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Rachel Rice
rrice@unomaha.edu

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MICRON

CHANGES FOR CONTINUED SUCCESS

RACHEL RICE

UNIVERSITY OF NEBRASKA AT OMAHA
Kayser Hall 208, 6001 Dodge Street, Omaha, NE 68182




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Executive Summary

Strategy is important for every industry, and to succeed in such a competitive industry as the technology industry, it becomes imperative. As the following describes in great detail, Micron Technology, Inc. (Micron) is one of the companies in the technology industry that must have a strategic plan such as this.

The first step to developing this plan for Micron was to analyze the strategy that Micron has employed so far through a detailed description of their previous developments. First, Micron's product development was analyzed. From DRAM to 3D XPoint™ technology, Micron has continuously been on the cutting edge of development in the technology industry. The management of the company has had a role in this position as well. The four CEO's that have been employed by Micron since the late 1970s led Micron to the success that they have previously seen. From their management decisions, Micron became a leader in expansion through physical developments, acquisitions and partnerships with other technology firms.

The background provided on Micron helped reach the conclusion of the problem that is the biggest threat to the Micron and the industry: the highly competitive industry competes on technological advancements. If Micron was to slightly fall behind competition in this research area, it could create large problems in the future.

This problem was further explored throughout the external and internal analysis conducted. Micron's core competency was established through the internal analysis: management provided by the new CEO hired in April of 2017, Sanjay Mehrotra. Both a PESTEL and Porter's Five Forces analysis were conducted to analyze the industry. The PESTEL analysis pointed to three major areas that should be considered for the company: legal, economic and

technological. The legal implications showed that there is a possibility of tax reform in the United States that would alter future operations for this highly global industry. The economic forces are also important to note with advancing markets all over the globe, as well. Finally, the technological side of the industry contributed highly to the overall market status. Extensive research and development was noted as important throughout the industry. The Porter's Five Forces analysis gave extra insight into the areas that the PESTEL could be seen.

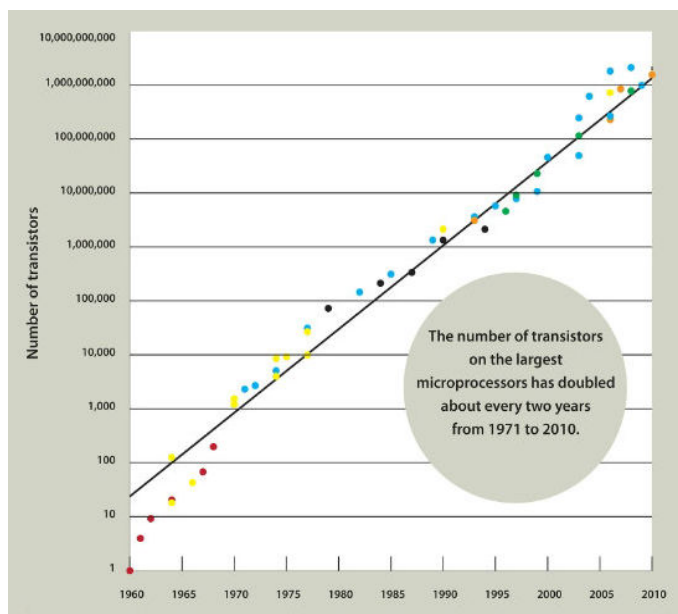
This analysis supported the recommendation that was provided: to increase spending on research and development and other expenses related to improving technology. New process innovations will cut the price of Micron's product and in turn use the low switching costs between each of the players in this industry to increase market share and in turn profit.

To implement this plan, spending should be increased on these expenses to 10% of sales at a minimum for each period in order to develop additional process innovations. This money should be spent on recruitment of new talent to develop new technologies, salaries and bonuses to incentivize this creations and investments in further research and development facilities. This plan is a strong way to remain competitive in a very strong industry.

