

# **Competitive Advantage of Intel in the Segment of the Microprocessors**

Ventaja competitiva de Intel en el segmento de los microprocesadores

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## Abstract

The present work has the objective of analyzing how the company Intel Corporation has developed worldwide and what its competitive advantage is in relation to other competitors in the market. The analysis will be made from an industry-based point of view, identifying Michael Porter's Five Forces, which provides an assessment of the strengths of external factors to the company in order to define strategies against threats. What is Intel's competitive advantage given its current dominance in the personal computer segment in face of technological changes and new segments of the semiconductor industry? The hypothesis: Intel has a competitive advantage over production volume, alliances with PC manufacturers, its own factories (Fabs) for the production of processors, which allows it to enter the new segments of technology with greater ease, and as a goal: to analyze Intel's competitive advantage through Porter's Five Forces.

## Keywords

Market, strategy, oligopoly, industry

JEL Classification: L11, L13, L22.

## Resumen

El presente trabajo tiene el objetivo de analizar cómo la empresa Intel Corporation se ha desarrollado a nivel mundial y cuál es su ventaja competitiva con respecto a los competidores en el mercado. El análisis se hará desde un punto de vista basado en la industria identificando las cinco fuerzas de Michael Porter, lo cual brinda una evaluación de las fortalezas de los factores externos a la compañía para poder así definir estrategias ante las amenazas. Así mismo se buscará conocer cuál es la ventaja competitiva de Intel dado su dominio actual en el segmento de las computadoras personales ante los cambios tecnológicos y los nuevos segmentos de la industria de los semiconductores. La hipótesis: Intel cuenta ventaja competitiva a través de volumen de producción, alianzas con fabricantes de PCs, fábricas propias (Fabs) para producción de procesadores, que le permite entrar con mayor facilidad a los nuevos segmentos de tecnología. El objetivo del estudio es analizar la ventaja competitiva de Intel a través de las cinco fuerzas de Porter.

## Palabras clave

Mercado, estrategia, oligopolio, industria

Clasificación JEL: L11, L13, L22.

## Introduction

This document is intended for the analysis of the Intel Company and how it has been developing as a leader in the semiconductor market. Intel processors can be found in personal computers. Due to the high production, quality, and innovation that it has been managing for several years since its foundation, it has positioned itself as a leading company in its field, in addition to consolidating itself as a company that is recognized worldwide. Along with Intel, is AMD (Advanced Micro Devices), this is the main competitor for Intel in the personal computer field. Semmler places Intel as a company that, due to its market structure, is classified as an oligopoly, which will be explained more in detail, describing the topics that this author points out in a more in-depth manner.

It also analyzes how Intel Corporation has performed to obtain a competitive advantage over its rivals, and as a point of reference, it will take Michael Porter who makes his contribution to this methodology with this research. It studies the analysis techniques of the industry which are called the Five Forces or also called Porter Diamonds. They are identified as: the rivalry between competitors, the threat of a potential entry, the bargaining power of suppliers, the bargaining power of buyers, and the threat of substitute products. These forces will be analyzed later in order to understand what each of them consists of and to be able to identify the characteristics that each one possesses and how they are related and implemented by the company, Intel Corporation.

This research concludes with an analysis of the advantages that Intel currently has and how it is preparing to enter new markets that are booming as a sort of technology portfolio focused on data for artificial intelligence, analysis, and the cloud.

## Background

Intel Corporation is one of the leading semiconductor manufacturers in the world. This American company is the creator of the series of x86

processors. Said processors are commonly found in most personal computers (Intel 2019). The company was established in 1968 by Robert N. Noyce, co-inventor of the Integrated Circuit with Gordon E. Moore, a colleague of Noyce at Fairchild Semiconductor Companies which already existed at that time. Since the name of Moore Noyce had already been registered as a brand so they opted to call the company, Intel, which is an acronym for “Integrated Electronics” (Intel, 2019).

**Mission:** To use the power of Moore’s Law to make it possible for every person on Earth to be connected to intelligent devices. The mission focuses on how Intel continues to trust and use Moore’s Law today. This law sets the number of transistors in a processor that will double every 18 months. On the other hand, the ambition of the company is further highlighted by the inclusion of “connected to every person on earth”, where it makes clear that its strategy continues to point to a global market in the segment of semiconductors, microprocessors, and technologies related to computing.

