

MSIS – 2604 – INFORMATION SYSTEMS POLICY & STRATEGY

DR. DAREL MANK

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AKHIL PARASHARA – W1166146

BHAUMIK DEDHIA – W1166729

LEI XU – W1027387

EXECUTIVE SUMMARY

Working on the Project was a tremendous learning curve for all of us. The project helps us to understand and evaluate the various business intricate strategies for Texas Instrument. Our project focuses on the semiconductor industry of T.I. The way we have modeled this project is to get a better insight of the various factors on which companies relies while making their decisions. We have studied the porters five force model, Stakeholders analysis and many financial data which had helped us to understand the depth and entire working of their semiconductor domain.

One of the biggest questions which we have highlighted thru this project study is the decision of Texas Instrument to buy National Semiconductor in 2011 and what made them to totally scrap their DSP stream and focus mainly on Analog and embedded market.

With the analysis of the project, we came to the conclusion that it was a very good decision for T.I. to buy National Semiconductor. N.I was one the biggest players in analog domain and acquiring had helped Texas Instrument to recover their lost revenues after the 2009 decline. Some of the other factors which helped us to come to the decision were the competition financial data and their market share.

Evaluating and understanding the facts helped us figure out the key strategic decisions and the business model of the company.

INTRODUCTION

Texas Instruments (TI) is an American electronics company making semiconductors. TI has always been among the Top 10 semiconductor suppliers, the graph below shows TI as the third largest semiconductor manufacturer across the world in 2012, with the total revenue of more than \$3 billion in only one quarter of 2012, after Intel and Samsung. TI is also the largest digital signal processors (DSP) and analog semiconductors vendor. Its products have a wide range, include chips for mobiles, tablets, calculators, microcontrollers, microprocessors, etc.

Q2-12 Rank	Company Name	Q2-11 Revenue	Q2-12 Revenue	Revenue Percent Change
1	Intel	11,645	12,010	3.1%
2	Samsung Electronics	7,159	7,571	5.8%
3	Texas Instruments	3,597	3,128	-13.0%
4	Qualcomm	2,319	2,869	23.7%
5	Toshiba	2,786	2,381	-14.5%
6	SK Hynix	2,523	2,233	-11.5%
7	STMicroelectronics	2,567	2,147	-16.4%
8	Renesas Electronics Corp.	2,253	2,098	-6.9%
9	Broadcom	1,742	1,917	10.0%
10	Micron Technology	1,815	1,780	-1.9%
	Other Companies	39,141	37,113	-5.2%
	Total Semiconductor	77,547	75,247	-3.0%

Semiconductors revenue Q1, Q2 in 2012

TI was founded by Cecil H. Green, J. Erik Jonson, Eugene McDermott, and Patrick E. Haggerty in 1951.

These four people who were the employees of Geophysical Service Incorporated (GSI) purchased it in

1941, and its task was to make the transistors invented by its parent company GSI. In 1951, the company was reorganized and renamed General Instruments Inc., and then be renamed as Texas Instruments at the same year. Several years later, GSI became a subsidiary of TI. Today, TI is made up of three divisions: Semiconductors, Educational Technology, and Digital Light Processing. Selling semiconductor products is the main source of revenue for TI. TI's semiconductor products include digital signal processors, high speed digital-to-analog converters, microcontrollers, etc. Since areas in which TI was involved was too large, our analysis focus mainly on semiconductors; DSP.

Digital Signal Process (DSP), is the technique that makes signal to be processed in a digital representation. In general, Signals in the real world are the continuous analog signal, corresponding to analog systems. In order to apply digital signal processing in the analog system, we must convert them to digital.

TIMELINE EVENTS FOR TEXAS INSTRUMENTS (DSP)

- **1978:** TI made TMC0280/TMS5100, which was the first self-contained LPC speech synthesizer integrated circuit. This chip introduced digital signal processing technology to consumers.
- **1980:** TI introduced its first commercial single-chip DSP, the TMS32010, which was the first generation of DSP made by TI. In later years, TI kept improving digital signal processing technology, introduced several generations of DSP, including the first float point DSP, the TMS320C3x, and the highest performance fixed point DSP, the TMS320C5x. TI also published DSP Textbook, which was an Application used for TMS320 Family.
- **1990s:** TI continued disclose new generations of DSP, with new abilities like enabling real-time processing, full-duplex interactive videoconferencing, imaging systems, etc. These new generations DSP including TMS320C32, which was the first DSP to combine both fixed and

floating-point DSP together, and TMS320C6x, which was the world's most powerful DSP generation. TI also created the TMS320 Software Cooperative, the first comprehensive DSP software package which contained more than 100 algorithms for digital signal processing. TI won 1996 Institute of Electrical and Electronics Engineers (IEEE) Corporate Innovation Award for technical excellence in the design and application of DSPs. The later 1990s, TI started making DSP-based embedded processing systems.

- **2006:** TI acquired Chipcon for \$200 million.
- **2008:** TI announced they were no longer a DSP company but an Analog and Embedded Processor company.
- **2009:** TI acquired Luminary Micro for unknown amount of money. This deal was expected to enable Texas Instruments to expand its microcontroller portfolio.
- **2011:** TI acquired National Semiconductor in 2011 for \$6.5 billion in cash.
- **2012:** TI completed strategic changing to become an analog and embedded processing company.