Introduction

Technology in general is a complex, yet necessary product that is continuously advancing and changing. According to David Chandler from the MIT News Office, “Researchers at MIT and the Santa Fe Institute have found that some widely used formulas for predicting how rapidly technology will advance — notably, Moore’s Law [...] — offer superior approximations of the pace of technological progress.” Continuing, the article explains that Moore’s Law was originally used to describe “the rate of improvement in the power of computer chips” but has since been expanded to include all technology. As is visible in [Figure 1](#), the computer chip power

Figure 1



Transistor count on largest microprocessors 1975-2010
From: Computer History Museum Revolution exhibit

over the years has followed this pattern of growth. Nearly 17 million people employed in the high-tech industry in 2014 as was reported by Michael Wolfe and Dalton Terrell in their article “The high-tech industry, what is it and why it matters to our economic future,” which also shows the growth in the industry. They continued to explain that the high-tech industry also counted for twenty-three percent of all output during that

year, as well.

Several challenges and potential returns are included in the technology industry. Being involved in this industry leads to several challenges and potential for returns for many companies. Micron Technologies, Inc. (Micron) is one of the few successful companies in this

area currently. Continuous advancement and change is one of the largest challenges that the technology industry faces at this time. Control of the strategic plan for Micron is highly important. In order to remain successful in this area, it is important to maintain in control of the strategic plan for the company. Maintaining that success is highly important, which leads to the need for a review of strategic goals for the company. The full scope of this is done through a description of the background of Micron, the assertion of a potential problem within Micron, an internal analysis of the company, an external analysis of the technology industry, a recommendation to place them in a competitive position in the future, and finally how to implement this recommendation into their operations.

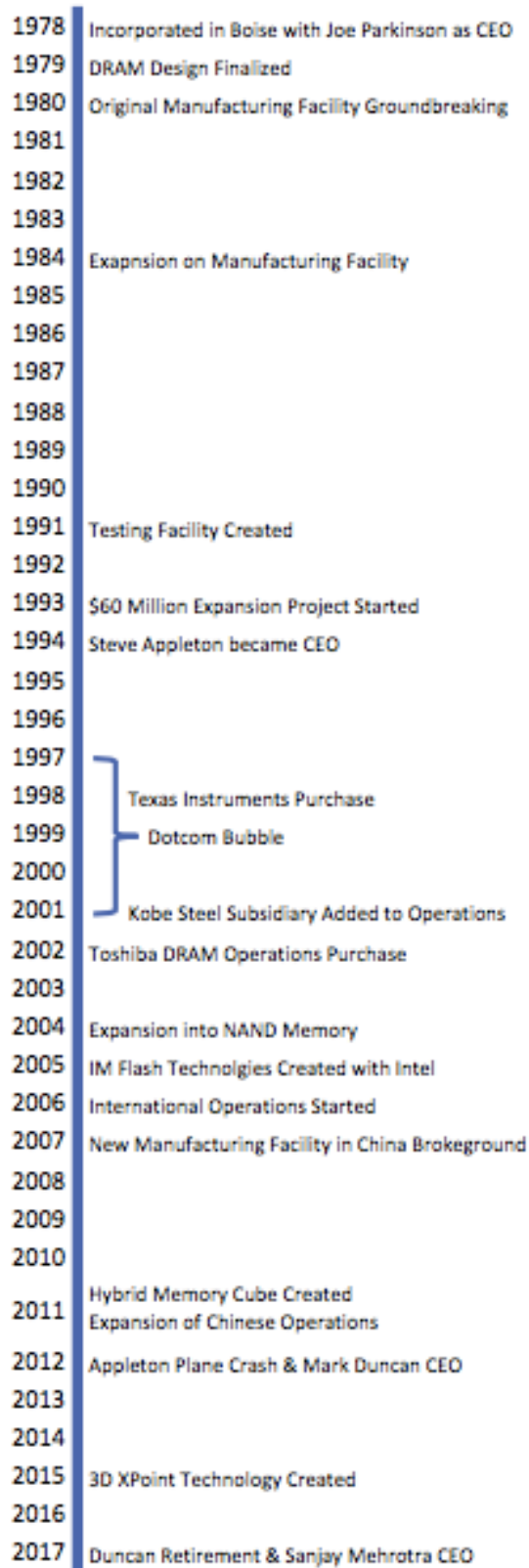
History

In order to understand where Micron is today, knowing how they got to their current position is imperative. Micron has become the company they are now through expansion and change to keep up with the industry. These changes have come in three distinct areas. The first is their products offerings. Next are the changes in management over the company's nearly forty years in existence. Finally, Micron has changed through their acquisitions, partnerships and physical expansion. Each of these areas of change are discussed in more detail below.

