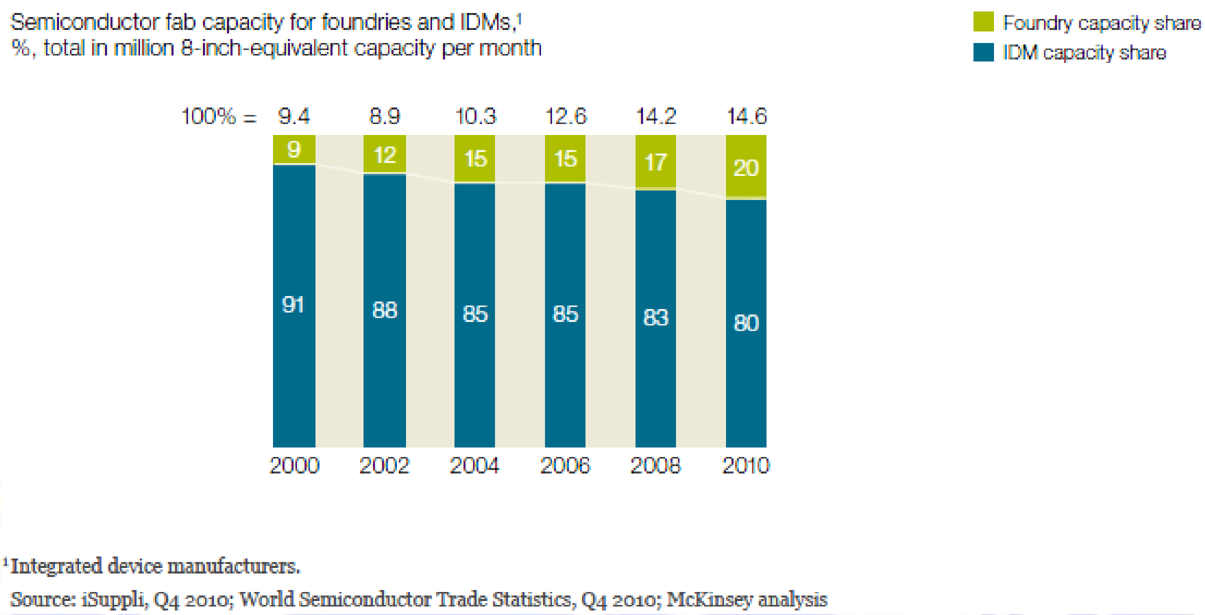

Figure 5.2 Foundries and IDM Capacity

Source: McKinsey on Semiconductor

The core idea of asset-light operations is to leverage the full use of external resources, to reduce their own investment, focus their resources on the most profitable stage of the industrial chain to improve corporate profitability. Below figure 5.3 is the graphic representation of Texas Instruments business model focusing on its core competency which give it superior performance over others.

