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Intel; a Study of Strategic and Policy Issues.

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Intel was founded by Gordon Moore and Bob Noyce in 1968 [34], and is currently the most powerful leader in computer business. They founded Intel because they believed that there was a potential to the technology of storing data on silicon rather than in the magnetic core memory that computers used at that time. They started the business with a $2.5 million dollar investment from Arthur Rock, thanks to Noyce's and Moore's credibility [52, p. 87]. By the end of 1996, Intel assets had grown to $23,735 millions [1, p.125], and were ranked by Fortune magazine to be the fifth earner with $5.2 billion's profit [44]. At first, the name of the company had been M & N Electronics but later was changed to Intel (Integrated Electronics) [46]

In the first year of business, Intel produced it first product, a Static Random Access Memory chip (SRAM) called 3101, and gained the revenues of $2,672 [36]. In early 70's, Busicom, a calculator manufacturer, hired Intel to design 12 chips for their products. Ted Hoff, an Intel engineer, came up with an idea that Intel should integrate 12 chips into a single chip that would incorporate all functions of those 12 chips [37]. Busicom welcomed the idea by funding Intel to design a programmable chip, which in 1975, became the world's first microprocessor, the i4004 [34]. "I think that it has to be up there in the top couple of dozen inventions of all time-certainly electric light, and electric engines, and internal combustion engines are all things of comparable or greater significance. It's in the same category of significance of those types if inventions that have really forever changed the nature of people's lives," said Michael Slater, the editor of the Microprocessor Report [38]. Intel realized the potential of this product but the right of the I4004 had been belonged to Busicom. Therefore, Intel bought the right of the I4004 back for $60,000 [35]. Intel had had hard time to sell the microprocessors.

Intel's strategies have evolved from the traditional product generations to the masters of fast product introduction and forced obsolescence. These strategies are one that Intel has learned from its mistakes and its successes. From 1968 to 1985, Intel history is very similar to many other companies. They started from 3101 which underwent several revisions and improvement as new technologies where developed. Intel made several technological advances such as the dynamic random access memory (DRAM) and the erasable programmable memory (EPROM). However, Intel's product introduction was no different as Micron introduction of a new memory SIMM, it was a natural product evolution. There was no need to accelerate introduction, or new technologies, since new products where introduced as the market needed them and old products became obsolete.

Intel rapid change strategy started in 1981 when the Japanese, who imitated Intel's memory products, already started to gain on Intel's market share. Intel tried to match the imitators in price and quality, but in 1985 after a long and costly battle with Japanese imitators Andy Grove and Gordon Moore realized that they had lost the war as they could not regain the market share that they had previously lost. At that point, the company underwent a massive change in strategy, a type of change that Andy Grove calls a strategic inflection point. The company ceded the memory business to their competitors and focused their entire energy on a product that have been slowly gaining market acceptance since 1980, the microprocessor!

This first inflection point triggered the evolution of Intel strategy. Intel learned from their loss that they needed a faster product development and introduction so that competitors could not imitate the newer product. This strategy that was tested the