Product Offerings

Micron Technology incorporated in Boise, Idaho on October 5, 1978 by Ward Parkinson, Joe Parkinson, Dennis Wilson and Doug Pitman. At this time, the business was founded as a consulting company for the technology industry; however, the focus shifted to manufacturing shortly into its creation. Prior to this incorporation, Micron reincorporated in Delaware for better business treatment. In 1979, one year after the creation of the company, engineers finalized the design for the first 64K DRAM (Dynamic Random Access Memory) storage solution. "DRAM

Figure 2



is a type of memory that is typically used for data or program code that a computer processor needs to function” (Rouse, 2015). Random access memory is “the physical hardware inside computer that temporarily stores data, serving as the computer’s ‘working’ memory” (Fisher, 2017).

Micron has continued to expand from the creation of their first storage solution. The first 64K DRAM was shipped two years after the design finalization (in 1981). This product continued to be changed to keep up with industry standards, and the design became smaller as time passed. From there, the storage size increased with the 256K DRAM being created in 1984, and the 1MB DRAM in 1987. The DRAM system continued to be changed over several years, including increases in size in 1991 and 1992. In 1997, Dell Computer recognized the hard work that had been completed by Micron when the computer manufacturer announced that it received 256MB DRAM samples from Micron (*Innovations*). Additional changes have been

made to the DRAM technology produced by Micron up to this point with help from several outside partnerships that will be explained in more detail in the “Acquisitions, Partnerships & Physical Expansions” section .

However, Micron created several products in addition to the DRAM over the years that are still currently available. NAND memory was the next product that underwent design plans in 2004. From this point on, Micron began leading the advancement in NAND technology. In 2006, Micron provided “the industry’s first NAND Flash memory device built on 50 nanometer process technology.” Additional advances took place in 2009, 2011, and 2013. Following these advances, Micron was awarded TechInsights’ Most Innovative Memory Device and Semiconductor of the Year (*Innovations*).

As growth has increased, so have the number of products available. Micron created the Hybrid Memory Cube in 2011, which won the Memory Product of the Year by EE Times and EDN. Micron was involved with the creation of 3D XPoint™ technology which is described as a “transistor-less cross point architecture [which] creates a three-dimensional checkerboard where memory cells sit at the intersection of word lines and bit lines, allowing the cells to be addressed individually” in 2015 (*Innovations*). This is technology similar to what is used to manage bitcoin systems on the web, which is a very large and advancing area of business at this point in time.

Management Changes

Micron has had continual success with management. Joe Parkinson, one of the four founders, acted as CEO of Micron initially. He led the company that he helped to found until 1994 when Steve Appleton took over the position (*Innovations*). Appleton was the youngest-ever chief executive officer of a Fortune 500 Company at the time that he was hired. Appleton led the company through the Dotcom Bubble from 1997 to 2001, and even though the company hit a

very low point at that time, they continued to exist. In a shocking change of events, Appleton passed away suddenly in February of 2012 in the “crash of an experimental plane he was piloting” (Arthur, 2012).

Micron entered an era with somewhat less successful leaders following the loss of Appleton. Mark Durcan was named CEO following Appleton’s death. Durcan was placed in the position quickly. He was previously the COO and president of the company, and he had been employed with Micron as of 1984 (Savitz, 2012). However, this fit was not meant to last. Durcan announced his retirement in the beginning of 2017, and Sanjay Mehrotra was named as his successor. Mehrotra was previously the CEO of SanDisk. Micron had some very successful changes implemented into the company with Mehrotra leading the company, and stock prices rose to the highest they had been since the Dotcom Bubble (*Micron Technology, Inc.*, 2017).

These management changes have led to new ideas and changes in the company that has helped them progress to current operation levels.

