The Impact of Selected Determinants on the Perceived Competitiveness and Quality of Processor Manufacturers: A Case Study

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Abstract:

Purpose: The aim of the research was to compare Advanced Micro Devices Inc., and Intel processors with regard to selected market and technological determinants that influenced development of AMD and contributed to the increase of its competitive advantage in the processors market.

Design/Methodology/Approach: The research was carried out using the analysis of company's documentation and annual reports supported by statistical data from third party companies like, German retailer - Mindfactory.de or steam community. Additionally in this paper qualitative research was used among customers of AMD processors in order to evaluate the quality of products and operations. Conducted data analysis and empirical research has shown an increase of sales in volume of AMD products as well as an increase in the market share of processors in years 2016-2020.

Findings: The results indicate that advanced, innovative solutions have significant impact on achieving a competitive advantage in the market of desktop processors. Further determinates which play important role in this respect are quality, price and building positive relationships through regular feedback. Research reveals that competition entails the need of higher innovation if consumers have higher preferences for quality and lower price.

Practical Implications: Presented indicators may be useful for monitoring the performance of any company operating in technological competition to ensure appropriate conditions for the development and growth of its competitiveness.

Originality/Value: The specificity of competition based on the model of dynamic oligopoly in desktop processors industry limits the possibility of using exactly same determinants in other competitive markets although some aspects are common and can be taken into consideration by other companies.

Keywords: Competitiveness, quality, desktop processors industry.

JEL classification: L13, L26, L15.

Paper Type: Research paper.

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1. Introduction

The paper indicates the determinants that influenced development of Advanced Micro Devices Inc. (AMD) supported by the analysis of primary and secondary data as the significant increase of AMD company has been observed in years 2016-2020. Conducted data analysis and empirical research has shown an increase of sales in volume of AMD products as well as an increase in the market share of processors. Analysis of the processor market indicates how difficult this environment is for the enterprises and how huge are the barriers to enter the market. Competition in this sector of market has been lasting for several years between only two companies – AMD and Intel which is currently a leader of this market. Analysis of documentation and annual reports of both companies supported by statistical data of third companies helped to show how Advanced Micro Devices have significantly increased its competitive attitude and the conducted research allowed to collect data about quality of AMD operations and check what brings satisfaction to its customers and how they perceive company on the market.

Currently there aren't fixed determinants of entrepreneurship development. The fact is that enterprises are determining new factors that in significant way stimulate growth of them. Important determinants can be innovativeness which refreshes and improves the company's offer to market, abilities to take risk and to act more proactively to seize the opportunities or efficient human resources management.

The paper includes the analysis of company's documentation and annual reports supported by statistical data from third parties companies like: German retailer - Mindfactory.de or steam community. Authors analyse the competitive environment of AMD, compare revenues of companies and draw attention to investments and key business partners. Additionally in this paper qualitative research was used among customers of AMD processors in order to evaluate the quality of products and operations of company in past four years. Presented indicators in the research may be useful for monitoring the market of any company to ensure appropriate conditions for the development and growth of its competitiveness.

2. Desktop Processor Market – Consumer's Perspective and AMD's Performance in years 2016-2020

AMD and Intel are the two companies that have been contributing to the processor market for years (Goettler and Gordon, 2011) and have been the subject of comparative studies in literature (Kumar, 2019; Igiri, Asagba, and Olowookere, 2014; Najem and Sami, 2018). Head quarter of Advanced Micro devices is located in California in Sunnyvale and company was set up in 1969, while Intel is also located in California, but in Santa Clara and was created in 1968. The years 2016-2020 are extremely interesting in the context of the development of this market. By the end of 2016 Intel was the clear leader of this industry. To better understand the characteristics of processor's, it is necessary to explain these factors. Customer's making a purchase

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on processor market have to consider among others the following features:

1. Number of cores – Each processor has a central processing unit responsible for running a process. Higher number of cores will increase the overall performance, because there will be more processing units so more different processes can be managed by CPU at the same time (Hoffman, 2018).
2. Number of threads – These are logical central processing units. Manufacturers use their technology to implement them inside their processors (Intel – Hyper Threading, AMD – Simultaneous Multi-Threading). By these technologies a single core CPU appears as two logical CPU's to an operating system. The CPU use them to speed up program execution (Hoffman, 2018).
3. Lithography process – CPU's are made using tiny transistors and the smaller they are the less power is needed. Transistors are being measured in nanometres (nm). Smaller transistors are more power efficient, they can do more operations without getting high temperature as well as time of batteries is also extended. The smaller are transistors the better overall effect is (Heddings, 2019).
4. Thermal design power (TDP) – TDP is used to measure amount of expected heat that component will output under load. However, TDP is not a factor that should be used to correctly judge energy consumption. Rather it is the class to which the processor belongs. Energy consumption depends not only on the parameters of the component, but also the number of tasks and their complexity. CPU with higher TDP will usually provide more in terms of performance, but will draw more electricity from power supply (Rich, 2016).
5. Cache – Is a memory bank built within CPU module that help central processing unit in executing operations. Today's chips contain usually three caches, with L1 being the fastest but the smallest up to L3 which is the largest but the slowest and boosts the performance of L1 and L2 cache (Faris, 2019).
6. CPU's clock speed – clock speed represents how many cycles per second can CPU execute. It is measured in gigahertz (Ghz). Clock frequency is an indicator of CPU performance and how fast a central processing unit can process data. Generally, the higher clock speed it, the better it is. Today CPU's have a minimum "base" clock speed and a maximum "turbo" speed. When the tasks are more demanding, the turbo speed is being enabled. However, clock speed is not the only one good measurement of performance to consider when buying a CPU (Harding, 2018).

The above factors are not all which consumers have to consider. Other indicators that affect the choice of processor are based on currently owned hardware components, mostly on motherboard. Intel and AMD are developing own chipsets to their processors which are later implemented to motherboards. That means, that consumers which have a motherboard with chipset from AMD can't equip Intel processor because it has different socket. In such case, customer who wants an Intel processor has to buy a new motherboard with correct chipset that increases the total costs of change.

In 2016 AMD was a shadow for Intel company. Intel introduced advanced lithography process in their processors (14nm), with most powerful HEDT processor to date – 10

core i7 6950X. Besides the company has a wide offer for each segment of processor market. AMD was using more power-consuming, less advanced process (28nm) and introduced only processor for lower segment of market while for performance segment AMD had outdated units from 2014 year. In this case, Intel CPU's from segment performance/high-end desktop didn't have any competition advantage on the market. Consumers were purchasing Intel products much more often due to better performance and wider offer despite the higher price which was properly argued (Mindfactory.de 2020).

Year 2017 brought significant changes to processor market, especially by AMD company. Company introduced architectures based on "Zen" cores with new lithography process 14nm. Unlike the previous year, AMD introduced processors in each segment of the market. When company from Sunnyvale showed completely new processors Intel only focused on refreshing the processors from last year with slightly improvements. However during the premiere - Advanced Micro Devices company got some issues with delivering processors to retailers, which caused problems with their availability on the launch and the price was higher than the company declared but after a few months the problem of availability was solved. New CPU's of AMD proved to be very competitive because of the performance and the price. The effect was a significant increase in the company's sales as well as revenues (Mindfactory.de 2020).