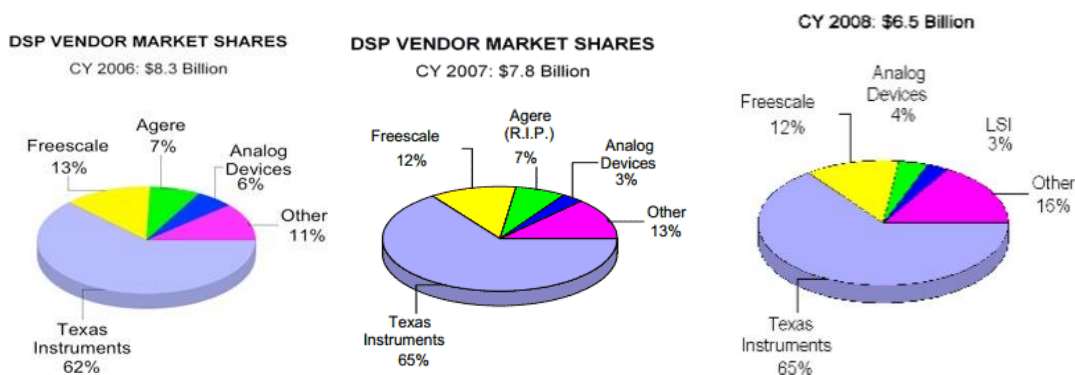
MAJOR PRODUCTS OF TI (DSP)

TMS32010	First commercial single-chip DSP
TMS320C2x	Second generation DSP.
TMS320C3x	First floating point DSP.
TMS320C5x	Highest performance fixed point DSP.
TMS320C4x	Second floating point generation.

TMS320C80	First commercial single chip processor which combined both a RISC processor and multiple parallel DSPs.
TMS320C32	The first to bridge the gap between fixed and floating point DSPs.
TMS320C82	Industry's most highly integrated DSP.
TMS320C24x	First DSP generation which specifically designed to improve system performance, lower system cost, and reduce component count in digital motor and motion control systems.
TMS320C6x	The most powerful DSP generation worldwide.

According to data shown below, TI has had almost 65% of the DSP market share for these three years.

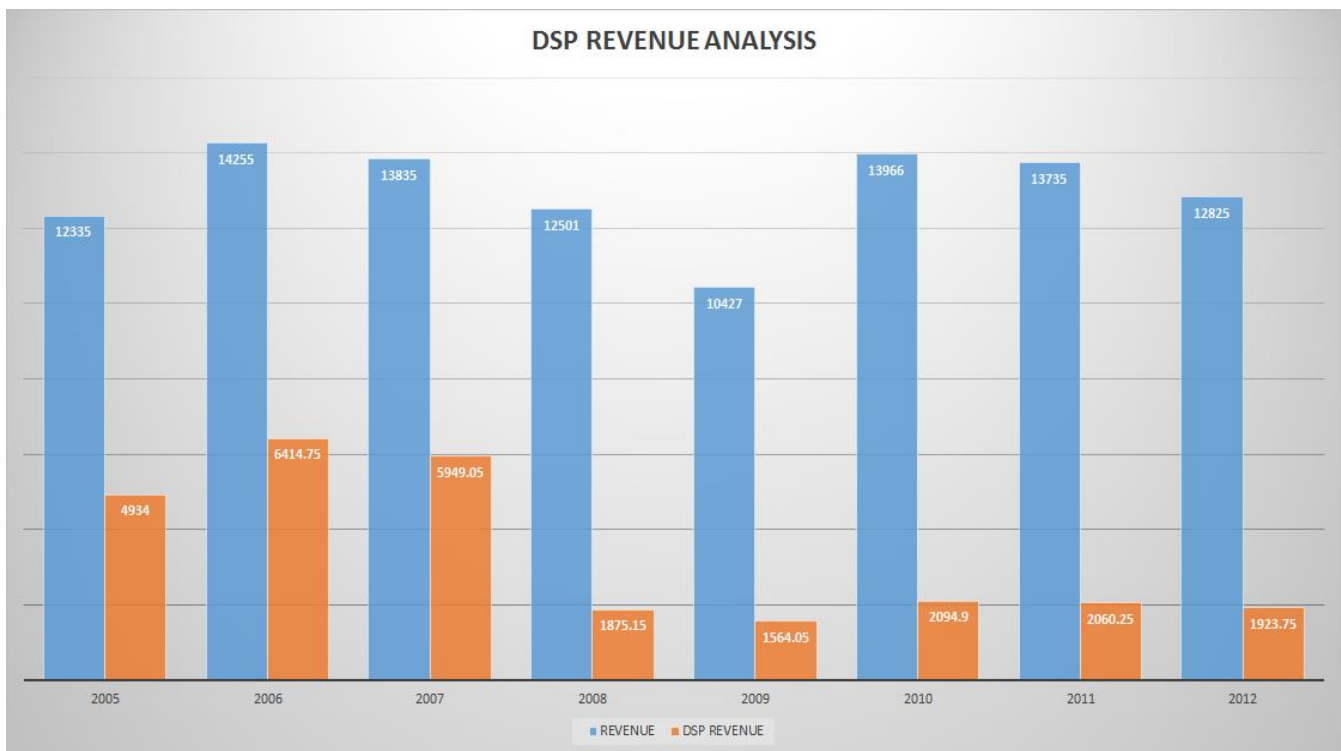
But the total DSP revenue were down from \$8.3billion in 2006 to \$7.8 billion in 2007. And down again to 6.5\$ billion in 2008. The total revenue was shrinking, however, TI was still the leader among the DSP vendors.



The successful factor of TI was that TI combined software, high-performance analog process technology, support and manufacturing capability with 20 years' experience in fulfilling customers' requirements.

For example, it is only TI's DSPs that can meet the low-power, high-performance requirement for real-time Internet applications.

TI was doing well in DSP. But from the graph below, we can see that the revenue percentage of DSP from the total revenue decreased after 2008. Because after 2008, TI changed its business model to the analog and DSP-based embedded processing for its main revenue sources.