Acquisitions, Partnerships & Physical Expansion

Finally, Micron has been very proactive in been their acquisitions, partnership and physical expansion of the company over the years. The physical expansion happened naturally over time. Two years after the firm opening its doors, ground was broken for a 50,000-square-foot manufacturing facility near their headquarters in Boise, Idaho. Expansion on this facility happened in 1984, just four years after the initial investment. Another testing facility was created in the United States in 1991, and two years later, Micron began a \$60 million expansion project to expand their physical assets. Micron began operations outside of Idaho by expanding into Utah at this point (*Aquistions*).

Physical expansion of facilities located outside of the United States (acquired through a series of business acquisitions overseas) began in 2006 in order to improve capacity. Micron broke ground on a new manufacturing facility in China in 2007, which was the first time that they began a construction project without improvements to already existing facilities as the final goal in a foreign country. This facility was successful overall, and was expanded upon in 2011. These physical expansions were enhanced through the acquisitions and partnerships that Micron created over the years which will be described shortly (*Aquisitions*).

Micron began their series of acquisitions in 1998 when they purchased Texas Instruments' worldwide memory operations. This purchase made Micron one of the largest memory producers (DRAM and NAND) in the world. Micron continued the trend of expansion by buying into a joint-venture previously owned by Kobe Steel, Ltd in 2001. Through the purchase of this interest, KMT Semiconductor, Ltd (located in Nishiwaki City, Japan) became a wholly owned subsidiary of Micron. Micron continued to purchase Toshiba's DRAM operations that were located in Virginia in 2002. Additional companies acquired by Micron throughout the years include: Lexar Media (2006), Displaytech, Inc. (2009), Numonyx B.V. (2010), STMicroelectronics N.V. (2010), Francisco Partners (2010), Virtensys (2012), Elpida Memory, Inc. (2013), Rexchip Electronics Corporation (2013), Tidal Systems (2015), Convey Computer (2015), Pico Computing (2015), and Inotera Memories (2016) (*Aquisitions*).

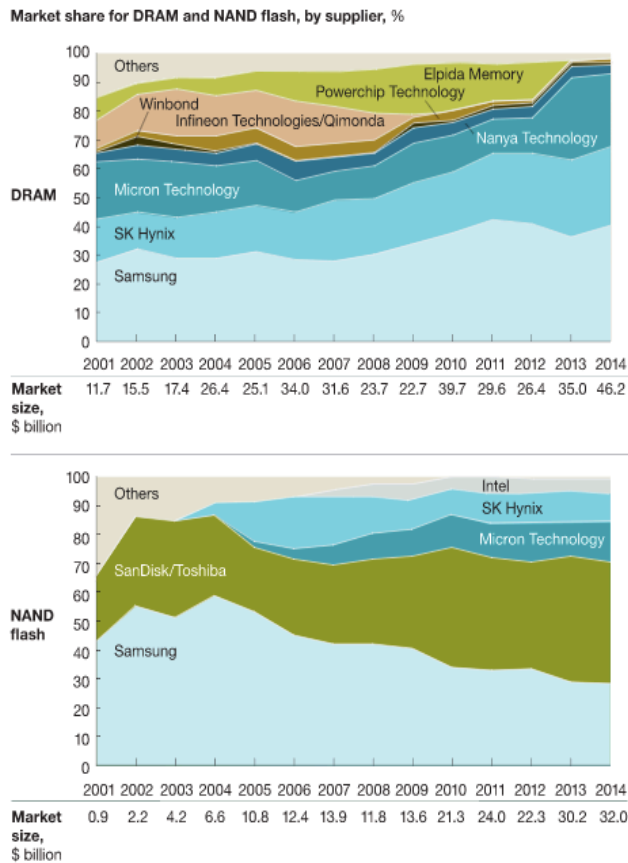
Micron continued to expand through partnerships and joint ventures in addition to acquisitions. Micron announced that they would be starting a joint venture named IM Flash Technologies which was to be used to create NAND Flash memory with Intel in 2005. This led to a long, successful partnership between the two companies which has since expanded internationally. Additional joint ventures and partnerships have since been created by Micron

with Photronics (2006), Nanya (2008), Origin (2010), Powertech Technology (2014), and Seagate (2015) (*Acquisitions*). Micron used these acquisitions and expansions to reach their current balance of \$19,431 million of net property, plant and equipment on their balance sheet as of September 30, 2017 (Micron Technology, Inc., 2017).