Year 2018 was a continuation of AMD's development of the new microarchitecture. AMD introduced slightly improved technology process into refreshed Zen cores (Pinnacle ridge), thanks to which processors were characterized by improved processor clocks, lower power consumption and better memory controller. Meanwhile Intel company again focused mainly on refreshing a previous technology process (14nm), however consumers could benefit from the much higher clock performance (up to 5Ghz, when AMD best chips offered 4.2 Ghz), but still the AMD was much cheaper that why consumers was starting to choose their processors becouse of better price-performance relation. After small regression in AMD CPU sales in Mindfactory by the end of 2017, the premiere of Pinnacle ridge brings an increase in sales as well as in revenues for the company from Sunnyvale, when Intel continues in falling mainly in numbers of sales (Mindfactory.de 2020).

Processor market in 2019 belonged to only AMD company which was following the continuous development started in 2017. Matisse CPU's was characterized again by improvement in technology process which brings benefits to overall performance of the processors and by the end of year AMD introduced the first 12 core/24 thread consumer processor in enthusiast segment - Ryzen 9 3900X. Intel only presented chips from the previous year with version without integrated graphics and introduced cascade lake CPU's for high-end desktop market which are refreshed version of Skylake X processors. It is not difficult to notice Intel's problems in further development. The sales of AMD went up and their attractive offer forced Intel to decrease the price of Coffee Lake refreshed processor's even by 50%.

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By the start of 2020 AMD broke its own record and introduced first 16 core/32 thread processor (Ryzen 9 3950X) for consumers in enthusiast segment, and in High-end desktop segment the company from Sunnyvale revealed the first 64 core/128 thread processor (Ryzen Threadripper 3990X). The market of consumers processors in ages 2016-2020 shows a development road of AMD company on the market where Intel has been a leader for a long time with not equal competitor until year 2017 (Mindfactory.de 2020). Assuming the key facts of desktop processor market in 2016-2020 it should be stated as follows:

• 2016 is characterized by strong position of Intel on the market and big plans of AMD in development of the road-map,
• 2017 is characterized by execution of the plans of AMD with truly competitive microarchitecture for Intel processors and stagnation of Intel company and loose in sales,
• 2018 is characterized by development of the new microarchitecture by AMD company with strengthening its position on the market and slight improvement of Intel by refreshing their processors from previous year and little increase in sales according to previous year,
• 2019 is characterized by further development of AMD with introducing new technology process (7nm) in their processors and significant increase in sales with a big decrease in Intel company by the stagnation.
• 2020 is characterized by strong position of AMD company on the market with reveal the first on the world processor 64 core/128 thread for consumers. Further decreasing of sales in Intel company can be observed.

3. Desktop Processor Market Segments with Characteristics of Consumers and Analysis of weekly Sales Reports from Mindfactory.de

In order to understand better the customer characteristics it is needed to look closer at the market. AMD and Intel are using a division of desktop market into 5 groups:

1. entry level,
2. mainstream,
3. performance,
4. enthusiast,
5. high-end desktop.

Entry level segment are processors for less demanding users. Customers in this segment are mostly using computer for multimedia entertainment or work in office applications and/or programming software. Such activities don't need more than 4 cores to operate smooth and even watching movies in 4k resolution is no problem for these small processors. We can see some differences between Intel and AMD companies. AMD is more attractive with price for consumers and has lower power consumption. Looking at the data from Germany retailer – Mindfactory.de, consumers

much often choose processor from AMD at the beginning of 2020 – about 500 AMD CPU's sold with 150 Intel's in this segment (Figure 1).

Figure 1. *Entry level segment of market with sales in Mindfactory.de in 4ᵗʰ week 2020*

Entry level processors sales in Mindfactory in 4th week 2020
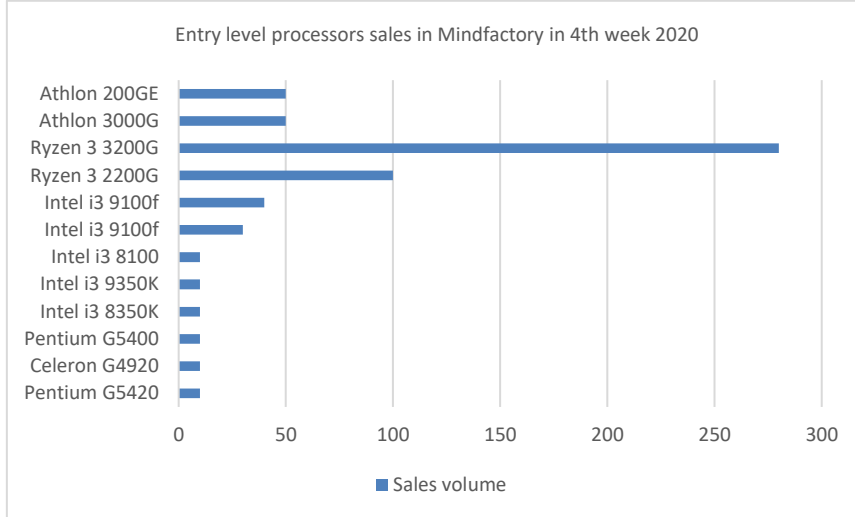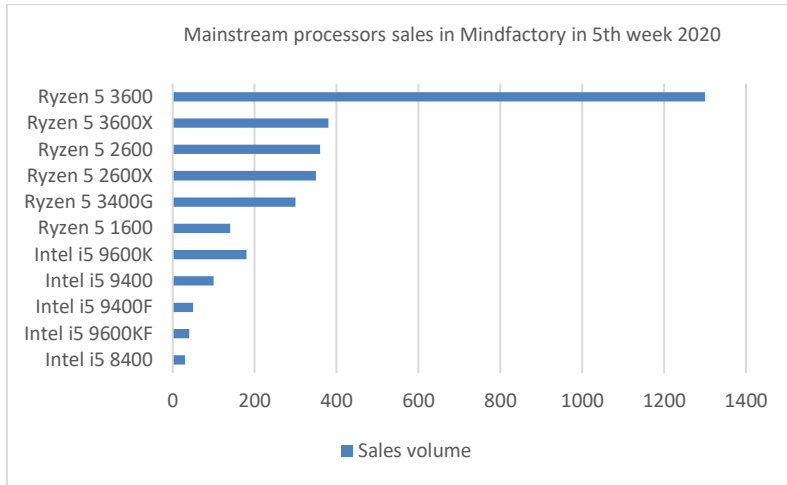
Source: *Mindfactory.de (2020)*

Mainstream segment are processors for daily users of computers with same tasks as in entry level but enriched with work in more demanding applications e.g., rendering apps, and playing various computer games. Based on the information retrieved from the company's website, AMD is more oriented in multi-tasking becouse of more available cores in processors (amd.com 2020). Becouse of more cores, the processor can benefits with longer life-cycle comparing to Intel core i5 unit. Also in this segment AMD is more price attractive for consumers. Intel benefits mainly with higher clock speed of single core, thanks to this consumers can have a better performance in applications oriented in single core operations. But nowadays applications are starting to make a use from larger number of cores, so again AMD with Zen processors are becoming a better option than Intel for clients becouse of having 12 threads. Confirmation of this statement may be the following sales results in Mindfactory which are shown below (Figure 2), where from mainstream processors – Ryzen's 5 are best-selling units (AMD about 2600 units, Intel about 500).

Performance market segment is for more demanding consumers who are working in professional applications or/and are creators in 3D environment or create videos and more. Performance market segment is characterized with processors equipped in 8 cores, so they are oriented on multi-tasking operations and the most demanding games. When it comes to comparison of two companies AMD again looks better than Intel. Besides of 8 cores, AMD has implemented into their processor a Simultaneous Multi-Threading technology, and their processors have extra 8 threads. For creators, professional users or streamers it's a big advantage becouse they can do more

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operations on the computer in the same time and render time is shorter. AMD is also much cheaper – about 15% when we consider Intel core i7 9700K with Ryzen 7 3800X.