This might be because of the decrease in DSP market itself. In the late 1990's, a new area of signal processing was emerging. Most microprocessors, microcontrollers could meet the performance requirement to be alternatives of a DSP, but with simpler algorithms compared with DSP algorithms.

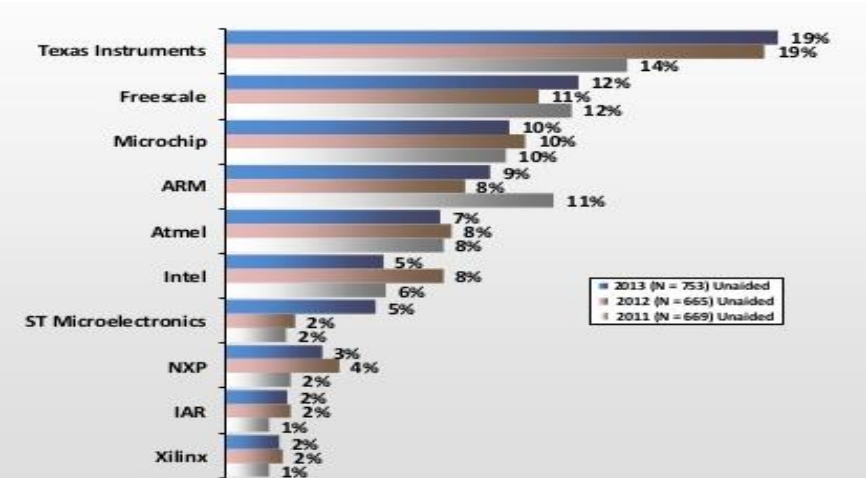
On the one hand, there were few in this industry who could match their performance, since TI's first generation DSP. On the other hand, many of the new alternatives and more specific demand made the general purpose DSP not adequate. It might be one of the reason why TI changed their strategy.

EMBEDDED PROCESSING

Embedded processing products include DSPs and microcontrollers. TI's embedded processing products are used in many places such as communications infrastructure equipment and automotive. Embedded processors helped company earn 18% of its total revenue in 2012, increased to 20% in 2013. This market valued in \$19 billion and the second graph shows that TI was the leader in embedded process market.



TI segment revenues, 2011-2013

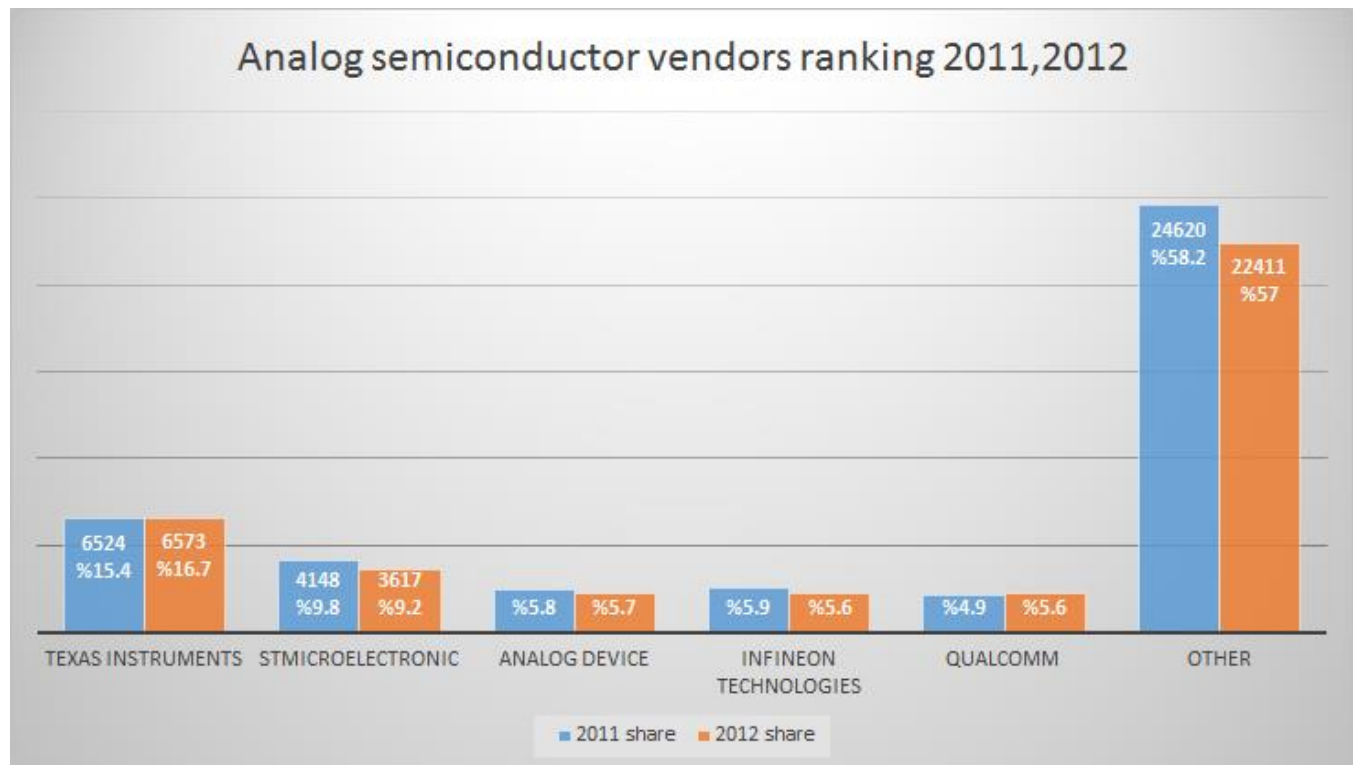


Embedded processing companies ranking 2011, 2012, 2013

ANALOG PROCESSING

Analog semiconductors are used to change real-world signals. By conditioning, amplifying, the signals are converted into digital data stream, so that it can be processed by other semiconductors.