**Vision:** Yes, it’s smart and it’s connected. It’s better with Intel. In this vision, you can see how Intel defines the types of products it intends to offer to its target market, followed by self-recognition as the best company. In other words, Intel is seen as the best qualified company, capable of providing intelligent products and connected. According to Intel (2019), the Moore law says that the number of transistors per inch in integrated circuits would double every 18 months and that this trend would continue for at least two decades. Although many think that Moore’s law is no longer valid, the mission of Intel makes it clear that the company is still searching for the miniaturization of its processors.

Intel was the creator of the first model 4004 microprocessor in the world in 1969, calling it the computer on a chip. By the year 1980, the 8080 architecture was created, which was chosen as the central processing unit of IBM’s first personal computer (Encyclopedia Britannica, 2019).

In the mid-1990s, Intel expanded beyond the chip business. Large manufacturers of personal computers (PCs) such as IBM and Hewl-

ett-Packard, were able to design and manufacture Intel-based computers for their markets. However, Intel, in its desire to increase its market, looked for ways to provide its technology to smaller companies, which would help expand its market with greater speed. To achieve this, they created a system that contained all the necessary parts of a computer called a motherboard. By 1995, Intel was selling more than 10 million motherboards to PC makers (Encyclopedia Britanica, 2019).

By the end of the century, Intel and compatible chips from companies like AMD were on all PCs except Macintosh Apple Inc., which had used Motorola CPUs since 1984. In 2005 Craig Barret, CEO of Intel that year, managed to close a contract with Apple Inc, being the very Steve Jobs, executive director of Apple, who gave the announcement that Apple's future computers would use Intel's CPUs, thus covering practically the entire segment of PCs worldwide. (Encyclopedia Britanica, 2019).

Intel dominates the market of processors and microprocessors, but when talking about this company, one can think of the large number of competitors that the company. However, this company, due to the different segments it focuses on, has an immense variety of competitors in respect to each turn, and in this research work, we will focus mainly on the segment of personal computers (laptops). Within this segment, Intel has a single competitor: Advanced Micro Devices.

Advanced Micro Devices or AMD is a semiconductor company based in Sunnyvale, California, dedicated to the development of processors. It is the second largest manufacturer of x86 processors worldwide and the second largest manufacturer of graphic cards for the professional and domestic sectors (AMD, 2019). It was founded on May 1, 1969 by a group of executives out of Fairchild Semiconductor, among them Jerry Sanders III, Edwin Turney, John Carey, Steven Simonsen, Jack Gifford, Frank Botte, Jim Giles, and Larry Sterfer (AMD, 2019). AMD and Intel are currently the only two companies that sell x86 processors.

## Concepts

### Strategy

According to Vargas, Guerra, Bojórquez and Bojórquez (2017) the strategy can be defined as a plan, as an action or as an integration or theory. This is why the strategy is defined as the alignment or direction that is given to the internal resources of an organization to modify, lead, adapt and in the worst case, survive the conditions of the environment. Using this definition, it allows companies to plan better and raises the case that there were changes to be able to adapt to or to adjust to changes.

### Industry

According to Peng (2012). An industry is a group of firms or companies that produce goods and/or services that are similar one to the other. Although it could also be defined as a set of companies that offer nearby substitute products (Hill & Jones, 2004).

### Market

The market definition by Smith (2011), who was the so-called father of modern economics; In his book, *The Wealth of Nations*, believed that selfishness is the characteristic of rational economic agents that motivates them to make deals, barter, and purchases in order to obtain what they need from others. He called that physical place the market. However, with the effect of globalization and innovation, the way in which transactions can be made, has changed and not only are transactions made in a physical place but also, through digital platforms making connection all over the world. This it can only happen if buyers and sellers establish prices (Banco de México, nd).

According to Parkin (2010) the market is any agreement that allows buyers and sellers to obtain information about a good or service and do business with each other. Although it can also be defined by Vargas *et al* (2017) since he considers that the market is the best mech-

anism for matching supply and demand, setting prices, and extracting maximum utility from finite resources.

## Oligopoly

According to Varían (2010) an oligopoly is a market in which there are some companies that carry out their strategic interdependence. It can behave in several ways depending on the exact type of interrelation.

## Theoretical revision

According to the vision based on the Peng Industry (2012), it mentions that this approach studies how companies use opportunities and confront industry threats. In other words, the way in which they compete, or compete with this activity, is the basis of his differentiation (Vargas *et al.*, 2017).