Figure 2. *Mainstream segment of market with sales in Mindfactory.de in 5th week 2020*

Mainstream processors sales in Mindfactory in 5th week 2020

Source: Mindfactory.de (2020).

Intel wins again only in single core performance because of higher clock speed, but it is not enough to encourage customers to buy their processors which is shown on chart below from Germany retailer – Mindfactory.de with sales report of 8th week 2020 (Figure 3).

Figure 3. *Performance segment of market with sales in Mindfactory.de in 8th week 2020*

Performance processors sales in Mindfactory in 8th week 2020
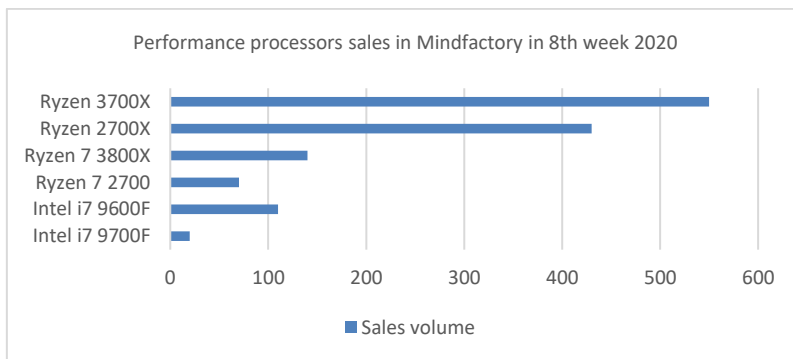
Source: Mindfactory.de (2020).

In 8th week of 2020, Mindfactory has sold about 1100 AMD CPU's and about 150 Intel's in performance processors market segment. Enthusiast market segment of desktop processors is designed for demanding consumers, same like processors in

performance market but mainly with guarantee in longer life-cycle because of more cores which is a large supply of power for several years. In this segment, we can see big differences between AMD and Intel company. We can say that Intel core i9 can compete more with AMD's performance processors becouse of equal number of cores/threads while AMD's enthusiast processors with Intel's HEDT. Becouse of this fact, AMD in this segment is less attractive with price but its argued with outperforming specification compering to Intel units. So, analysing the data we can say that the choice of processor in this segment for consumers is very simple and similarly says the Mindfactory.de report for 8th week of 2020 (Figure 4). In 8th week of 2020, Mindfactory has sold about 300 AMD CPU's and about 100 Intel's in enthusiast processors market segment.

Figure 4. *Enthusiast segment of market with sales in Mindfactory.de in 8th week 2020*

Enthusiast processors sales in Mindfactory in 8th week 2020
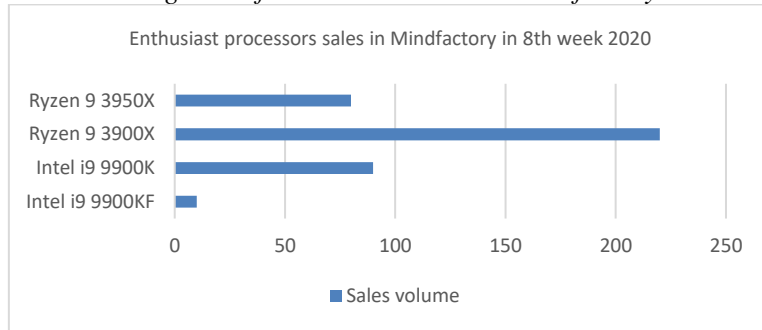
Source: Mindfactory.de (2020).

High-end desktop market segment of processors is designed for the most demanding professional users which want to create a workstation used in virtualization and very advanced rendering projects. Looking at data at table 13, its difficult to say that these processor compete in same market segment becouse of even more than triple times number of cores in AMD processors then in Intel's. Ryzen Threadripper processor are more similar with specification to Intel Xeon processors which are available on server market not a consumer. Apparently intel comes from the assumption that such a number of cores is not needed on the market for consumers and most of the users are unable to use the power of these processors. Different view on this market has AMD company, giving a possibility for consumers to build such a workstation. Unlike the previous charts, for HEDT processors segment chart present sales for 4-8th week of 2020 becouse of significant lower numbers of sales. Its shows that interest is such processor is lower, however AMD again sells more CPU's in this segment especially in Germany retailer – Mindfactory.de (Figure 5). During 4 weeks AMD has sold by this retailer 110 units of Ryzen Threadripper processors when Intel has only 30.

Assuming the key facts of desktop processor segments with sales in Mindfactory.de:

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- entry level – budget CPU's with max 4 cores mainly for multimedia entertainment and office applications. Sales of processors was 77% AMD when Intel got 23% during 4th week of 2020,
- mainstream – mostly targeted processors by consumers, with max 6 cores for gaming, multimedia entertainment and use in more advanced applications. Sales of processors was 84% AMD when Intel got 16% during 5th week of 2020,
- performance – processors for more demanding consumers and professional users, with max 8 cores. Sales of processors was 90% AMD when Intel got 10% during 8th week of 2020,
- enthusiast – processors for demanding users with guarantee of longer life-cycle with max 16 cores. Sales of processors was 75% AMD when Intel got 25% during 8th week of 2020,
- high-end desktop – processors for advanced workstations and virtualization with max 64 cores. Sales of processors was 78% AMD when Intel got 22% during 4-8th week of 2020.

Figure 5. *HEDT segment of market with sales in Mindfactory.de in 4-8th week 2020*
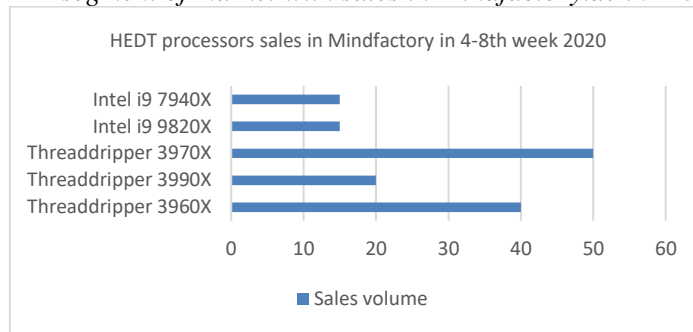
Source: *Mindfactory.de (2020).*

4. Characteristics of the AMD Competition Environment

On desktop processor market main competitor for AMD is Intel company. Intel company was founded in 1968 with name N M Electronics. Soon after, they purchased rights from Intelco to use name Intel. In 1979 Intel has produced first commercially available microprocessor – the 4004. In 1993 company introduced very powerful new processor – Pentium. These series of processors is produced up to nowadays in entry level processor segment. Intel's business offers computing, networking, data storage and communications solutions to a broad set of customers in multiple industries. In 2013 Intel company strategy has changed and was set to transform from a PC-centric company to a data-centric that brings collectively more revenues. On processor market, Intel is stuck with innovating its products in 14 nanometre manufacturing process technology. We can read in annual report 2018 of company that they face problems with implementing of 10 nm's and the premiere is delayed (Intel 2018 Annual Report).

Data-Centric business of Intel is oriented on server market with mainly Intel Xeon processors and Intel Stratix 10 SX FPGA with advanced AI that help consumers of company to better process and analyse data. PC-Centric business focus on personal computers and gaming market with its Intel core processors. Intel is making further investments to align demand of customers becouse competition with AMD is a big challenge mainly since 2017. Total revenues of Intel comes 52% from PC-Centric Business and 48% from Data-Centric. Net income of the company in 2018 was $21,05 billion (Intel 2018 Annual Report). while in 2019 it has decreased by 0,02% (to 21,04) (macrotrends.net 2020). Besides processors in Intel portfolio are:

• server boards and systems such as Intel NUCs,
• memory and storage,
• cellular modem, ethernet controllers, wifi, Bluetooth, silicon photonics,
• accelerators.