Analog semiconductors helped company earns 55% of its total revenue in 2012, increased to 59% in 2013. The Analog semiconductors market valued in \$39 billion in 2012 and TI was still the leader in this market, accounting for %16.7 of this market.

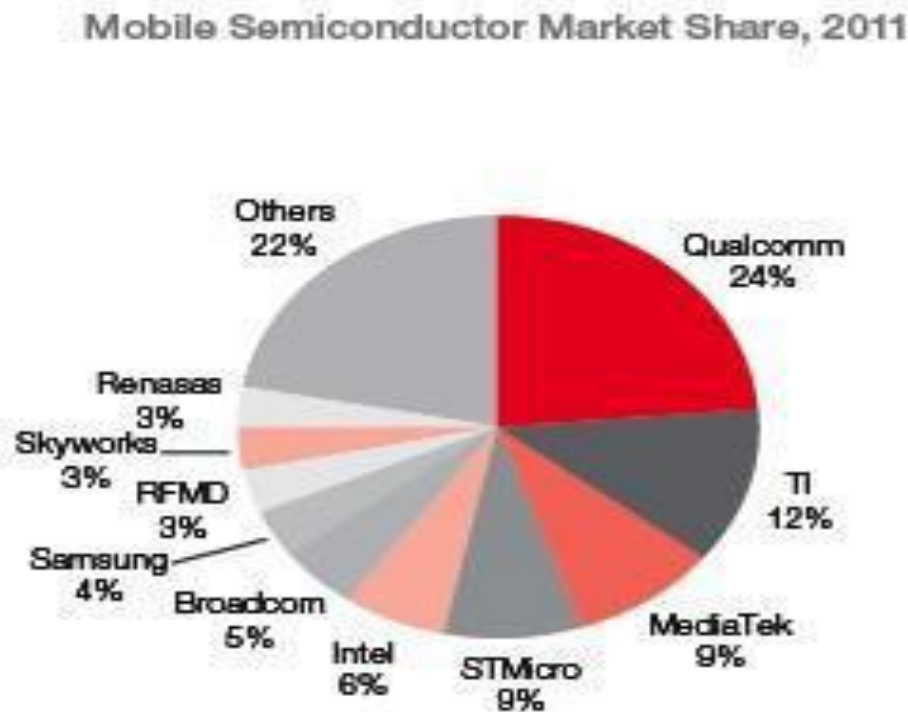


So TI seemed to make a strong position for itself in the two segments.

COMPETITION OR RIVALRY

Some of the biggest competitors of Texas Instruments in the semiconductor industry are the market giants like Intel, Samsung, QUALCOMM, NVidia, Freescale Semiconductors and ST Microelectronics. The

following data shows the market share in Mobile sector for the year 2011. It can be easily depicted from the pie chart that QUALCOMM dominates the whole Mobile semiconductor business with almost a quarter of the industry. TI on the other hand has the third largest market share after others.



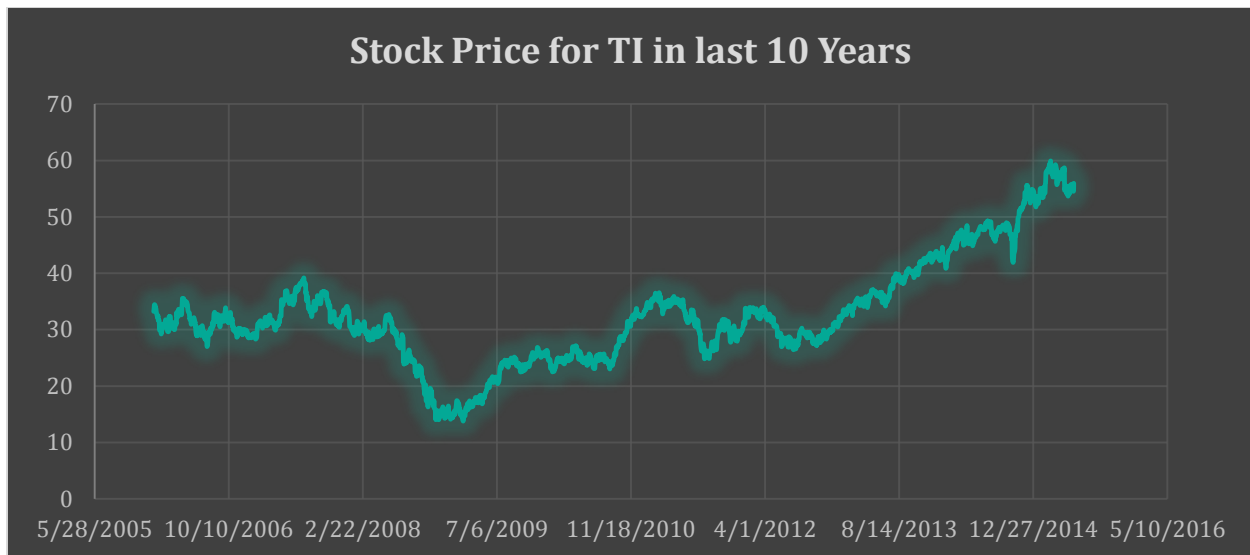
STAKEHOLDER'S ANALYSIS

CUSTOMERS: Texas Instrument even still best known for its Analog chips, Calculators and in the field of Digital Signal Processing serving more than 100,000 customers across 35 countries across the globe. In 2011, more than 12% of TI's total revenue came from the Digital/embedded processing. With the quality of product and services provided by TI, it had already surpassed the minimum expectation of its customers. Having happy customers brings the biggest cash flow and market share for the company.