The competition, in order to obtain benefits, goes beyond the rivals that, in this case, may have Intel reach or whose competitors can reach it. Said expansion of the rivalry originates from the combination of five forces that defines the structure of an industry and shapes the nature of the competitive interaction within it (Porter, 2017). Michel Porter, who created the model, called them the Five Forces. They form the main part of the strategic vision based on the industry (Vargas *et al.*, 2017).

The five Porter forces are (Vargas *et al.*, 2017):

1. Rivalry among competitors: This relates to the number of competitors, the competitors that are similar in size, the products they offer, the capacity of each industry, the slow growth of the industry and the high costs of exit.
2. Threat of a potential entry: Entry barriers which increase costs (economies of scale, know how) and customer loyalty.
3. The power of negotiation of suppliers: The ability to raise prices or quality of goods and services, providing unique products, and few suppliers.

4. The bargaining power of the buyers. Few buyers have strength in negotiation, buying products without specific brands, products that do not produce savings.
5. Threat of substitute products: these are threatening as long as they are superior in their quality.

This is according to Porter (1981) which provides a framework to analyze the level of competition within an industry so that it can develop in their environment. That said, an efficient strategy had to fulfill key elements that Porter (1981) mentions are Strengths and weaknesses of the company, Economic and technical opportunities and threats of the industry, Personal values of key implementers, and Broader social expectations.

## Research method

Given the nature of this research, the method that will be used in the case of the Intel Company will be the Analytical method which will contemplate critical thinking skills and the evaluation of the facts that are being carried out, as well as understanding them. In addition to analyzing the data collected which are important tools in order to examine our hypothesis, raised previously, and to be able to reach a conclusion on the subject.

## Analysis of results

### Rivalry among competitors

According to Semmler (2010) regarding the microprocessor industry, it is well known that Intel and AMD are the two world leaders in the production of microprocessors. Intel has a market share of 81.7%, while AMD has a market share of 16.9%. Intel is historically the largest, and the oldest, of the two companies.

These two companies compete in the capabilities in relation to processors, both in the area of security and processing speed. This competition is based on the size of the processor, where it is said that



the current measure in a processor is 14 nanometers, so today the two companies jumped to a new technology that is meant to manufacture a smaller processor that reaches 10 and 7 nanometers, in order to offer a better competitive advantage in the market. Currently, the two are in a competition to make the processor smaller and offer it first in the market (Extreme Tech, 2019).

Despite the rivalries between these two companies, Intel still holds the lead with respect to AMD. According to Digital Trends (2019) makes mention that although both companies are producing processors that are at a surprising place of improvement on almost all fronts: price, power and performance, Intel chips tend to offer better performance per core. According to (Semmler 2010) in his article, he mentions that Intel can be defined as an Oligopoly with a leading company, and AMD as a follower, or master, with respect to the type of competition it has with Advanced Micro Devices AMD and its market structure, since there are no other large producers of microprocessors and about 98.6% of the total market share is held by the 2 companies.

According to (Semmler, 2010), the typical characteristics of this Oligopolic market are:

1. Companies sell standardized products.
2. Companies are price setters, which means that they can influence the market share of the product by establishing the prices of their products (Bertrand Oligopoly) or by establishing the quantities and allowing the prices to react (the Cournot oligopoly).
3. There are great barriers for entry. Entry barriers are factors that make it costly or expensive for other companies, newcomers, to enter an industry or market. Such barriers can be legal, bureaucratic, financial, or economic.
4. There are few companies and there are strategic interactions between these companies.

5. Heavy advertising and brand name, as well as the use of technology, are produced in the market in order to differentiate the products.

There are only two companies, and the entry barriers are large enough to prevent new companies from entering the market. These barriers are the patents that each of the companies has acquired over the years in addition to contracts with PC and laptop manufacturers (Semmler 2010).

Having said this, it can be mentioned that, Intel worldwide can be located in an oligopolistic market structure, especially as a duopoly because, as mentioned above, AMD is the only company in its field that can compete with the processors currently in the market. The market is to say that there are only two companies, and according to the assumptions presented by an Oligopolic structure, is precisely that there are few companies in the same market. However, in this case, the Oligopoly also has a fourth assumption where it can be said that the Companies have strategic interaction between them. However, this is not the case. All the tools that both Intel and AMD have are strictly confidential.

Sharing information about their processes and interacting in a strategic way between them could become a monopolistic practice called collusion and which Intel (2019), for ethical reasons, does not perform, as has been mentioned (Semmler, 2010). In 1976 AMD and Intel signed a cross-licensing agreement that eventually lead to the elimination of other competitors due to a growing technological gap. It is not until 1987 that the cross-licensing agreement between AMD and Intel is terminated. This marks the beginning of strong competition between the two companies (Semmler, 2010).