Micron made many successful moves in their history, as were discussed through their product offerings, management changes, and expansions through acquisitions, partnerships and physical expansions, which point toward the importance of continuing to identify problems and prepare the best strategies possible to further improve the business.

Problem Statement

Figure 3



McKinsey&Company | Source: iSuppli; McKinsey analysis

The biggest problem in the industry currently is the level of competitiveness. Several companies compete in this small area, and the nature of the product leads to price competition. As you can see in [Figure 3](#), both the NAND and the DRAM markets are controlled by a small number of competitors, and as time has progressed, the number of competitors in the market have decreased as well.

Micron needs to position itself to take advantage of those smaller companies that cannot compete in the market by absorbing their market share as

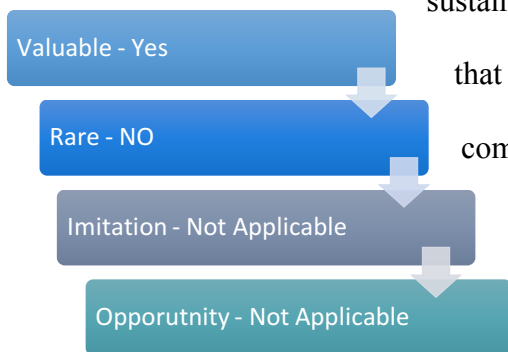
they fail. The changes that Micron has made this past year have been moving them in the right direction, but in order to address the level of competition in the market, slack in that process cannot exist.

Internal Analysis

Internal analysis is important to consider when trying to understand the overall business that Micron is currently running. VRIO analysis is the easiest way to conduct this research.. VRIO is an analysis that displays the core competencies of a business if they exist. The “V” stands for “value” and begs the question “is value being added” through the addition of this factor that the company possesses. The “R” stands for “rare” and questions whether the quality that is possessed is specific to the company at hand. Next is the “I” which stands for “imitation.” The ability of other firms to imitate this quality is questioned by examining whether it is costly or impossible to have the same qualities as the competency at hand. Finally, there is the “O” which stands for “opportunity.” The question that accompanies this letter asks whether the firm is able to benefit from this quality at this current point in time. If a business is lacking the ability to collect on the competency that they have found, all other factors become irrelevant.

By following these steps, we can determine if a quality is a competitive disadvantage, a competitive parity, a temporary competitive advantage, or a

Figure 4



competitive parity, a temporary competitive advantage, or a sustained competitive advantage. Below is the VRIO analysis that provided insight into Micron’s current biggest core competency.

The first competency that was analyzed was Micron’s manufacturing capacity. The manufacturing capacity that is currently held by Micron is extensive.

As was discussed throughout the background, Micron has several joint ventures, partnerships and expansions that have increased the capacity of their facilities exponentially. The ability to manufacture large quantities of products is very important in the competitive industry such as the semiconductor industry. Micron is currently competing based on cost (which is better explained in the “External Analysis” section), and owning the facilities to produce large quantities is highly valuable. Large manufacturing capacity is an important factor to the product that Micron provides; however, it is also a factor that all of the companies in this industry possess, as well, meaning that it is only a competitive parity for the industry.

The second competency that was analyzed was the strength of Micron’s management. Sanjay Mehrotra was appointed to CEO during April of 2017, and shortly after, shareholder

Figure 5



wealth increased immensely (*Micron Technologies, Inc.*, 2017).

The value that has been brought to the company is evident through the raise in earning per share that Micron experienced throughout the year. Mehrotra was one of the founders of SanDisk, and he acted as CEO from 2011 to 2015 when his company was purchased by

Western Digital for \$19 billion (Morra, 2017). This exact management is rare because Mehrotra is the only person with his exact experiences and management styles. Imitation is also difficult due to the nature of finding good management. Finally, it is obvious that Micron is taking advantage of this management as the increase in earnings per share indicates.