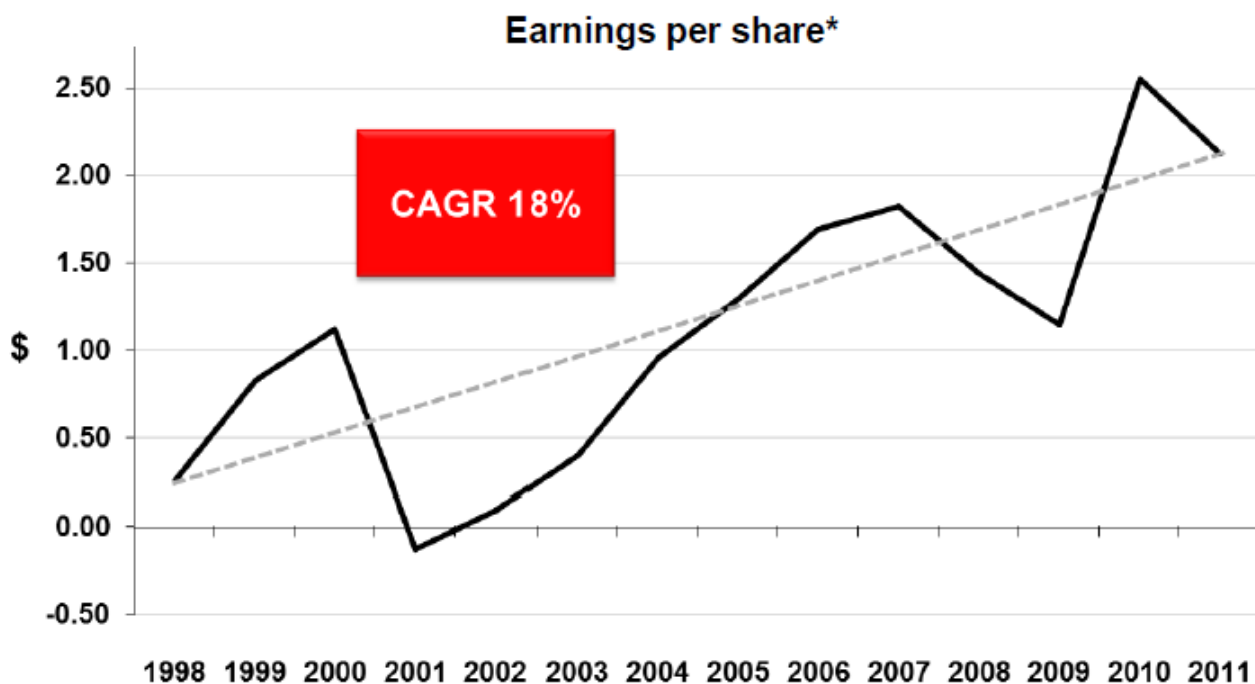
EMPLOYEES: As of 2012, TI has recorder 34,759 employees across the world. TI has captured the market for more than 80 years because of the ingenuity and expertise of these employees. With the sharpest brains and positive attitudes, the revenues and growth of TI has sky rocketed within last Decade. In addition to that TI has also been known to be most enjoyed company in terms of work environment and culture.

RIVARLS: In the field of Digital Signal Processing, TI faces the toughest competition from telecom giant Qualcomm. Some of the other companies in the industry are like STMicroelectronics, Cadence, Synopsis and Freescale. Among all of them Qualcomm poses the biggest threat to Texas Instrument. Each of them are fighting for the market share. In Analog Domain, TI is the third largest seller of chips after Intel and Samsung. TI has the largest market share in the analog semiconductor industry which has an estimated market TAM exceeding US\$37 Billion. TI is reported to have 12% of the market, leading ahead of competitors ST Microelectronics. The high degree of rivalry helps the company to improve their quality of products and services.

STOCKHOLDERS: In terms of stock price, TI has always been a very good investment decision for the stock holders. Excluding the IT recession in 2009, TI has maintained a continuous growth in their share price. They have grown exponentially in last 10 years which has brought shareholders a huge sum of money. Each of these stock has enabled TI to leverage close to \$1 Billion at the end of 2014 from market.



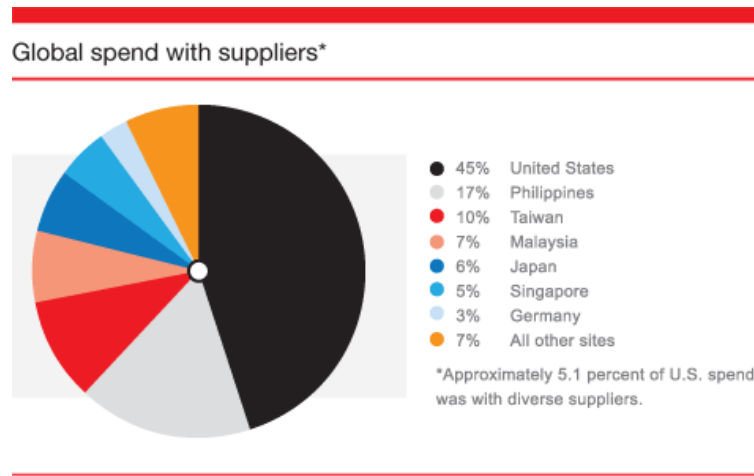
Transforming TI: higher returns



* Continuing operations from 2003; excludes gains/(losses) on sale of Micron stock of \$0.59, (\$0.37) and \$0.20 per share in 2000, 2002 and 2003. Excludes gain on sale of a product line of \$0.08 in 2010 and total acquisition charges of \$0.24 per share in 2011.