Intel company maintain investments at approximately 20% of revenue. In 2018 the investment in logic sector (platform products, like CPU and chipsets) and memory has grown. The first priority of Intel is to invest in R&D and capital to strength its position on the market (Intel 2018 Annual Report). R&D spending in Intel company (total $13,5 billion in 2018) (Intel 2018 Annual Report):

• investments in data-centric business,
• investments in 10nm process technology,

Intel employs 107,400 people and all of them are highly educated with approximately 85% of people working in technical roles. The company know that its success depends on its ability to attract and retain talented and skilled employees. According to factory network Intel has 9 factories (Intel 2018 Annual Report):

• 3 factories in USA (10nm. 14nm, 22nm, 32nm, 45nm process node)
• 1 factory in Ireland (14nm process node)
• 1 factory in Israel (10nm, 22nm process node)
• 3 factors in Asia – Malaysia, Vietnam, Chengdu (assembly and test)
• 1 factory in Dalian (memory fab)

AMD got very big competitor, which create huge entry barrier's for new companies in this industry. This is the main reason why there are only 2 companies on the desktop processor market. Share of this market was occupied mostly by Intel since years and some statics about this can be found in the most popular distribution platform of games – Steam. Steam is a digital distribution platform where are about 90 million registered users. Every month steam is collecting data from their users about hardware information's or operating system and post data on website. According to the newest data from February 2020, Intel is still leading, however AMD's share is slightly increasing (Table 1.). The reason is mainly in successful premiere of Ryzen processors

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with 7nm process technology while Intel got problems and has delay in adapting 10nm. Decrease of 2% by Intel during 4 months is without a doubt significant.

Table 1. *Share of processors in Steam community in 2019/2020*

	OCTOBER	NOVEMBER	DECEMBER	JANUARY	FEBRUARY
INTEL	80,6%	80,54%	80,61%	78,64%	78,61%
AMD	19,39%	19,45%	19,38%	21,36%	21,39%

Source: *store.steampowered.com (2020).*

5. AMD Company and its Development Plans for Desktop Processor Market in years 2016-2020

AMD company was founded in 1969 as a Silicon Valley start-up focused on semiconductor products market. In 2000, the company has introduced the first processor that breaks the 1 Ghz CPU clock barrier – Athlon 1000. Examples of innovation on processor market by AMD are much more, for example in 2004 the company presented the first dual core processor in industry which has been manufactured on 90nm process technology and was called HP ProLiant DL585 or in 2013 – the first CPU that reach 5GHz – FX-9000. Today AMD develops high-performance computing and visualization products. (amd.com 2020). AMD's portfolio is (AMD Annual Report 2019):2

- central processing unit (CPU)
- graphics processing unit (GPU) – is a logic chip, that helps in rendering animations, images, videos.
- accelerated processing unit (APU) – is a combination of CPU and GPU for users of mobile devices like laptops and is characterized with low energy consumption.
- system on chip (SOC) – similar to APU but is combined with more components, such as memory controller, peripheral management comprising a complete computing system on a single chip,
- chipset – is a device that allow the microprocessor to connect with other components of computer (like storage, peripherals, USB and more). Chipset manage system control and power management of all components within the computer.

**Table 2.** *AMD's product classification for each market*

Microprocessor and Chipset market	Graphics market	Server market and Semi-Custom and Embedded
desktop processors (e.g. AMD Ryzen, Ryzen Threadripper)	discrete desktop graphics (e.g. Radeon RX 5xxx series)	server processors (e.g. AMD EPYC, AMD Opteron)
notebooks APU's (e.g. AMD Ryzen Mobile,	notebook graphics (e.g. Radeon RX 5xxxM series)	SOC products designed for specific customers (e.g. SOC for game consoles)

Athlon Mobile both with Vega graphics)		
enterprise-class desktop/notebooks processors (e.g. AMD Ryzen PRO)	professional graphics (e.g. Radeon PRO)	processors for specific industries (e.g. AMD Embedded series for casino gaming or medical devices)
chipsets for own processors (e.g. A320, B450, X570)	data centric graphics (e.g. Radeon Instinct)	

Source: AMD Annual Report 2019 (2020).

It can be stated that AMD company operates in number of specific markets offering products for each market (Table 2). First consist of desktop processors, APU's for laptops, professional processors for both which are specially optimized for specific applications and chipsets that are responsible for control of these processors. Graphic market are similar like microprocessor but we can count here a specific GPU for data centres that are responsible for computing workloads including deep learning training. The last one are for specific customers (like OEM's – original equipment manufacturers) large data centres, manufacturers or system integrators (AMD Annual Report 2019).

Figure 6. *AMD's revenue in years 2015-2019*
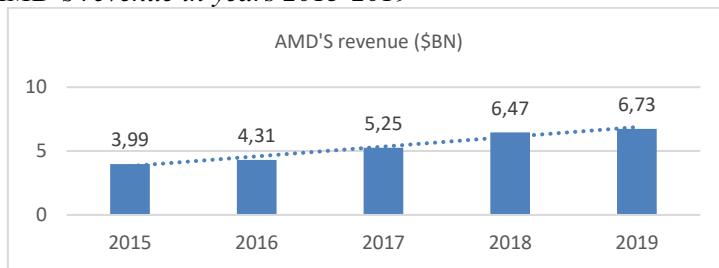
Source: AMD Annual Report 2019 (2020).

Revenue of AMD company is steadily growing every year (Figure 6). The biggest growth was noticed in 2018 (1,22$bn that give 19% of growth compared to 2017). In 2019 the revenue was 6,73$bn and with comparison to the biggest competitor – Intel, AMD revenue is lower by about 90% (Intel had 71$bn in 2019). The most of AMD revenues comes from USA and China (approximately 50%), however the biggest growth in years 2017-2019 is noticed in Europe. Starting from 267 million up to 762 million in 2019. The overall share of Europe in revenues is about 12% (AMD Annual Report 2019).When we look at operations, the biggest share in revenues has computing and graphics – 4,7$bn in 2019 (the successful premiere of Ryzen processors in 2017 got a significant impact in these results because since 2017 the growth is noticed mainly in these category) while servers, embedded and semi-custom products are behind them – 2,02$bn in 2019. Detailed data are presented in Figure 7.

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Since 2018 AMD has started gathering net income (Figure 8.), while in years 2012-2017 company got always net loss (statistica.com 2020). The premiere of new processors by the end of 2017 had started to bring profits for the company. The biggest share in incomes have processors and graphics, when they are bigger more than twice since 2018 from server, embedded and semi-custom market operations (Figure 9).

**Figure 7.** *Classification of AMD's revenues in years 2017-2019*

Classification of AMD's revenues ($BN)

	2019	2018	2017
Processors and Graphics	4,7	4,12	2,97
Server, Embedded and Semi-Custom	2,02	2,35	2,27
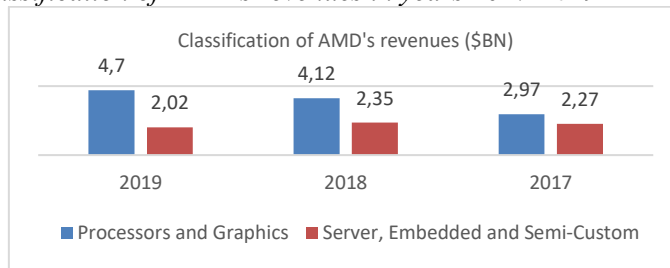
Source: AMD Annual Report 2019 (2020).