External Analysis

When it comes to external analysis there are two important areas to analyze. First, a PESTEL analysis was conducted for Micron. Each letter in the PESTEL is an acronym similar to

the VRIO analysis discussed for internal analysis. This analysis takes several areas of the overall environment and labels it for further discussion. The meaning of each letter and the analysis behind it is listed below. It is also important to think about the competitive nature of the business after completing this assessment, which is easiest displayed through a Porter's Five Forces analysis.

PESTEL

The first letter of our acronym is "P," which stands for "political," and in this section, the political factors that influence this industry are analyzed. There were few political factors that contributed to the industry. The current government support of globalization is one potential area to notice. This can act both in favor of and a threat to what Micron can accomplish. While this globalization invites in extra competition from outside sources. It also, however, creates more opportunities to take business elsewhere. In addition to increases in globalization, many political bodies are finally coming together to protect intellectual property evenly throughout the world. This means more protection for the products that Micron creates in the future.

The first "E" stands for "economic" factors that are influential in the industry. The economic factors that play into this area in several ways. Many global markets are becoming more economically stable and are experiencing growth. This provides growth opportunities yet again for Micron to enter growing areas. Disposable spending is also increasing which is another factor that plays into the economic side of this analysis. As other businesses succeed, they will invest more heavily in technology when they have the funds to better their memory and storage systems.

Next is the "S" which stands for "sociocultural variables." Sociocultural values for the industry match the lifestyles and societal values of different areas. The semiconductor industry

does not market to the direct public, and therefore does not have much sociocultural opinion surrounding the industry.

Following the sociocultural values is the “T” which stands for “technological” factors. Technology is huge in many industries and is an especially important factor in the industry that creates this technology. Technology is advancing in several ways, as we saw in [Figure 1](#), and research and development is putting out more useful products more quickly than ever before. The increase in speed of new product development can be highly beneficial to Micron, or it could be a large threat. If research and development is funded correctly, it can lead to the development of several new and useful technologies to provide to the public. If it is not funded, there can be loss of customers to other competitors that do fund this new technology. Technologies that are being developed will also become obsolete much quicker than in the past. Continuous management is needed to ensure that assets and products are managed effectively.

Next, is the second “E” in the acronym that stands for “ecological.” The environment has been a very large part of the world during the 21st century, and viewing each industry through this lens is important, as well. Ecological footprints can be improved in almost all cases, and manufacturing facilities typically have a very hard time finding the balance between profitability and ecological awareness. This is an area must be monitored to not only ensure that regulations are being met, but to maintain a positive public appearance. However, ecological concerns will not be of much concern politically or legally in the next four years with the Trump administration in place, but beyond that, this area should receive consideration.

Finally, is the “L” which stands for “legal.” Legislation and legal limits are important to keep in mind throughout navigating the industry. Much of the legislation now in place in the United States currently refers to tax reform. There could potentially be changes that impact the

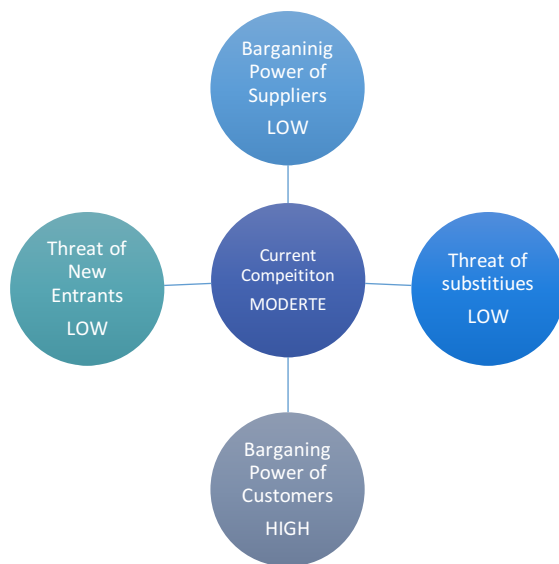
nature of the global business environment for the semiconductor industry, as well as several other industries if Congress passes a version of the new tax reform system that is currently being deliberated. The better tax rates for corporation here in the United States will improve the competitiveness in this area due to lower costs for large corporations. The proposed tax rate for corporations at this point in time is cut from 35.0% to 20.0% (Sahadi, 2017). However, this is all hypothetical at this point. The changes that are being proposed are currently still being reconciled between the House and the Senate. Both bodies of Congress have several differences currently, and it is unclear as to whether they will come to an agreement that includes the drastic cuts that have been proposed.