SUPPLIERS: Long-standing partnerships are promoted with suppliers to achieve TI's goals of zero wasted resources and zero injuries and illnesses from the use of manufacturing equipment and materials. With

the company's exponential growth, many hardware and software vendors start collaborating with Texas Instrument. With the relationship, the count of these vendors have also grown rapidly.



FIVE FORCE ANALYSIS

THREAT OF SUBSTITUTES

If there comes a technology that could make the same chip for a fraction of price with more functions then the threat of substitute's will be high. The R&D is going on in that field, but the chances seem to be low.

BARGAINING POWER OF BUYERS

This industry is dominated by very few large players. Hence the bargaining power of buyers is very low. For example, some of the TI's top customers are Google, Lenovo, Intel, Optisense, etc. Let's take an example of each one of them.

Google is always interested in what is best in the market and at that time Texas Instruments was at the peak position. Google chose OMAP4 Chipset for its Android Ice Cream Sandwich because NVIDIA's chip had been postponed and so TI was their only viable option.

TI's another product called 'LoCostco', was a single chip for low cost handsets with exceptional performance and cutting edge features. At the time when Lenovo needed this type of chip, TI was the only one in market with those rate and such performances.

Intel buys TI's modem and cable products to enhance its cable product lines. The quality and performance of these product lines were not available with any other company.

TI's C2000 MCU coupled with its analog technology was a perfect solution for Optisense's grid solution which can be run in real time with the help of TI's chip. They couldn't find this configuration of chip with any other company and hence this was very important for them.

BARGAINING POWER OF SUPPLIERS

The bargaining power of suppliers is not very great. Because TI has hundreds of suppliers for different requirements. Hence they can always reach out to a different vendor. But when it comes to silicon wafers, the bargaining power of suppliers increases. There are very few silicon wafer vendors like Applied Materials or Lam Research. So in this field, the bargaining power of suppliers is more.

THREAT OF NEW ENTRANTS

When semiconductor industry started, many designers would shift from one company to another and after gaining enough experience would start their own company. This was possible in earlier days. But now the rates of semiconductor industry has grown so much that billions of dollars are required to set

up a company which is clearly out of reach of new comers. The already established companies definitely have had a huge advantage with respect to this.

INDUSTRY RIVALRY

The main competitors of TI are INTEL, Samsung, TOSHIBA, QUALCOMM, etc.

With respect to the ranking of sales, TI ranks 3rd after Intel and Samsung. TI faces competition from both large and small competitors around the world. The large companies like INTEL, SAMSUNG, AMD, produce similar chips as compared to TI which forces TI to sell their products at a cheaper rate or to come out with more enhanced solutions. Also, the competitive performance in semiconductor industry depends on many factors such as range and variety of products, the technological innovation, strength of the sales network, customer service, price, etc. We see that earlier in some sections TI didn't have much rivalry, but gradually as the market scenario changed and as technology advanced, the industry rivalry kept on increasing. Let's see this with an example.

TI was the biggest player for manufacturing mobile chips for NOKIA and low power consumption chips for Apple. TI's 96% of revenue came from semiconductors and of that 30% came from sales of mobile chips. But with 3g and 4g coming into picture, its biggest competitor became QUALCOMM, and since NOKIA started losing market share for smartphones, TI lost a major share for mobile products. Even Apple started manufacturing their own low power consumption chips. So Industry rivalry was getting tough for TI.

It was time that TI had to put more focus in different sections of the industry rather than focusing mainly on Mobile chips and DSP Processors.

“IN THIS WORLD, THE BIGGEST COMPETITIVE CHALLENGE IS HAVING THE BEST CUSTOMERS.” –

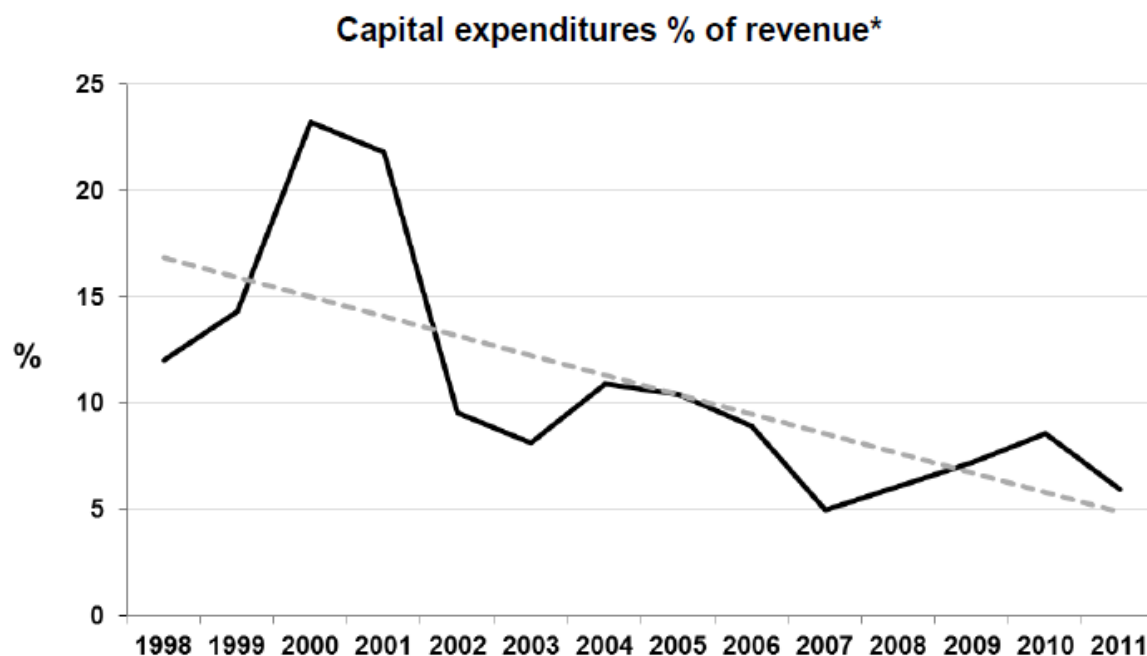
Templeton. CEO, Texas Instruments.