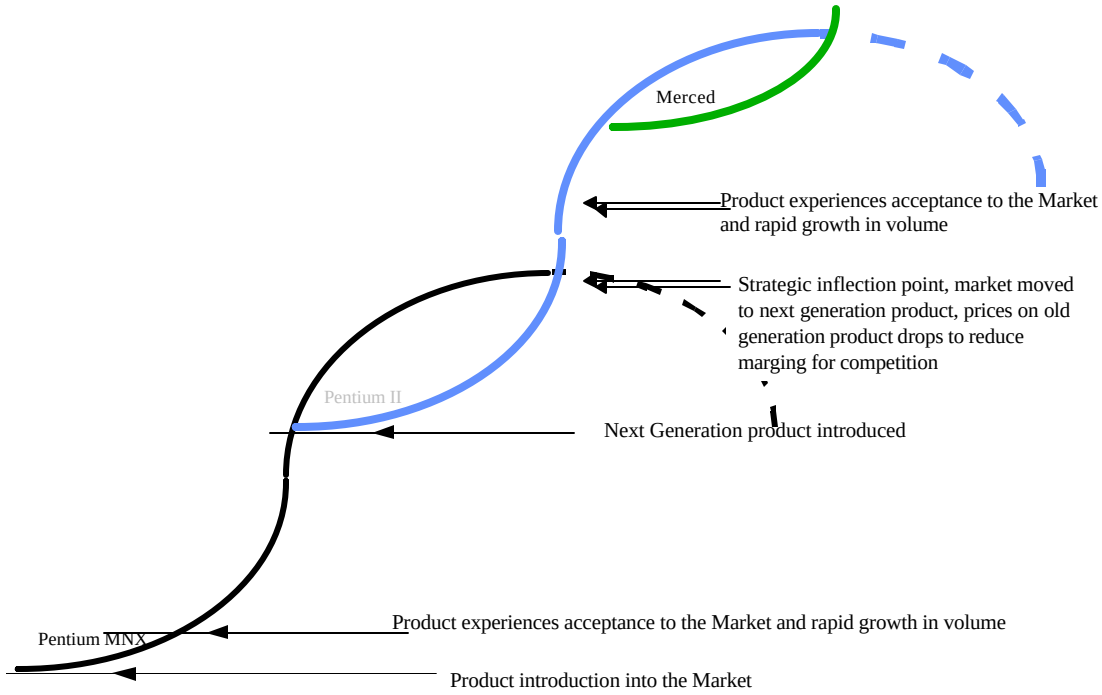
following year when Intel introduced the new generation product the i80386 Microprocessor. The strategy at the beginning looked like a failure since the 286 Microprocessor, the older generation, which already had imitators, was not becoming obsolete by the introduction of the 386 microprocessor. The 286 had still a strong demand by the PC makers, as they did not see the need to go through the expense of changing their PC product lines to introduce a new microprocessor. Intel's strategy was missing a key point, the forced obsolescence. Intel needed to move the market to the new product; which was attended by Red X campaign. The campaign was an unprecedented series of advertisement that bypassed Intel's paying customers and those PC makers and focused directly to the end users encouraging them to buy the fastest and newest processors. This campaign succeeded as the end users created a demand for the 386 based computers that the PC makers needed to fulfill. The PC makers that did not change their product line to introduce the 386 lost the market share. From this success Intel learned the recipe on how to force obsolescence on an older generation product. Intel's learning was beneficial as they increased their distance from the imitators who had not been able to produce a 386 compatible product creating an advantageous marketing position, a product with a healthy demand and without competition.

Intel marketing program has also evolved to allow Intel influence external forces during the transition to a new generation. In the past, Intel focused their marketing team on the Original Equipment Manufacturers (OEM). The most recognized example of this OEM focus marketing approach was Operation Crush where Intel marketing had the goal of winning 2,000 design over the competitor product from Motorola before the end of that year. The first change to this approach was the Red X campaign where Intel targeted the end-users showing them the advantages of the 386 over the 286. Marketing learned that the end users demand are key to product life cycles. Intel needed to learn from the Red X and improve it without affecting the relationship with the OEMs. The Red X campaign was used for the 386 and 486 generation change, but Intel needed something extra for the Pentium. They change the marketing program and created the Intel Inside campaign. Intel is not the first company to target the end user bypassing their direct customer. In fact Intel's new program is very similar to the Dolby® and Nutrasweet marketing programs. The end customer will buy a diet Coke because it has Nutrasweet, even though he will never see it or taste it. In the same way Intel's inside campaign created a brand name recognition where users will go to an OEM and demand an Intel based system. Intel already started the new transition, the transition to the Pentium II and has allocated hundreds of millions of dollars a year for Intel inside advertising [5]. Intel have modified their marketing efforts not only to show the end users the added processing power and speed, but also to show them all the new application "Kool things" that the personal computer based on the Pentium II can achieve.

What Intel had learned was to control and utilize their technology roadmap to their advantage. Using this learning they plan and introduce products before imitators could imitate their products. When to move the demand from one product to the other and when to make the older generation product obsolete. This can be explained using McKinsey's S-Curve. The first step is to introduce the new product before the competitors start to imitate the current product. During this time the new generation is only used by limited application and the volume and revenue is still focused on the older generation product. The second step starts when competitors are about to release a product similar to the older generation product. At this time

Intel mobilize their marketing skills and move the demand to the newer microprocessor rendering its own design, and the competitors obsolete and without demand. It is when Intel abandons a profitable product and focus on a new product before the competitors have a chance to imitate their products. These steps can be visualized on Figure #1.