Technologic, economic and legal factors are the biggest forces for Micron to consider at this time in the industry. Micron must be aware of these changes to advance and stay successful, from rapid advancement for all of the players in the industry to changes in how much individuals will be willing to spend on products, finally to the competitive barriers to entry that may be lowered due to tax reform in the United States, the industry is subject to change over the next few years.

Porter's Five Forces

A Porter's Five Forces analysis must be considered in addition to completing the PESTEL analysis. Porter's Five Forces are made of five different sections: Threat of new entrants, competition between current competitors, power of buyers, power of suppliers, and threat of substitutes. Each of these different factors must be analyzed to fully understand how the industry is currently functioning.

Figure 6



Threat of new entrants is low currently.

While this is a powerful industry, there are several large players that have most of the market share already, and those players are competition on price at this point in time.

Economies of scale are imperative to successfully employing a low-cost strategy.

High capital costs are also required to reach those large economies of scale. Costs cannot be

as low as the current competitors without these requirements, leading many firms that try to enter this industry to failure.

Competition between the current players in the industry is high, even though threat of new entrants is low for the industry at this time. As we saw in [Figure 3](#), there are few competitors, but those who are in the industry have been competing for market share for quite some time. Very few competitors are left in the industry at this time which is a benefit to those in the industry currently.

Threat of substitutes, however is low, which is a great benefit to the few still left in the industry, as well. If someone needs a memory or storage system, they cannot go out into another industry and find a simple replacement.

Bargaining power of suppliers is low, in addition to the low threat of substitutes. The components that go into creating the products in this industry are created by several producers. Micron has applications that must be filled out to become one of their suppliers (*Suppliers at Micron*). There is no limit to the amount of suppliers for this product, so there is very little power given to the suppliers.

Bargaining power of buyers is quite high, on the other hand. The storage solutions have very few differences, so a majority of the decisions used to purchase these products typically come down to price. Margins are cut due to this nature of the industry. There is still very little room for profit, even though this has been turning around slightly over the last five years.

The overall industry is highly attractive at this point as we saw through both the PESTEL analysis and Porter's Five Forces analyses. The competition is somewhat locked into their current positions, and the industry has room for growth overall. The industry as a whole looks positive at this point in time.

Recommendation

Research and development of new products has helped to get Micron to where it is today, as we saw throughout the history of Micron, but it is unrealistic to expect them to maintain that lead in the industry without investing in following and advancing the trends in that industry. Further analysis into Micron's current standings and the market that they are operating in will provide more evidence as to why the additional revenues that Micron has been creating should

be reinvested into research and development and associated development expenses to improve the processes that Micron uses to produce their product. These improvements will help maintain the success that they have been seeing during 2017.

[Figure 7](#) contains a partial common sized income statement for Micron for the past five years. The highlighted “Gross Income” line shows that in 2017, Micron experienced a large jump in gross income as a percentage of sales. While this percentage change was taking place, there

Figure 7

	2017	2016	2015	2014	2013
Sales/Revenue	100.00%	100.00%	100.00%	100.00%	100.00%
COGS excluding D&A	39.49%	55.76%	51.32%	53.91%	59.76%
Depreciation & Amortization Expense	19.00%	24.03%	24.03%	16.47%	12.86%
Gross Income	41.51%	20.20%	32.21%	33.24%	20.36%
SG&A Expense	12.57%	18.36%	13.95%	12.70%	15.90%
Research & Development	8.98%	13.04%	9.51%	8.38%	10.26%
Other SG&A	3.59%	5.31%	4.44%	4.32%	5.64%
EBIT	28.94%	1.85%	18.26%	20.53%	4.45%

(Micron Technology, Inc., 2017) – Information used from source to develop common size income statement.

was not a similar jump in research and development costs, as is highlighted on the “Research & Development” line. While the overall expenses incurred for research and development did increase in 2017 (from \$1.6 billion in 2016 to \$1.8 billion in 2017), that percentage dropped significantly. Lower costs are typically a good sign for companies, but in this industry, falling behind in process innovations is the fastest way to lose your competitive edge in this industry.