## Financial results

In the economic aspect, the profits that both companies had in 2018 can be analyzed. According to the financial reports of Intel, in 2018, the company obtained 70.8 billion dollars, this being an increase of 13% with respect to the reported in 2017 (Intel, 2019). On the other hand,

AMD (2019) reported an annual income in 2018 of 6.48 billion dollars (23% more than in 2017).

### *Threat of a potential entry*

Economies arise when companies produce volume and enjoy of low prices per unit, in addition to having more technology and efficiency in order to be competitive, ensuring that no other competitor can enter the market (Porter 2017).

According to studies carried out by the Massachusetts Institute of Technology (2010), the cost for the construction of a microprocessor manufacturing plant is around 3 to 5 billion dollars, which is a high cost which forces companies to maintain 100% of said factories in operation in order to recover the investment. According to the Massachusetts Institute of Technology (2010), in the microprocessor industry, only Samsung and Intel have a high production volume that allows them to pay for these state-of-the-art production plants, making other companies in this sector, such as AMD, to look into the need to contract external factories for the production of their processors. Companies such as Global Foundries and Taiwan Semiconductor Manufacturing Company may provide this service.

The need to invest large amounts of money in order to compete with the applicants, that is, if any company that wants to compete with the Intel company should invest in facilities, and in some cases, assume the initial losses of a company when it starts (Porter 2017). Panmore Institute (2017) states that one of the constraints that the industry has is precisely the access to these factories. The high cost of construction and maintenance prevents smaller companies such as ARM from aspiring to have a plant to manufacture their own devices. This is one of the main barriers that other companies have to face in order to enter the wide world of personal computers and servers.

One of the strategies based on Moore's law is to decrease the size of the processor. This change entails a large investment since it has to build a new factory that has the capabilities and tools necessary

to achieve this new size, this being an advantage of Intel's competitive position with respect to its competition since the manufacturing time and cost of its competitors is even higher (Berkeley Economic Review, 2019).

### Bargaining power of suppliers

The fact that for large companies like Intel, it is difficult to change supplier as they spend large sums of money for specialized equipment in the manufacturing of the product, (Porter, 2017).

There is no substitute for the product that is offered because its high innovation makes it difficult for a buyer to reject the product and therefore suppliers will have more influence in the negotiation since no other industry may have it (Porter, 2017).

### Buying power of the buyers

Buyers can become powerful if they have negotiating influence over the industry. A group of clients can be an influential negotiator if there are few buyers, and if they buy in large volume. Another influence is that buyers face few variations in costs when they change vendors, in addition to threatening to withdraw and produce that same product if other sellers can be profitable (Porter, 2017).

However, in the case of Intel, there are factors that alter the five forces of Porter in the aspect of negotiation with customers. These factors benefit the Intel brand since with the low availability of substitutes in the case of personal computers, only AMD is competition. Buyers are in need of continuing to consume Intel products coupled with the high switching costs that exist between current alternative products. Intel (2019) says that for many years the alliance of Intel with Microsoft has helped Intel to have dominance in the computer market and especially in the new segments that are already starting to grow exponentially, such as the cloud, 5G, and artificial intelligence. Wired (2017) mentions that this alliance, dating from the beginning of the 80s, influences the negotiation of customers with Intel since, if Microsoft wanted to replace the current processors, they would have many problems of compatibility with previous products.

Companies such as Microsoft and Apple lack microprocessor manufacturing facilities, as well as companies that can provide such substitutes lack the same factories that limit their production capacity in high volumes. This is why customers exert a weak force in the Intel industry environment which would allow you to have a high power in negotiations.

Intel has factories for the production of microprocessors worldwide. If we refer to the United States, it has four factories located (Intel, 2019) in:

- Chandler, Arizona
- Hudson
- Rio Rancho
- Hillsboro, Oregon

Outside the United States:

- Leixlip, Ireland
- Jerusalem, Israel
- Kiryal, Spain
- Dalian, China

Production sites outside the United States are located in places that allow production and distribution close to the different research and development centers, as well as their customers around the world. Research and development centers can be found both inside and outside the United States (Intel 2019).