Figure 8. *AMD's net income in years 2015-2019*

AMD's net income ($M)

2015	2016	2017	2018	2019
-660	-498	-33	337	341
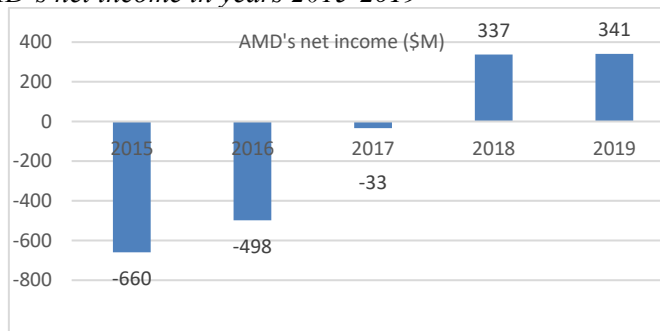
Source: statistica.com (2020).

Figure 9. *AMD's net income classification in years 2017-2019*

Classification of AMD's net income ($M)

|	2017	2018	2019
Processors and graphics	92	470	577
Servers, Embedded and Semi-Custom	132	163	263
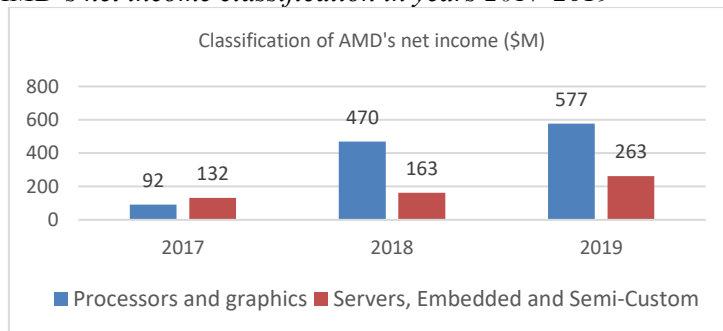
Source: AMD Annual Report 2019 (2020).

Financial conditions show that operations in desktop processor market since 2017 were very successful for company. AMD set up target in continuous improvement of

the technological advancement process of its products and they implement it thoroughly without any delays. This is one of the competitive advantage of the company.

The success of AMD's business depend upon ability to introduce new products on a timely basis with features and performance that provide value for customers. Thanks to increasing revenues, the company can invest more into research and development to keep up the continuous development (Figure 10).

Figure 10. *AMD's investments into Research and development in years 2017-2019*
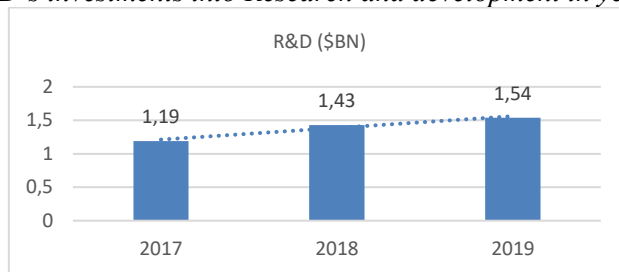
Source: *AMD Annual Report 2019 (2020).*

6. Key Business Partners and Risk Factors of AMD

When we compare employment of AMD company to Intel's, company from Sunnyvale is much more smaller than its competitor – about 10 times. Besides the human resources force, AMD company don't have any own production facilities, like Intel does. In this case, operations of company are much more dependent to its business partners and key actions to build relationships with them are very important. Main business partners for AMD are (AMD Annual Report, 2019):

1) Manufacturing – AMD company has agreement with two foundry facilities, Globalfoundires Inc. and Taiwan Semiconductor Manufacturing Company. Products from these partners are delivered to the Tongfu Microelectronics Co., which is responsible for testing, marking and packaging.

2) Add-in-Board Manufacturers (AIB) – AMD offers chipsets and graphics processors to AIB manufacturers who in turn build and sell products using AMD's technology (e.g. Asus, Asrock, MSI, Gigabyte, PowerColor and more)

3) Original Equipment Partners – these companies utilize AMD technology in their products, for example in laptops, game consoles (e.g. Microsoft, Sony, Lenovo, Apple and more)

4) Microsoft Corporation – AMD products are designed to run in Windows software. Support from Microsoft in developing the Windows and optimizing it for AMD products is essential. Microsoft's operating system is the most popular OS on the world.

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5) Third-party distributors – typically distributors maintain an inventory of AMD products and sell them to the final customer's or smaller OEM's and ODM's.

AMD rely on third parties in manufacturing facilities. It is very important to have reliable relationships with all of third-party manufacturing suppliers to ensure good product supply to respond to customer demand. Thus, the company have to manage these relationship in effective way because wrong management can affect financial conditions of the company and can result in lost sales. Similar situation is with depending on third-party companies add-in-board (AIB) and OEM's. They are responsible for designing motherboards for AMD's processors, GPU's, supporting APU's. If the designers will reduce the production of current or future products that are based on AMD technology, the business of company can be adversely affected.

Direct marketing of Company and sales efforts are supported by third-party distributors. Besides AMD products, they are also equipped in competition products. Termination of relationships with AMD, decided to choosing competitor products over AMD's can impact the ability of bringing the products to market and decrease the sales of the company. AMD operates in area of processors for desktops, laptops, servers and other OE's devices that are running under operating system.

The most popular operating system is Windows – about 88% of market share (netmarketshare.com 2020) (not counting smartphones market). Support from Microsoft company for AMD's products is very important. If Microsoft doesn't continue in developing its operating system and will stop in certifying a drivers for AMD's technology the customers can stop purchasing products from AMD company. Other important risk factors that can affect the AMD business are as follows (AMD Annual Report, 2019):

1. Intel Corporation dominance on the processor market,
2. generating too small revenues which may cause a slowdown of investments and general development of the company,
3. incompatibility of AMD technology with some of industry software,
4. decrease in supply-chain logistics efficiency,
5. cyber-attacks, data loss that can affect the reputation of the company,
6. political, legal, economic factors as well as natural disasters.

Future plans of AMD considering processors operations:

- In June 2020, company was to introduce new mobile processors and APU's for laptops based on 7nm technology,
- by the end of 2020, OEM's customers of company like Sony and Microsoft are going to introduce new generation of game consoles which are based on SOC of AMD,

- by the end of 2021, company want to introduce new desktop processors manufactured in 5nm technology process.

7. Measurement of AMD Operation's Quality in the Light of Empirical Research

7.1 Research Methodology: The Objectives of the Research

The research had qualitative nature and has been based on conducted survey among Internet users. Authors' expectations before research was about confirmation of very good quality of new AMD products and a high level of satisfaction associated with the purchase of these processors. The reasons of such expectations are rapidly rising sales and incomes of company as well as decreasing share of Intel processors on the market. Authors have used various forums with theme about computer hardware to choose the sample unit. Sample unit had a simple random character – every members of these forums had an equal chance of being selected. By sample unit, a person is characterized like: is a user of device with AMD processor that is based on Zen microarchitecture that had premiere in 2017. Research process was based on:

- designing a web survey using a Google forms,
- uploading of survey into 5 Polish forums devoted to clearly computer hardware-related topics,
- use of English-oriented community service such as Reddit to upload questionnaire into 4 communities with computer hardware as theme,
- taking a data from sample of 90 during the research which lasted two weeks,
- making an analysis of data using Excel.

Basic research objectives are for what purposes do the respondent's use AMD processors, what they guided when buying a device equipped with an AMD product and what were their motivations and needs. Author want to check the quality of AMD processors that had premiere in 2017 and to measure the satisfaction level among customers of this brand and loyalty. Next step is to identify the factors that affect perceived satisfaction and identify factors that create dissatisfaction. Last target is to check if respondents agree or disagree with statements that consider company from Sunnyvale and overall desktop processor market.