Figure #1, Product Generation Strategy



Intel during the following product transitions 486, Pentium, Pentium Pro, Pentium MMX, has perfected this processes. Intel noticed that there are some external forces that can affect their product transition. Intel has studied them and they have placed resources to influence them.

Intel knows that consumers need motivation to spend top money purchasing the newest and greatest microprocessor. For that reason, Intel is exploring several projects that would create a need for extra processing power. Since the first microprocessor generations, Intel had the advantage that the newest and greatest microprocessor was available in the market. This interdependency between Intel's microprocessor and applications can be compared to the interdependency of automotive and gasoline, or of VHS players and VCR movies. If both are available the products will succeed, if not the product will flop. Examples like the Betamax video recorder, the electric and diesel automotive demonstrates that the product will fail if the interdependent product is not developed in parallel. Intel had depended heavily on Microsoft applications to provide new uses for the microprocessors, but Microsoft today, is focusing also on several other areas as Windows CE and software for Macintosh. Intel, being paranoid does not want to have its future depend on other companies is engaged in several areas in order to develop that new killer application that can only be run on Intel microprocessors.

An external force need to be present in order to have a successful market

transition is an application. Lotus 123 was one of the first application that motivated customers to purchase the 286 based computers, since they could do equation tables that allowed them to do "what if scenarios" real time. Other applications that followed and motivated further product generations where Windows with it graphic user interface, and multimedia. Intel is now in the middle of a product transition and is making sure of new applications that will motivate the use of the computer by either assisting developers or creating them in house.

The microprocessor strength is in data processing and what better applications to use the additional computing power of a new microprocessor in data processing that video, audio and digital communications. On the audio, front Intel in working on at least two projects on Audio Codec (AC) '97, and Intel's 3D RSX technology. Audio Codec ' 97 is a co-development with Creative Labs, National Semiconductor and Yamaha. It is a technology that would allow the personal computer, using an Intel microprocessor, to integrate high fidelity audio circuitry, digitally intensive PC bus interfaces and synthesizer circuits into a cost effective guidelines. This is designed to help PC OEMs support the next generation audio-intensive PC applications such as DVD, 3-D multiplayer games and interactive music, supporting up to six surround outputs. The 3D RSX technology is a new software that allows an Intel based computer to reproduce surround sound from all directions using only two speakers. These audio applications will eliminate the need for an expensive external surround sound decoder as the microprocessor is performing that function. The 3D RSX technology is the first software to meet Dolby Laboratories' stringent requirements for Virtual Surround playback.

Another data intensive is Digital Video, and Intel is focusing resources in order to assure that their microprocessor is in good position to be the device of choice for processing. Intel is working on still pictures Intel is working on creating a design guideline called the Portable PC Camera '98 to capture, enhance, store and share images using the power of an Intel based PC. It is also focusing resources in the Digital TV areas. Intel is backing an approach for digital cable TV, Digital Video Devices (DVD) and High Definition Television (HDTV) open standards. On the HDTV Intel is supporting a standard that competes with Microsoft and is spearheaded by a firm that majority-owned by Oracle. Intel aims of inaugurating an open standard for set-top boxes and digital TV.

Integrating the advances into audio and video, Intel creates what could become another motivational application, the computer based video communication. Intel developed the ProShare ™ Technology which allows the Intel passed PCs to be used as a video communication device. The ProShare ™ Technology have been integrated into different new products like the Intel Create & Share ™ Camera Pack and the Conference room PC. The Create and Share Camera Pack is an all in one PC communications, photo and video editing package that includes an Intel PC camera, hard ware, integrated suit of communications and image-editing software, and also includes the Intel Video Phone.

Another new use that can motivate the need for new microprocessors is electronic commerce. Intel and the U.S. arm of German enterprise software giant SAP joined forces and created a new company called Pandesic. The charter of this new company is to create an application that will fulfill the order

fulfillment, store managing, warehousing, accounting, logistics, operations, and payment, all using and Intel based computer. If Pandestic is successful in their charter they will provide the PC users an application reserved for mainframe. Another area of focus on the electronic commerce is the "Point of View" ticketing technology that Intel and Ticketmaster are developing. This application will allow Internet users to preview the seat they are procuring before purchasing the ticket. If they approve the seat they can procure the ticket, as well as merchandise and food that will be delivered to their seats over a secure connection of Internet.