Intel offices within the United States:

- Oregon
- Santa Clara
- Austin
- Chandler
- Folsom

Intel offices outside the United States:

Argentina	Denmark	Italy	Romania	Vietnam
Australia	Egypt	Japan	Russian Federation	Israel
Austria	Finland	Latvia	Singapore	Portugal

Belgium	France	Malaysia	South Korea	United Kingdom
Canada	Germany	Mexico	Sweden	Poland
Chile	India	Netherlands	Switzerland	Ireland
China	Indonesia	Peru	Taiwan	Costa Rica

### Threat of substitute products

With the appearance of new technologies and constant innovation, these can act as substitute products to microprocessors. Consequently, to these constant changes Intel, unlike AMD, has tried to implement a strategy that allows it to guarantee a competitive advantage and reinvent itself around the innovation and trend that is currently advancing by leaps and bounds into the world of 5G technology, intelligence artificial, quantum computing, and developments with more technology such as an autonomous car. However, currently the development of processors is still one of the largest businesses Intel has. With this, Intel is positioned as a leader in the market in unique competition with AMD as it continues to focus on the development of microprocessors (The World, 2018).

Intel knows that before the technological changes that are so accelerated today, the threat of substitutes is high. If it does not innovate or think about implementing a new strategy, Intel would resent the arrival of such products. This makes the performance of an industry limited in its potential (Porter 2017).

### Conclusions and recommendations

Intel is a company that, since its inception in 1968, due to its innovation, has been positioning itself in the microprocessor market, relying on the Moore Law. This has allowed Intel to continue to attack the global market. Intel Corporation, solely based on its semiconductor segment, has a global competitor which is Advanced Micro Devices (AMD), a company that was founded a few years after Intel in 1969 and represents Intel as the only rival in the market of microprocessors since it is considered the second manufacturer worldwide. These companies compete in the capacities of their processors, both in the area of security, and the speed of processing.

This research focuses primarily on an industry-based vision, but makes it very clear that we cannot think about it without considering the five forces of Michael Porter, also known as Porter's Diamonds, which indicates how a company can have competitive advantages. These are mentioned below:

Rivalry among competitors: in the industry according to Semmler, Intel, and AMD, even though they are the two leaders of this industry, he makes it very clear that Intel is the most outstanding of the two as it covers a market of 81.7% and AMD covers only 16.9%. That places Intel as number one. In the same way, within the financial part, it realizes that Intel is still leading, as its reports for 2018 are practically 10 times higher than those of AMD.

Threat of a potential entry: Intel has invested in manufacturing plants in various parts of the world which makes their production costs decrease. That is why companies that intend to enter the competition in the same market are removed because the cost is too high and it is required to be sustained if in any case they had losses, which is why Intel is covered with a large investment.

The power of negotiation of the suppliers: when the supplier has the control of said negotiation, it can be either by having the best quality, security, speed, and all the ideal characteristics that the client looks for so that he does not have any other options and must consume directly from the company.

The bargaining power of consumers: Consumers can have a lot of influence in this aspect, since if the supplying company has some competition that can offer a substitute product or a product with the same characteristics and with lower prices, the consumer may threaten to withdraw and look for someone else, so Intel should always be one step ahead in innovation and a sense of customer service in order to keep consumers satisfied.

Threat of substitute products: Innovation is a fundamental tool for the company as this can be its main threat. That is why Intel, taking a step towards innovation and difference with the competition, decided to

also enter the world of 5g technology, artificial intelligence, and quantum computing, which will allow it, in the future, to be one of the companies with the most technology and above all, to be more profitable for the entire technology industry.

With the previous analysis made of Intel Corporation, it can be concluded that Intel is the leading company in the semiconductor segment given its reported financial profits, as well as the market that it currently covers. Advanced Micro Devices is the only company to make an effort to reach a larger market in the personal computers segment. Likewise, companies like ARM have tried to enter without any success. Carrying out an analysis with the 5 forces of Porter, more specifically in the factor of substitute products or a threat of potential entry, it has been found that there are different barriers for a company to compete in this large segment. The most important barriers are:

1. Partnerships with PC manufacturers
2. High cost of creation and maintenance of the production factories
3. Incompatibility with previous systems
4. High cost of switching, by PC manufacturers, to a new processor.

A small company that does not have the financial capital to invest in factories producing processors has diminished its chances of success, since it will not be able to solve the current demand from buyers such as Apple Inc., Microsoft, Dell, etc. This also complicates the possibility that buyers can make strategic alliances with smaller companies.

Intel has offices and factories throughout the world that give buyers greater security in terms of production capacity and support. Intel has more than 50 locations worldwide which allows it to provide support.

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