Hence TI made a strategic decision to become a company to focus on analog and embedded systems.

The following are the reasons for that

- Analog market is worth \$42B and embedded market is worth \$18B.
- TI has more than 90,000 customers who use electronic components which require analog and embedded processing.
- The investment was not much since they already had long lasting manufacturing assets.

Transforming TI: lower capital needs result in more cash



- Also the competition is distributed in both analog and embedded processing.

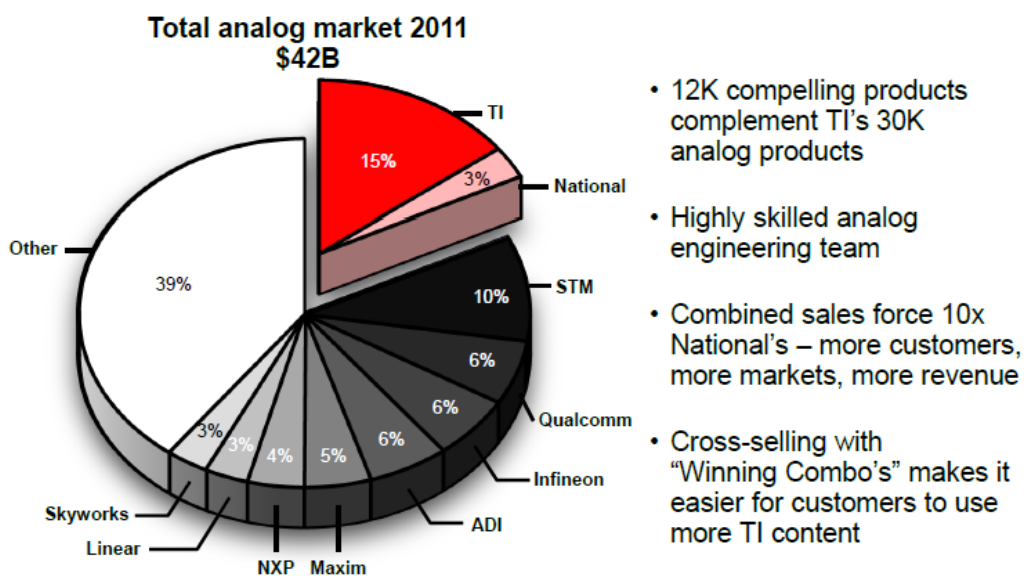
- There are 31 companies who take 80% of market share for analog and out of that TI has 15% market share making it number one for the analog industry.
- On the other hand for embedded systems, 10 companies have 80% of the market share, out of which TI holds 12% share which makes it the number 2 for the embedded processing industry.

After their shift to the analog and embedded market, this was the only correct step to go out there and buy the National Semiconductors, since this would give them a boost to raise in their market share and customers.

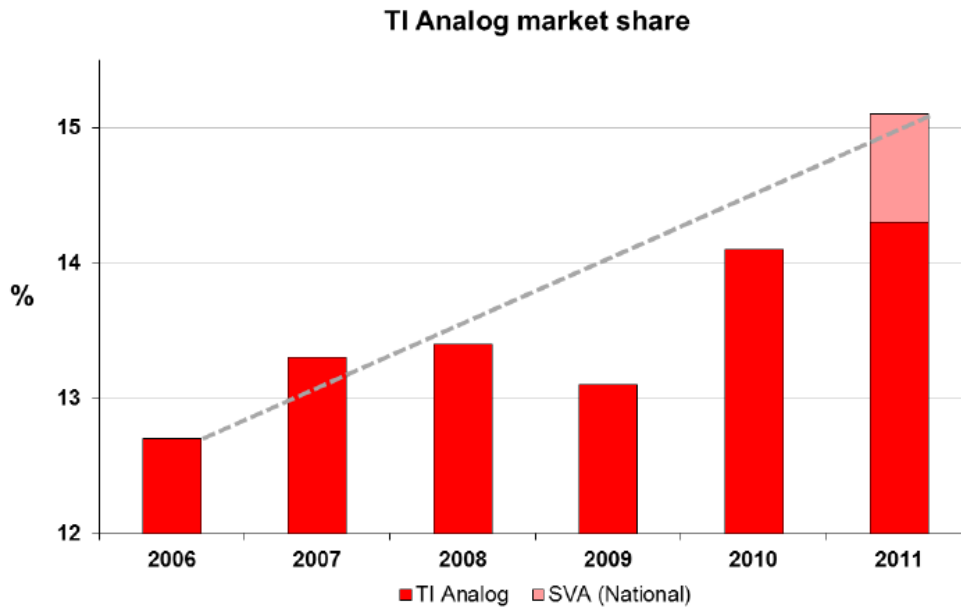
Acquisition of national instruments was a powerful addition for TI.

- National gave those 12k more products in complement to TI's 30k analog products.
- They got a highly skilled analog engineering team.
- As a result they got more customers which lead to more market share and eventually more revenue.