The transmission of electronic commerce information as well as audio and video communication will greatly motivate the growth of the PC but there is one problem. How to allow the computer to reliably and efficiently sends large amounts of information? The solution is improved Internet standards. On this area created the Intel Web Design Effect Software, The Intel Indeo video software, and the Intel Indeo audio software. The Intel Web Design Effects Software is the software that uses the PC's processing power to manufacture the graphic effects, more wisely than sending complicated images via Internet. For example, generating running water, floating clouds and other effects on web pages. The Intel's new Indeo video software 5.0 enables PC users to look at videos more quickly from the web and download and save high-quality files. Intel's new Indeo Audio Software will advance audio squeezing capabilities performing up to 8:1 ratio that deliver high-quality sound over the web [15]. Intel is also working on solutions to reduce congestion on the Internet [11] some areas that Intel is focusing is by broadcasting and storing in memory documents rather than going to the source every time needed.

Other areas of focus are games, animation and digital arts. Intel is helping to develop an Open Arcade Architecture that allows developing arcade games based on an Intel based computing. On the animation front Digital Arts is being addressed by a long-term initiative to support the research of digital arts between Intel and the California Institute of the Arts (CalArts).

What will be the next applications? Well the only thing published that will give us an idea of what is in the design table for future applications is the Car PC technology. Intel and Citroën introduced Car PC technology which provides navigation and information to driver and amusement to passenger. This technology will enable drivers to update weather, traffic and tourism information, which can be downloaded data directly from Internet, drivers can also respond to electronic mail immediately by using speech converter, or listen to music with Dolby Surround Sound Stereo. This integration between automobile and personal computer is the first of its kind.

Intel is focusing on providing added value to direct customers, the Original Equipment Manufacturers. Intel focuses on providing their customers more value than the competitors can. An example of the value added mentality can be see by Dr. Gordon Moore explanation of this area: "We'll sell you (the integrator) the complete circuit for less than you can buy the individual components to build your own .... And from those very simple circuits it's grown in complexity. We've had to bring more and more and more and more of the stuff onto the chip. And the result is, in technology, it often swallows the customer's added value and gives it back to them for free." "The customer that understand that, anticipate it and use it, have been very successful. Those that try to resist it find themselves spending a lot of time and energy and money on things that their

competitors don't." [17] This theory has been successful as competitors in the microprocessor markets do not have the ability to provide the complete solutions that Intel provides. At this time Intel is providing processors, chipsets and motherboards [5].

Another external force needed to archive a successful product transition is the ability of the entire system to sustain the improvements of the microprocessors. Intel can not wait for the rest of the system to match the speed of its microprocessors. In order to prevent processing bottle's neck, they are influencing the computer industry to increase the processing speed. Intel generation change depends on the need for faster microprocessors, but if there is another area of a computerized system that will limit the speed of the microprocessors to obtain and receive data, the end user will not have any benefit in going to the next generation product. A comparison can be made to the automotive racing market. If a car maker develops a 300 mph race car, but the tire makers only have available 120 mph tires, nobody will buy the new 300 mph car as they can spend less with a 120 mph car. Following this analogy, in order to utilize microprocessor go at full speed it needs to receive, deliver and store information at the same speed. Intel has been influencing the market either by creating open standards or by selling products needed to increase the speed of the Intel centric computer industry.

Intel needed to increase the performance of the personal computers and they have done it by improving the channels that the information need to move across. The computer transfer information on what it calls as BUS. A BUS is a series of cables, or connections, that connect different parts of the computers. A BUS controller regulates the traffic of information in the cables. The entire system of BUS connections and BUS controller is called the BUS architecture. Intel has improved the internal BUS of the computer by increasing its bandwidth, number of cables of simultaneous data transfer, and by increasing its speed and efficiency of those buses. Examples of these BUSES are the PCI BUS, the Accelerated Graphics Port [26,42], and the Universal Serial BUS (USB) that allow faster connections to keyboards, modems, scanners and other peripherals [9]. Another BUS designed solely for the purpose of the current product transition is the Dual Independent Bus Architecture of the Pentium II processor [26,42]. Intel is also working on using its own component expertise to create parts that will allow a faster computer, examples of these are the I2O, Intelligent Input/Output [26] controller. Intel is also assisting with Corolary allowing connections of up to eight processors in parallel [12].