7.2 Standardized Questionnaire with Use of the CAWI Method

Computer Assisted Web Interviews (CAWI) are very popular nowadays because of very fast development of internet technology. This is a channel of very simple and fast contact with the respondents. It's a great marketing tool that can be easily adapted to any individual requirements in terms of the length of the survey, the type of questions asked, how to collect results and finally – their analysis and reporting. The online survey can be freely modified at any time or depending on the answers given.

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CAWI surveys are also much easier to correct when needed. Author has decided on choosing this method because of:

- very low operating costs – there is no need of printing, in order to build such questionnaire, Author has used free in use platform – Google forms,
- large range – easy access to various forums with theme that is related to AMD processors and its products,
- insight into the answers given by respondents in real time,
- provide maximum comfort for the respondents, which translates into their willingness to participate in the survey and reliability of the answers,

Designed internet questionnaire for this research had questions such as:

- related with user profile: what type of device and which AMD Zen processor does it has, for what tasks is this being used,
- satisfaction evaluation,
- importance of factors that have impact in creation of satisfaction,
- evaluation of factors that have impact in creation of satisfaction,
- experience with AMD evaluation,
- agree or disagree statements that consider AMD processors and its market,
- imprint: gender, age, level of computer skills.

7.3 Characteristics of the Surveyed Population

Research has been done among different users of AMD processors that are based on Zen microarchitecture (premiere in 2017) in different age groups. In questionnaire the authors set up 4 groups which respondents could match. First group, the smallest one, was people in age up to 17 years old – 9% of overall surveyed population. These are younger people, which mostly do not decide alone in what device they want to purchase, they are dependent on their parents, and they use computer or laptops to learn or entertainment. Next group consist of users which has already graduated, are starting to work and their purchasing are much more less dependent from their parents.

They are aged between 18 and 26 years old and they represent 30% of total surveyed population. Third group are mature people which focus on their profession development, are very active market participants and at the same time they are very important group of customers for technology companies, i.e., AMD. People in this group are aged between 27 and 39 years old and they are the biggest group in conducted research – 45%. Last group are adults, people over 40 years old, they are the most experienced and they represent 16% of overall surveyed population. The most interested in taking part in the research was men – 98% and only 2% women. The reason can be, that women are much less interested in technological aspects and computer hardware theme than men.

In questionnaire the authors asked respondents to match their level of computing skills. The scale got 4 stages: below average, basic computer skills, intermediate computing and advanced computing. It's very important in the subject of computer processors to choose the sample which has experience in using computers and its help them to better evaluate computer equipment from a purely technical side – such as the manufacturer provided to the market. Less experienced group can provide opinion which are not reliable, because they are using these devices contrary to the manufacturer's instructions and/or is infected with malware which significantly affects the performance of the computer.

In research the biggest group was – advanced computing – 71% of overall population, next was intermediate computing – 26% and last one basic computing equal to 3%. Next step in characterizing the surveyed population is the classification of their devices with processors. Main subject of conducted research are desktop processors created by AMD. However the authors accepted vast minority – 4% of overall sample – users of laptops equipped with AMD Zen processors. The fact is, this processors are very similar to desktop units, they base on the same microarchitecture but they got less TDP as opposed to desktop units. Next vast minority of conducted research are users of Threadripper processors – only 1%. The reason can be, this processors are for the most demanding professional users, characterized by higher price. Even for demanding gamers, amateur professional application users will not be able to make a use of all cores in these processors.

Moving to more numerous groups, there was 6% of Ryzen 3 users, so processors that belong to entry-level market that are for less demanding users characterized by low prices. Next are Ryzen 9 users – 13%, processors designed for enthusiasts and demanding users. The last 2 groups are Ryzen 5 users – 37%, mainstream segment which is balanced between price attractiveness and good performance and Ryzen 7 – 38%, performance segment.

7.4 AMD's Consumers Requirements: IPA Analysis

The authors asked respondents to match their requirements toward processors, using 5 stage scale – irrelevant, less important, important, mid-important and very important (Table 3). People could chose for each feature only one stage of importunateness. The result can be seen in Table 3. Looking at the results, classification of the importunateness for each factor is not easy. We can easily evaluate that Integrated graphics in CPU's are not important for the research sample. The vast majority chose this feature as irrelevant (81%). The reason can be that users prefer dedicated graphics processor units because of the significantly better performance than the integrated ones. Next less important factor again has been chose by the most of respondents (58%) and this is overclock possibility for CPU's. Author thinks that most of the users expect very good performance and quality of the product straight from the manufacturer, without the need of "enhancing" this. The hard part comes when we try to evaluate which factor is really semi or the most important. Looking at the numbers

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we can classify that in such order: single core performance is the most important (35%), after that multi core performance (43%) and then quantity of cores and threads (36%). However the numbers are very close to each other. The conclusion is that all of these 3 factors are really important for the consumers and fulfilment of these requirements can give an competitive advantage for AMD.

***Table 3.** Importance factors*

	Integrated Graphics	Overlock possibility	Quantity of cores & threads	Multi core performance	Single core performance
Irrelevant	81%	18%	0%	0%	1%
Less important	15%	58%	12%	8%	7%
Mid-important	1%	9%	36%	21%	33%
Important	1%	10%	21%	43%	25%
Very important	2%	4%	30%	28%	35%

Source: *Own research.*

Whether AMD has been fulfilment this requirements, we can check this by using an importance performance analysis tool. Author has asked respondents to rate the same factors based on their so far experience. The verbal scale was replaced by a numerical scale (1-5) and after research the mean values has been calculated for each factor. The results are presented in Table 4. Results presented in this form are easier to put them in correct order of importunateness. The most important for respondents was the multi-core performance then quantity of cores and threads and after that single-core performance. But still this numbers are very close to each other and it's hard to assess them that way.

***Table 4.** Mean values of importance and evaluation for each factor*

|	Importance	Evaluation
Integrated graphics	1,29	2,45
Overclock posibility	2,25	2,97
Quantity of cores and threads	3,85	4,42
Multi-core performance	3,91	4,38
Single-core performance	3,70	3,60

Source: *Own research.*

Next step of IPA is to move this results into coordinate graph (Figure 11). The factors has been allocated in four different blocs:

- A1 – these factors are one of competitive advantage for AMD. Company should focus on maintaining them on the high level and not let them fall. They are determining customer satisfaction,

- A2 – priority for improvement. AMD should focus on improving this factor and upgrade it, however they are also determining customer satisfaction,
- C1 - the least important factor for consumers. AMD should not treat this with priority,
- D – less important factor for consumers. However it has been good evaluated by respondents. AMD should not treat this with priority.