As was explained in the industry analysis, the current industry is subject to rapid changes in research and development. If this area is not accurately funded and managed, the entire product line of the business could fail. Potential for growth in this area is great, as well. Micron has, in the past, been very proactive about funding these areas. This is show in their investments in manufacturing and testing facilities that we outlined in the timeline of the company. Mehrotra,

as the new leadership that has been added to the company this year, cannot forget to fund this area of development. With changes in management come changes in funding allocation, and while there have not been any problems with this throughout the first half of his first year leading Micron, this is not something that should be left to chance. Funding process innovations is mandatory.

The Porter's Five Forces analysis that was completed pointed out that competition in the industry is currently very high, so the best way to beat that problem is to develop new process technologies before anyone else. Before all of the other competitors enter the industry, margins can be slightly larger than when competition enters to compete on price. This slight edge can create additional initial revenue can help fund the next big process change, and the trend can continue to run as competition begins to reach the process levels that Micron creates.

As we also saw, the tax rate for corporations such as Micron will potentially decrease in the future. With this decrease, the industry will most likely provide another drastic cut on the overall sales price of the products they provide, shrinking overall margins again. The overall net income will remain relatively unchanged at the end of the day; however, financial statement views will change drastically. The overall sales revenue will most likely decrease, which makes it imperative to raise the overall percentage of sales dollars that are reinvested to research and development. The lower percentages that were used in the past, such as the 8.89% and 8.38% in 2017 and 2014 respectively as were shown in [Figure 7](#), will not be near the required amount of investment in this important area of process innovation.

This recommendation addresses the problem (the level of competition currently in the industry) by getting ahead of the competition in the competition to provide lower costs. If Micron can be the first one to produce these new processes, there will be no other firms to

compete with in that area. This lower cost increases the value gap of the product and maintains Micron's position as a leader in the industry.

Recommendation Implementation

There are two steps that should be taken in order to make this recommendation successful for Micron. They include, first, always investing a minimum of 10% of sales back into research and development; and second, those funds should be used to purchase research facilities, recruiting new talent for process innovation, and salaries to incentives new technological advancements from employees.

The first step is continuing to monitor the level of research and development as a percentage of sales. This measurement is an accurate way to calculate the amount that should be reinvested because it depends on the amount that is received by the company. This percentage is also accurate because it sets a minimum around the average percentage over the last 5 years. This will increase overall investment in research and development while not imposing a large new burden on the company. The implementation of this portion of the plan can begin to take effect as soon as the next quarter.

The second step involves the how that money should be spent. The first step to this process is to improve the recruiting process for Micron. Additional recruiting employees will be necessary to complete this, as well as more financing for recruiting activities. Improved recruiting will lead to more development professionals joining the Micron team. These professionals will be leading the company in the development of new technologies; therefore, recruiting the best and brightest professionals available is highly important. Incentives for new hires to join the Micron team are also imperative to the success of this process. High salaries and bonuses for successful development of new technologies should be incorporated into the

employment plan. As this area grows, the new process technologies and increases in the value gap will fund additional investments into this area, and improvements to research and development facilities will be required.

If these steps are followed, Micron should be able to maintain its competitive stance in the market, and hopefully improve to the point where they are the leaders in the industry.

Conclusion

Micron is obviously in a position to succeed currently in their industry, as the strategic analysis displayed throughout this research. However, this position is not guaranteed, so it is important to maintain a plan that leads to continued success in the future. This plan was developed through the understanding of the previous strategy of Micron and their products, management and expansions. After that, the extreme level of competition in the industry in which Micron competes was established as the problem. Following that assertion, analysis of the internal and external environment for Micron were conducted. The recommendation was reached that Micron should invest more heavily in research and development and costs associated with improving the technology being sold, and the plan to reaching this goal was defined in detail using the internal and external analysis provided. Micron will position itself for continued success in the future with the implementation of this plan.

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