Most of the information that a personal computer processes comes from the outside of the computer. Intel also needs to address this technology that is the external to overall system performance. Intel has created a wide range of products aimed to increase the speed, and bandwidth, while lowering the price of data transfer over networks [49,14,15]. Intel has 100 megabytes solutions for Network adapters, Hubs, Switches and Routers [29,30] in order to satisfy broad bandwidth on corporate systems, Intel Home Networking Division recently acquired Dayna corporation [23] in order to facilitate data transmission from the home user.

Andrew Grove's philosophy of "Only the Paranoid Survive" attitude have

prepared Intel to recognize, understand and to prepare for risk areas that may hurt the company. Intel already lost the memory market by underestimating the Japanese memory makers. From this lesson, they learned and they are working to prepare and prevent a similar loss to happen again. We already discussed how the absence of new applications will prevent a new technology to be successful and we already discuss what new applications Intel is working on. We discuss how external factors could limit the usability of a faster microprocessor and what Intel is doing to influence them. However, there are several other risk areas that Intel needs to focus on to maintain their leadership in the marketplace. Andrew Grove wrote in his book "Only the Paranoid Survive," "I worry about competitors. I worry about other people figuring out how to do what we do better or cheaper, and displacing us with our customers." [xx].

Primarily, Intel needs to focus on is their direct competitors as Intel's key strength is its ability to design and produce the microprocessors that are ahead of the competition. More than 80% of Intel's revenue comes from sales of the microprocessor, the heart of 89% of the world's personal computers [10, p.104]. Clearly the microprocessor is Intel greatest strength that support its growth. For the reason, it is also the biggest risk factor that the company has to focus. The only thing that Intel can do to protect themselves from the competitions is to be always one step ahead in technology.

The main competitors are the direct imitators AMD and Cyrix. AMD was founded in 1969 by Jerry Sander, who was one of the directors of Fairchild Semiconductor. As a requirement of second source, AMD where licensed to make exact copies of Intel's i8086. Later during the introduction of i80486, Intel canceled the technology licensing of the i80486 that forced AMD to design own products. Their newest product the AMD K6 have created some interest at Compaq, a major PC producer, who is interested in using the AMD K6 for their low end PCs. Compaq estimates that the demand for the AMD K6 will be about one million chips annually. AMD is pricing their product for $80 to $90, which is lower than Intel's processors while its performance has been measured at only 7% of the Pentium II 300mhz [50].

Cyrix was founded in 1988 and focused on competing in the numerical processor extensions (NPX) market. In 1993, they started to produce microprocessors that competing with Intel's 486, called Cx486. Their latest product is the 6x86 MX processor that Cyrix claims that its 233 MHz version has performance enough to compete with Intel's Pentium II 233 MHz version. Cyrix also have a business relationship with Compaq to provide microprocessor for their low end PCs.

Motorola have also been producing high performance microprocessors since 1978. Their primary customer is the Apple Macintosh system, but as the Apple Macintosh system has been a closed system, Motorola's processor growth has been limited to Apple growth. Motorola later joined forces with IBM in 1991 to create the PowerPC microprocessor, a Reduced Instruction Set Computer (RISC) based system.

Digital, once had the world's fastest microprocessor, but it could not use it to its advantage to dominate the market. In 1996, Digital had a market share of only 0.1% of the microprocessors [41]. Analyst speculates that the absence of software was the main reason why the Alpha, which was the world's

faster microprocessor, did not dominate the market [41]. Intel and Digital have been involve in different lawsuits over technological issues, Recently, these the lawsuits have been settled and as part of the settlement Intel will buy Digital's integrated circuits manufacturing facilities for $650 million [47]. Digital is also an Intel's customer, as they integrate Intel's microprocessor into their computers.

Sun Microsystems, founded in 1982, is one of the leaders in workstation's market. It main microprocessor product is the SPARC microprocessor, which is an open architecture, as Sun believes that open availability is critical to technological success [51]. It means programmers and product designers can support SPARC processors in a broad range. For this reasons there are some manufacturers that produce SPARC's technology processors such as Texas Instrument and Fujitsu. The current top processor of Sun is UltraSPARC-IIi, a high-performance 64-bit RISC processor. Sun already announced their new generation the UltraSPARC-III 600-Mhz to be introduced in the summer 1998. The SPARC technology currently has 1.2% of the market [41].