Figure 11. *Importance Performance Analysis*
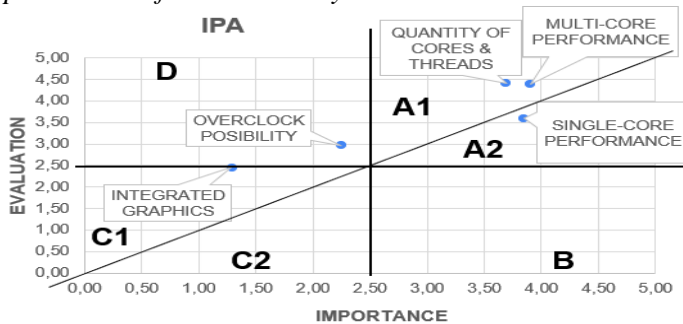
Source: *Own research.*
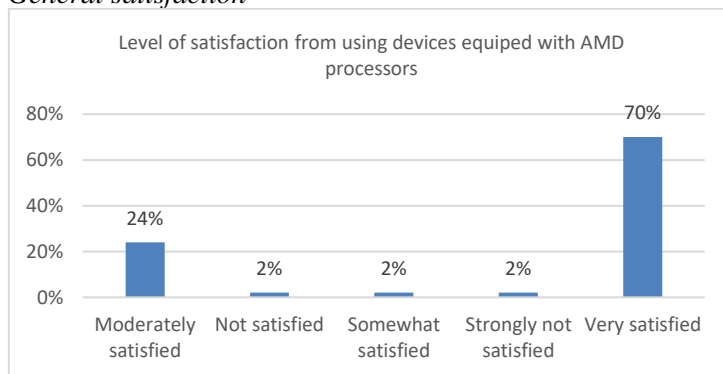
7.5 General Level of Customer Satisfaction

Satisfaction measurement has been supported by a question about perceived level of satisfaction while using a device equipped with an AMD processor. It is worth noting, that the general level of satisfaction is not only dependent on AMD company and its product, but on many other factors as well (e.g. manufacturer of this device) on which the company from Sunnyvale has less influence (AMD can decide to whom sell its products). General level of satisfaction from using a computer with AMD processor is very good. Only 4% of respondents has felt dissatisfaction from usage their device and 96% of them was more or less satisfied. That mean that AMD products built on Zen microarchitecture are really good as well as their cooperation with key business partners. General results are presented in Figure 12.

Figure 12. *General satisfaction*

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Source: Own research.

Looking for sources of satisfaction we should look into different types of processors. Results are presented in Figure 13.

Figure 13. *General satisfaction for different types of processors*
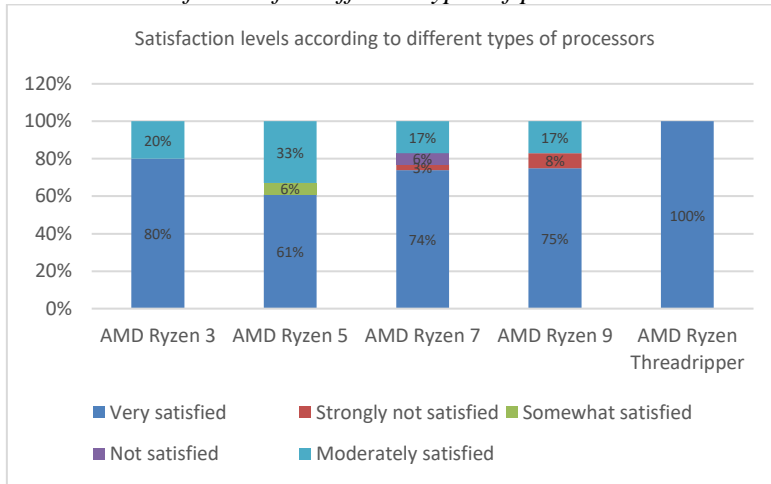
Source: Own research.

So generally speaking every user of AMD Ryzen 3, Ryzen 5 and Ryzen Threadripper was satisfied. Dissatisfaction has shown among users of AMD Ryzen 7 and Ryzen 9. To better understand the reasons, Author has calculated customer satisfaction index. CSI was calculated using data from Table 5 and is presented below for different groups.

Table 5. *Customer satisfaction index*

	CSI
All respondents	73%
Ryzen 3 users	62%
Ryzen 5 users	70%
Ryzen 7 users	74%
Ryzen 9 users	85%
Threadripper users	86%
Ryzen 7 dissatisfied users	84%
Ryzen 9 dissatisfied users	60%

Source: Own research.

Looking at the results we can say that CSI for all of these group is starting from medium level up (60%) up to very good (86%). The reasons of dissatisfaction among Ryzen 7 and Ryzen 9 users are not located in factors that are present in table 18. So, in next step the authors asked respondents to evaluate the AMD support in software and drivers update to their products and their opinion about work culture of these processors (Table 6).

Table 6. *Evaluation of AMD software and updates and processor work culture*

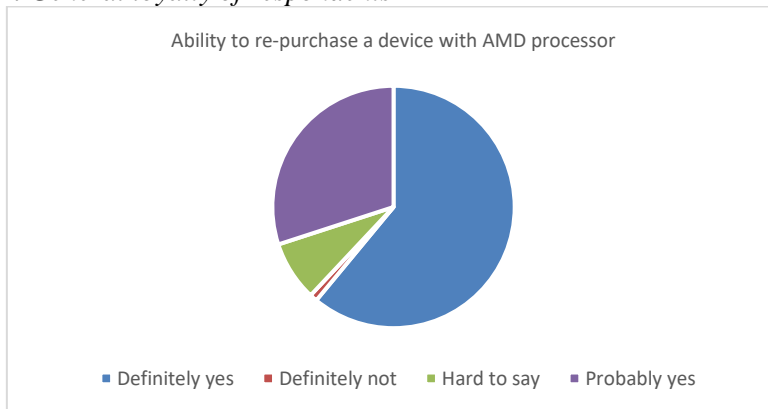|	Evaluation of AMD software and updates (1-5 scale)	Operating temperatures (1-5 scale)	Power consumption (1-5 scale)
Ryzen 7 dissatisfied users	2,47	2,66	1,66
Ryzen 9 dissatisfied users	4,00	4,00	4,00

Source: *Own research.*

While there aren't any problems for Ryzen 9 users, it is not as positive for Ryzen 7 users and it may be one of the sources of negative feelings. This three factors that AMD should carefully analyse and improve if necessary. The rest of the reasons may not come from AMD directly but from others that bring dissatisfaction for users of AMD processors.

7.6 Loyalty of the AMD's Customers and Net Promoter Score

Respondents were asked to validate their ability to re-purchase a device with AMD processor using a 5 stage scale (definitely not – definitely yes). The results are presented in Figure 14. The results are very positive. Only 1% has decided to not purchase a device with AMD processor again and 8% of respondents couldn't decide. This means that many users of AMD processors based on the Zen microarchitecture has trusted company and can't imagine buying another device without the Santa Clara company signature. This is undoubtedly a significant competitive advantage.

Figure 14. *General loyalty of respondents*

Source: *Own research.*

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A good indicator of loyalty and growth potential is NPS (Table 7). Authors asked respondents about how gladly they would recommend AMD to their relatives or family's using scale 0-10.