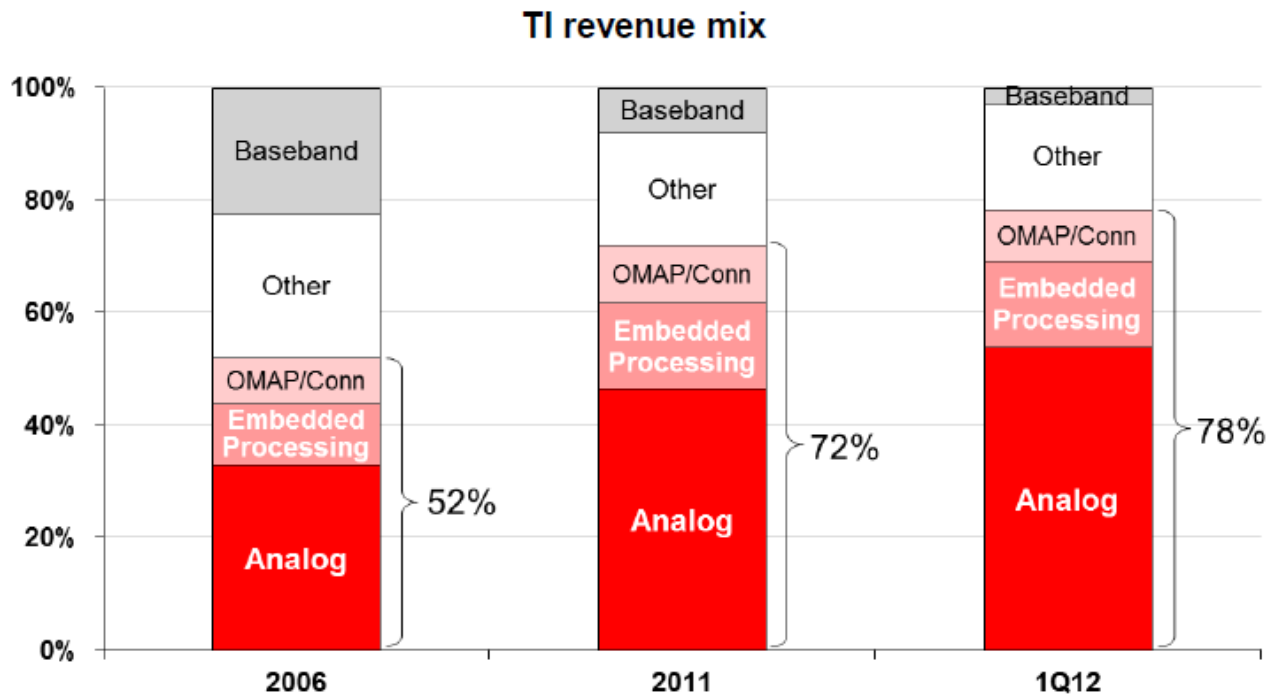
National is a powerful addition



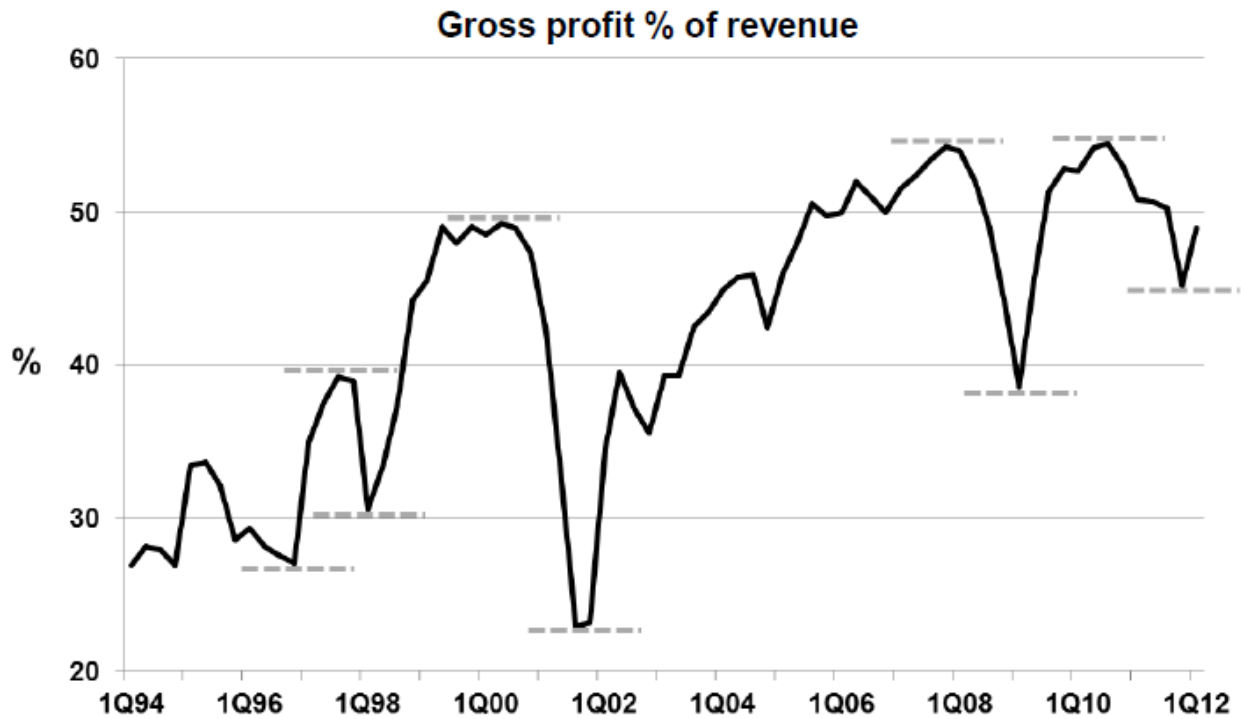
TI Analog is growing faster than market



Transition to higher quality revenue nearly complete



Transforming TI: more profitable



Going to the analog and embedded industry has made them customer independent. This means that now they are not dependent on a handful of customers. They now have thousands of customers.

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