Hitachi is the major chip provider of the growing market of the handheld personal assistant. Hitachi recently announced two new RISC processors for handheld PCs, SH7708R and SH771R. With these processors, that are priced as low as $25, the handheld PC can work for as long as 50 hours or more with just two alkaline batteries [16]. These handheld devices use Microsoft's Windows CE as an operating system, which has been updated to support color display. Hitachi is developing a 64-bit microprocessor for such market.

Intel growth to 89% of the market creates another risk. Based on its size, Intel has to be attentive of the Antitrust and Monopoly laws. This risk increased as on September 24, 1997 Federal Trade Commission (FTC) staff notified Intel Corporation that the commission has begun an investigation of the company's business practices [27]. The subpoena served on Intel by the FTC says that the FTC is looking into whether Intel "has engaged, or is engaging in unfair or deceptive practices.... by acting to monopolize, to attempt to monopolize, or otherwise restrict price or competition in the development or sale of microprocessors or other components or intellectual property"[5]. Antitrust laws encourage competition by preventing monopolies. True competition benefits consumers by ensuring lower prices and newer and better products. Two major federal antitrust laws are designed to protect competition, Sherman Antitrust Act and the Clayton Act. The Sherman Antitrust Act, passed in 1890 outlaws all contracts, combinations, and conspiracies that attempt to create a monopoly. The courts have ruled that is not monopoly cannot be defined as a company that dominates the market, the important is not how the monopoly was achieved. The Clayton Act signed in 1994 states that mergers or joint ventures among companies are prohibited if the effect will lessen competition. Analyst agrees that there is no objective evidence against has been made public. The reason for the investigation has been described by Richard F. Doherty, director of The Envisioneering Group, a marketing research firm based in Seaford, New York. He explains, "AMD and Cyrix are getting attention from the FTC here ... The Pentium II architecture is an extremely complex design protected by trade secrets and practically impossible to copy. No public statement have been made by Intel if this investigation could put the company at risk. We know that in 1993 FTC performed a similar investigation and concluded that no further action was warranted and the investigation

was closed" [27].

Not having sufficient or the best creative minds is another risk for Intel. Intel strategies and products described above need an incredible amount of brain power to create and generate. In order to continue delivering products at the rate needed to stay ahead of the competition, Intel needs to fully staff those projects with the best personnel available. In order to do so Intel is focusing on three fronts, training, recruiting, and education. Intel has 60,000 employees that need to keep trained in order to prevent company wide obsolescence. In order to do so Intel spends 6% of its total payroll $160 million last year on its in-house university, and all senior managers must teach stint there every quarter [1x]. Intel also needs to continue growing and recruit the best personnel available. The strategy to recruit the best personnel as described by Craig Barret is that "success attracts the best people and the best people sustain success.... People perceive us as leading-edge, successful, and visible in the marketplace, and they want to be a part of that" [1x]. The recruitment strategy works only when there are personnel to be recruited, and in order to assure this availability Intel have the program called Technology for Education 2000 where Intel is spending $85 Million Dollars on research and development on local universities. This grant will be used to assist the universities in educating new scientist. Tim Saponas, Intel's Corporate Contributions Manager who announced the grant expressed that "The long-term success of our industry and other industries depends on the quality of U.S. research universities, their computing infrastructure and the skills of their students," [3x].

In conclusion, Intel has grown from a start up company to be the biggest player in the computer industry by learning the strategies of: fast product introduction, creation of new markets, forcing obsolescence of products and by being paranoid. We have presented how Intel directs its resources to do fast product introduction; and how Intel uses its OEM and end user marketing programs, its applications and technology development in order to introduce a new product. We have presented how Intel creates new markets by developing new applications and by its marketing programs. We have presented how Intel forces obsolescence of older products by creating new and more powerful applications that will need the processing speed of new processors, how Intel uses it marketing programs to show the new applications. We have also presented how Intel paranoid attitude has allowed Intel to address the risks that could challenge their market leadership.

There is one risk that we had not discussed: what would happen if the computer market changes and Intel does not realize it on time? If this would happen it will create a great opportunity for the competitors to challenge Intel's leadership. In November 24, 1997 Intel was the first company to announce a change in the computing market. Intel announced that the computer market is now subdivided into new segmented markets, and, at the same time, that they will reorganize to be able to focus on this new market structure, proving that even with the size of 60,000 employees Intel still have the flexibility to adapt faster than their competitors [39]. By using this example and the strategies of, fast product introduction, creation of new markets, forcing obsolescence of products and by being paranoid we can conclude that Intel as a corporation have proven

to has the strength, knowledge and flexibility needed in the years to come.