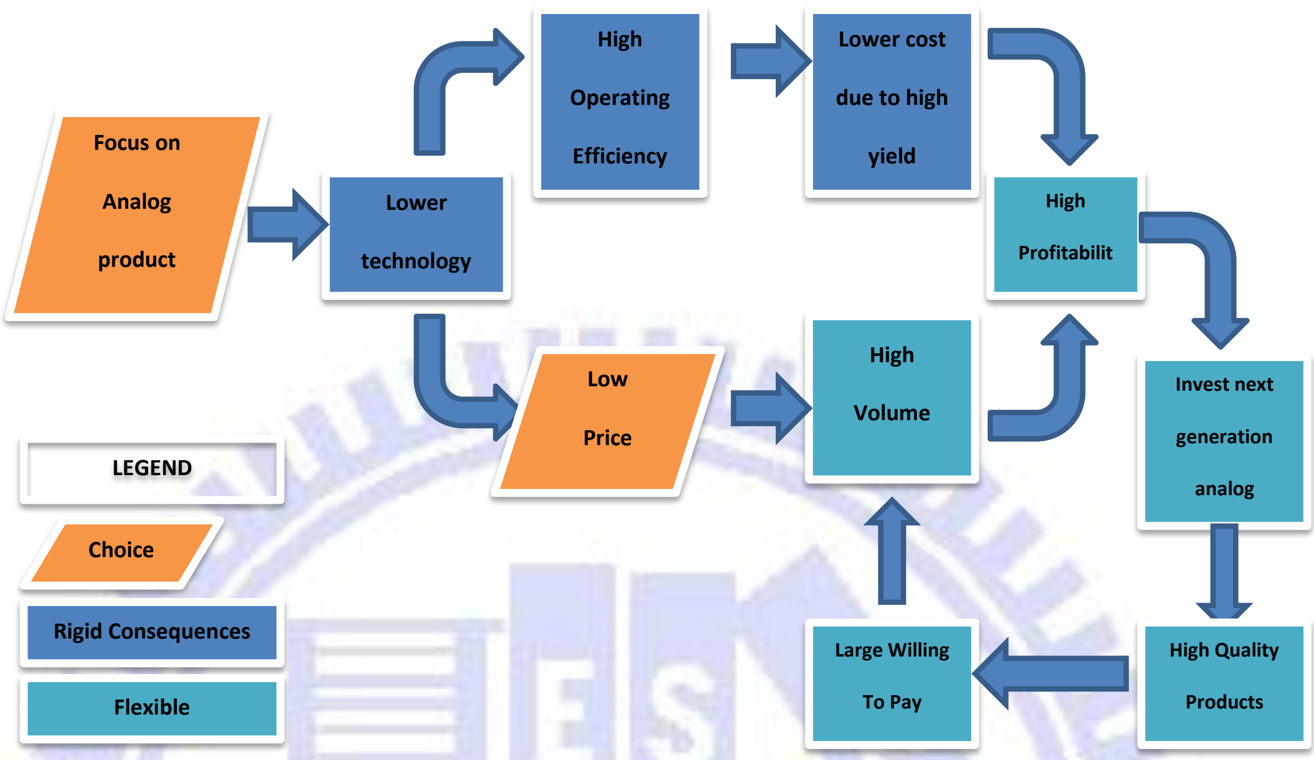

Figure 5.3 TI Analog Business Model

Source: Compiled by case writer

TI Analog Business Model is model based on Harvard Business Case for Business model Essentials (Casadesus-Masanell and Ricart, 2009). Business model define as the way the firm operates. “Choices” is how the organization will operate and it each choice creates its “consequences”. A consequence is “flexible” if it is sensitive to the choices that generate it. “Rigid” on the other hand does not change rapidly.

Texas Instruments light-asset strategy is to outsource the manufacturing of its non-core products such as in wireless to third party foundry which needed a high technology node such as 65 nm, 45 nm and 32 nm. While TI will focus on its core competency, the analog devices, which can be manufactured internally thru the old node technologies such as 0.25 um, 0.18 um and 130 nm in 300 mm in Richardson Texas, 200 mm wafer fab at Aizu-Wakamatsu Japan and 200 mm fab at Chengdu China. With this current fab where operational efficiency are high and since no additional investment made, TI can choose to lower the price of its analog products that will resulted to high profitability.

VI. Conclusions

To investigate how asset-light operations generate competitive advantage for Texas Instrument, selections of top revenue company in semiconductor industry are needed and categorized them based on their total assets. This paper valuated these companies using light-asset and intangible assets valuation method which resulted with the following comparison between selected firms.

Table 6.1 shows the 3 year average post-asset light timeline of Texas Instruments in comparable with other several firms. Texas Instruments resulted numbers was subtracted with other firms to show specifically how much the difference in their valuation value.

TI vs other firms	Light Asset Valuation		Intangible Assets Valuation Method		
	LA + IA (US$B)	DAL (times)	Market-to-book ratio	Excess earnings ROA (%)	EVA/Total Assets (%)
Intel	(45.30)	0.92	0.61	0.85%	3.20%
Marvell	26.24	2.59	1.03	3.80%	11.41%
Toshiba	214.66	5.96	0.97	1.10%	14.02%
Qualcomm	28.10	2.31	(0.85)	1.47%	8.06%
AMD	53.68	5.80	3.54	4.52%	18.33%
Broadcom	25.80	2.52	(0.06)	3.13%	9.57%

Legend
Heavy Fab Asset
Medium Fab Asset
Fabless

Table 6.1 Summary of Texas Instrument Valuation

Source: Compiled by case writer

In terms of Asset-light valuation which shows the light-asset value and Degree of asset lightness. Texas Instrument asset-light value shows higher return in comparison with the rest of the firms except for Intel which have a huge asset base. Both Texas Instruments and Intel are more efficient in allocating or investing their capital to have profitable returns as a result of higher ROIC in comparison with cost of capital. Texas Instrument though cannot compete with Intel in terms of total asset that is why it shows a negative result in the table. However, the DAL or degree of asset-lightness proves that TI outperforms everyone in terms of making intangible value from its tangible assets. It's DAL which shows more than everyone else demonstrates a rate of value creation greater than the tangible assets deployed.

The term asset-light implies a high ratio of intangible strategic resources relative to tangible assets. The Intangible assets valuation shows TI good indicator performance of its market-to-book ratio, ROAOR and its EVA. These 3 valuations shows high level of organization in terms of $-valuations with comparison either internal (market-to-book and EVA) or within industry (ROAOR). With high value from its Market-to-book ratio, this means TI have high return on capital and its shows that TI intangible assets are more than the other firms as well as in industry.

TI have comparative advantage in comparison with the other selected firms since it's ROAOR or return on asset method over reasonable rate measures higher intangible assets or unique resources. This also shows TI management capability in terms of asset management of sales over it fixed asset.

EVA or widely used as value enhancement which is computed as the product of the return spread (ROC – Cost of Capital) and Capital invested shows TI difference between market value and book value of capital are far more than the other 6 companies as well.

Base on indicators defined in this paper for Texas Instruments showing high results with the other comparable firms, showing both high degree of light-asset as well as high intangible ratio. We therefore conclude that TI execution of its light-asset strategy in the middle of 2006-2007 is a big success and it can say that strategy is sustainable at least within 5 years as this the only scope of this current study.

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Appendix

CDMA - stands for Code Division Multiple Access and is one of the main technologies currently used in digital wireless communications networks (also known as wireless networks). CDMA and TDMA (Time Division Multiple Access), of which Global System for Mobile Communications (GSM) is the primary commercial form, are the primary digital technologies currently used to transmit a wireless device user's voice or data over radio waves using a public cellular wireless network.

IDM's (Integrated Design Manufacture) - a company that performs every step of the chip-making process, design, manufacture, test and packaging (ex. Intel and TI)

IMFT and IMFS are variable interest entities that are designed to manufacture and sell NAND products to Intel and Micron at manufacturing cost.

Micro-electromechanical systems (MEMS) - is a technology that combines computers with tiny mechanical devices such as sensors, valves, gears, mirrors, and actuators embedded in semiconductor chips or what also called analog computing.

Moore's law - number of transistors doubles every 18 months as observed by Gordon Moore, Intel co-founder.

PHY - means physical layer, in wireless since there is no actual physical connection.

Platforms - is a collection of technologies that are designed to work together to provide a more complete computing solution.

SBU – Strategic Business Unit