References

[1] Armbruster, Elif S., "The numbers," Worth, November, 1997. (125)

[2] Block, Jane, "The antitrust maze," http://www.news.com/News/Item/0,4,14628,00.html, August 22, 1997

[3] Clark, Tim, "SAP, Intel team on e-commerce," http://www.news.com/News/Item/o,4,13100,00.html, August 5, 1997.

[4] CNET Staff, "Intel under scrutiny," http://www.news.com/News/Item/0,4,14618,00.html, September 26, 1997.

[5] Crothers, Brooke, "Do PC feel pressured to use Intel?" http://www.news.com/News/Item/0,4,14622,00.html, September 23, 1997.

[6] Crothers, Brooke, "Intel goes with Oracle on digital TV," http://www.news.com/News/Item/0,4,14883,00.html, October 3, 1997.

[7] Crothers, Brooke, "PC of future packs 350 MHz, DVD," http://www.news.com/News/Item/0,4,14690,00.html, September 29, 1997.

[8] Davis, Jim, "Digital TV gets a step closer," http://www.news.com/News/Item/0,4,13354,00.html, August 14, 1997.

[9] Festa, Paul, "USB coming of age?" http://www.news.com/News/Item/0,4,14864,00.html, October 2, 1997.

[10] Fryer, Bronwyn, "The product," Worth, November, 1997. (104)

[11] Galante, Suzanne, "Inktomi gets investment from Intel," http://www.news.com/News/Item/0,4,15037,00.html, October 8, 1997.

[12] Galante, Suzanne, "Intel acquires chipmaker Corollary," http://www.news.com/News/Item/0,4,14783,00.html, September 30, 1997.

[13] Grove, Andrew S., *Only the Paranoid Survive*. New York, NY: Doubleday, 1996.

[14] Haskett, Ben, "Intel, 3Com battle for Ethernet," http://www.news.com/News/Item/0,4,13557,00.html, August 20, 1997.

[15] Haskett, Ben, "Intel unveils new network cards," http://www.news.com/News/Item/0,4,14024,oo.html, September 8, 1997.

[16] Hitachi America, Ltd., "Hitachi's 100-MIPS SH-3 series 32-bit SuperH RISC microprocessors enhance the performance of personal access system," http://www.halsp.hitachi.com/news/html/pmh13pr008d1.html, September 29, 1997.

[17] Intel Corporation, "An Update on Moore's Law," http://www.intel.com/pressroom/archive/speeches/gem93097.html, September 30, 1997.

[18] Intel Corporation, "Centropolis, Fox And Intel Offer Parallel Television And Internet Series," http://www.intel.com/pressroom/archive/releases/cn092597.html, September 25, 1997.

[19] Intel Corporation, "Deutsche Telekom Signs Agreement To Sell Intel Business Video Conferencing System In Germany," http://www.intel.com/pressroom/archive/releases/ps080597.html, August 5, 1997.

[20] Intel Corporation, "Government-Industry Partnership To Develop Advanced Lithography Technology," http://www.intel.com.pressroom/archive/releases/cn091197.html, September 11, 1997.

[21] Intel Corporation, "Intel's And CalArts Announce Long-Term Program To Enable Next-Generation Digital Art," http://www.intel.com/pressroom/archive/releases/cn805971b.html, August 5, 1997.

[22] Intel Corporation, "Intel and Industry Leaders Unveil Intel-Based Servers with I20® Technology," http://www.intel.com/pressroom/archive/releases/io100797.html, October 7, 1997.

[23] Intel Corporation, "Intel Announces Intel Create & Share™ Camera Pack,"

http://www.intel.com/pressroom/archive/releases/ps091597.html, September 15, 1997.
[24] Intel Corporation, "Intel Connected Car PC Technology Demonstrated At World's Largest Automotive Show," http://www.intel.com/pressroom/archive/releases/ic090997.html, September 9, 1997.
[25] Intel Corporation, "Intel Corporation Annouces Audio Codec (AC)' 97 2.0 Update," http://www.intel.com/pressroom/archive/releases/pi072897.html, September 30, 1997.
[26] Intel Corporation, "Intel Corporation Introduces Next-Generation Pentium® Platform With New 440LX AGP set," http://www.intel.com/pressroom/archive/releases/cs082597.html, August 25, 1997.
[27] Intel Corporation, "Intel Notified Of FTC Investigation," http://www.intel.com/pressroom/archive/releases/CN092497.html, September, 1997
[28] Intel Corporation, "Intel Releases Design Guideline For PC Cameras," http://www.intel.com/pressroom/archive/releases/pio072897.html, July 28, 1997.
[29] Intel Corporation, "Intel Reuters Use Internet To Help Cut Wide-Area Networking Cost," http://www.intel.com/pressroom/archive/releases/nw082597.html, August 25, 1997.
[30] Intel Corporation, "Intel's Industries First Single-Chip Networking Adapters Deliver More Responsive and More Manageable Computing Experiences," http://www.intel.com/pressroom/archive/releases/fe090897.html, September 8, 1997.
[31] Intel Corporation, "Intel's Pentium® II Processor Delivers Visual Computing Capabilities To The Entertainment And Animation industries," http://www.intel.com/pressroom/archive/releases/wp080597.html, August5 1997.
[32] Intel Corporation, "Intel Surround Sound Software is Dolby*-Approved," http://www.intel.com/pressroom/archive/releases/in061797.html, June 17, 1997
[33] Intel Corporation, "Intel Unveils New Multimedia Software for Internet Web Pages," http://www.intel.com/pressroom/archive/releases/in080597.html, August 15, 1997.
[34] Intel Corporation, "Interact with history," http://www.intel.com/intel/museum/25anniv/iwh/iwhq8c.htm, 1997. (i4004)
[35] Intel Corporation, "Interact with history," http://www.intel.com/intel/museum/25anniv/iwh/iwhq9a.htm ($60,000)
[36] Intel Corporation, "Interact with history, 1969," http://www.intel.com/intel/museum/25anniv/iwh/iwh_q5.htm, 1997. ($2672)
[37] Intel Corporation, "Interact with history, a walk on the wild side," http://www.intel.com/intel/museum/25anniv/iwh/iwh_q7.htm, 1997.(ted hoff)
[38] Intel Corporation, "Interview with visionary, Michael Slater," http://www.intel.com/intel/museum/25anniv/int/slater.htm#microprocessor
[39] Intel Corporation, "Intel Reorganizes to Serve Marketplace Segmentation," http://www.intel.com/pressroom/archive/releases/CN112497.html, November 24, 1997.
[40] Jackson, Tim, *Inside Intel. New York*, NY: Dutton, 1997
[41] Judge, Paul C., Reinhardt, Andy, and McWilliams, Gary, "Why the fastest chip didn't win," Business Week, April 28, 1997. (%)
[42] Kanellos, Michale, and Crothers, Brooke, "Intel has new chipset for 3D graphics," http://www.news.com/News/Item/0,4,13605,00.html, August 25, 1997.
[43] Kanellos, Michale, "Pentium II PCs will get faster design," http://wwwnews.com/News/Item/0,4,13185,00.html, August 7, 1997.
[44] Kirkpatrick, David, "Intel's amazing profit machine," Fortune, February 17, 1997. (5.2 billion)
[45] Nocera, Joseph, and Kover, Amy, "Who Really Moves the Market, Part1," Fortune, October 27, 1997.
[46] Offerman, A., "Personal computer CHIPLIST 9.3 part 1 of 5," http://www.lib.ox.ac.uk/internet/news/faq/by_category.pc-hardware-

faq.chiplist.part1.html, June 26, 1996.
[47] Reinhardt, Andy, and Judge, Paul C., "Intel inside…DEC's chip plant," Business Week, October 20, 1997. (650)
[48] Ricciuti, Mike, "Intel, Ticketmaster in Web deal," http://www.news.com/News/Item/0,4,14730,00.html, September 30, 1997.
[49] Rupley, Sebastian, "Intel's media-rich net: CEO Grove bets on lacal bandwidth," PC Magazine, September 24, 1996.
[50] Snyder, Bill, "K6-266 challenges PII-266 on price/performance," PC World, November, 1997. (amd 7%)
[51] Sun Microsystems, Inc., "The UltraSPARC Processor—Technology White Paper, The SPARC Microprocessor Strategy," http://www.sun.com/microelectronics/whitepapers/UltraSPARCtechnology/ultra_arch_strategy.html, November 14, 1995.
[52] Willis, Clint, "The Business," Worth, November, 1997.