Table 7. *Net Promoter Score for AMD processor users*

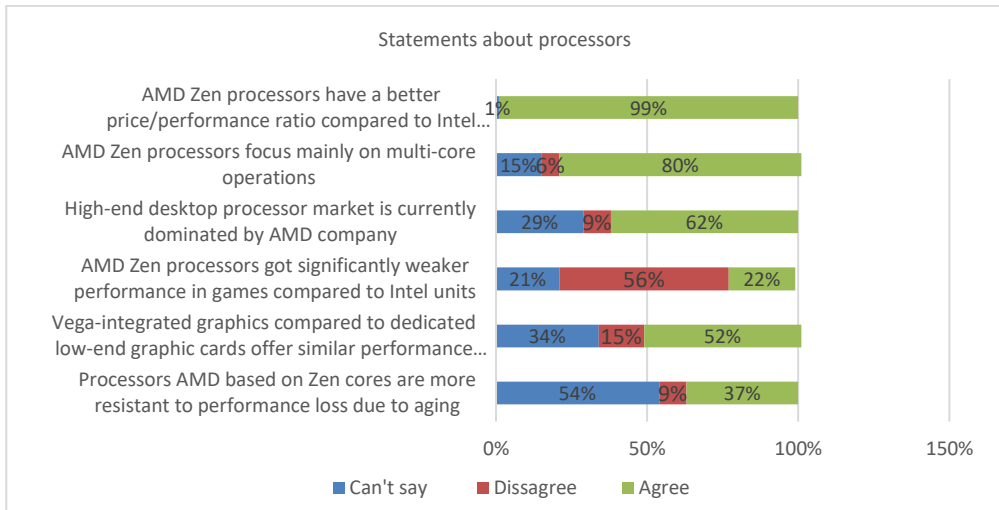|	Critics	Passives	Promoters	NPS score
All respondents	3%	16%	81%	78
Ryzen 3 users	0%	40%	60%	60
Ryzen 5 users	3%	14%	83%	81
Ryzen 7 users	3%	17%	80%	77
Ryzen 9 users	8%	8%	83%	75
Threadripper users	0%	0%	100%	100
Satisfied respondents	2%	16%	81%	79
Dissatisfied respondents	25%	0%	75%	50

Source: *Own research.*

NPS score for all respondents is equal to 78. Scores between 50 and 80 are very good and its mean that AMD is very good performing organization. Company should make appropriate adjustments to move the Passives to Promoters group in future as well as decrease the Critics to minimum.

7.7 Overall Evaluation of Experience with AMD Processors

Respondents were asked to decide whether they agree or disagree with some statements that consider processors and its market. They could agree or disagree but also not decide and stay neutral. The results are presented in figure 35. Looking at the chart, the hardest question for respondents to evaluate was about aging of processors. More than 50% couldn't decide whether they agree or disagree with this statement. However, 37% of respondent's was sure that Zen processors are more resistant to performance loss due to aging because of fact, that AMD has implemented more cores and used more advanced technology process than its competition (Figure 15).

Figure 15. *Statements about processors*

Statements about processors

Statement	Can't say	Dissagree	Agree
AMD Zen processors have a better price/performance ratio compared to Intel…	1%		99%
AMD Zen processors focus mainly on multi-core operations	15%	6%	80%
High-end desktop processor market is currently dominated by AMD company	29%	9%	62%
AMD Zen processors got significantly weaker performance in games compared to Intel units	21%	56%	22%
Vega-integrated graphics compared to dedicated low-end graphic cards offer similar performance…	34%	15%	52%
Processors AMD based on Zen cores are more resistant to performance loss due to aging	54%	9%	37%

Source: Own research.

Next question was about APU's. This combination of CPU with GPU is very attractive choice for less demanding users that are looking for cheap solution. Author has asked respondents whether Vega-integrated graphics is similar to dedicated low-end graphic cards and outperform Intel UHD graphics. More than 50% has agreed with that statements and that shows that APU's of AMD are really attractive choice. Without additional costs associated with the purchase of dedicated graphics card, consumers can play less demanding games or work comfortably and use multimedia on computer.

Another question is related with stereotype that AMD has been referring to for several years. It's about weaker performance in games compared to Intel units. For years, Intel has been the leader in this field, which showed significantly better performance in computer games due to the higher performance of a single processor core which was crucial in such computer activity. Now, 56% of respondents has disagreed with that statement. AMD thanks to new microarchitecture and more advanced technology process has improved performance per single core and consumer can benefit with better performance in games. Today, gamers have bigger choice on the processor market when they are faced with choosing a processor for their computer.

Other question was about market segment, to be more specify about high-end desktop. Comparing the latest releases of the processors of two competing companies, we can notice that AMD offer is bigger and more attractive for consumers. With such statement 62% of respondents has agreed. This is another area of the processor market in which the new premieres of AMD have greatly increased the competitiveness of this market.

Another question is about a usage of AMD processors. 80% of respondent's has agreed that Zen processors focus mainly on multi-core operations. The overwhelming number of cores on AMD processors compared to Intel may bring more benefits in the future for users of these processors as more applications will be optimized to better

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use multi-core power. Already, most applications are optimized to use more cores, however units like Threadripper 3990x (64 cores) can't be fully used by some operating systems today and cannot cope with this scale yet (Salter 2020). Last question was about price-performance relation. This statement was the easiest to evaluate by the respondents – 99% of them clearly agreed that AMD units are more attractive than Intel's in this field.

The general experience of respondents has been measured by asking them a question how would they evaluate their experience with AMD inside their device. They could choose using 5 stage scale, starting from very bad and ending with very good. More than 90% has evaluated this experience as positive. The results are presented in Figure 16.

Figure 16. *General experience with AMD*
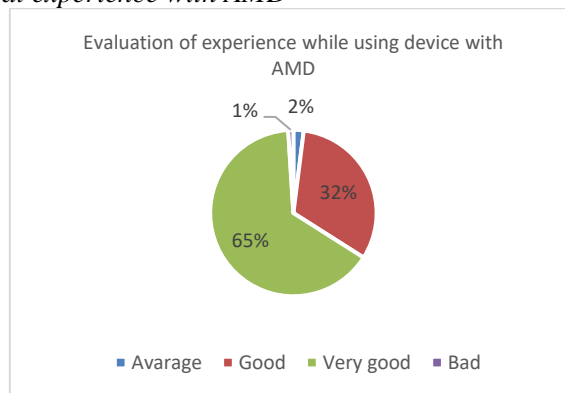
Source: Own research.

7.8 Summary of the Research

In conducted research the majority of respondents were men 98% and only 2% women. Despite the fact, the target of research were users of desktop processors (96% of respondents), the 4% of sample owned laptop with AMD processor. This is small part of test sample and laptop processors are based on the same microarchitecture like desktop's. They only have lower power consumption adopted to longer battery life. So they don't disturb the overall results for main objective or research. Owners of processors were divided into specific segments, the mainstream (40%) and performance (39%) is leading than we have enthusiast (14%) and entry-level (6%). The last one is high-end-desktop with 1% of total respondents**.** The sample unit size of different segments is similar to sales of processors, shown on example of retailer Mindfactory.de, when the numbers volumes of processors were more or less in the

same order**.** The size of the sample seems to be argued and this structure should not be surprising.

Factors that are important toward processors in descending order are: multi-core performance, quantity of cores and threads, single-core performance, overclock posibility and integrated graphics**.** Most of respondents decided that integrated graphics are irrelevant and they prefer to use dedicated one. Overclock possibility is neither important and more of respondents prefer to avoid this activity.

Importance Performance Analysis has shown that AMD mostly meets these requirements, especially quantity of cores and threads inside CPU's and their multi-core performance. These factors are main drivers when it comes to determine satisfaction and here company have competitive advantage. Single-core performance company should try to improve in next generation of processors to continue the development. Company could have noticed, that overclock posibility is not important for customers, so they instead of expanding this factor tried to get maximum power when it comes to the clock frequency of the core already in the production process, thus limiting the possibility of later modification of the processor speed. Similar situation is with integrated graphics – however company is trying to develop it to satisfying level with company's APU offering better performance than competition does but it's still weak when compared to mainstream GPU's, not mentioning better units. Company is seeking for additional opportunities in APU's and if IPA doesn't show possibilities now, we can't say it won't in next 4-6 years. When it comes to satisfaction, 70% of respondents were already very satisfied with using device based on AMD processor and 24% was more or less satisfied. The dissatisfied group was among users of AMD Ryzen 7 and Ryzen 9. The reason of dissatisfaction was about the software and drivers provided by AMD and the next noticed was high power consumption and operating temperatures of processors (table 20). Customer Satisfaction Index (CSI) for all respondents was equal to 73%. This is a very good result.

Next step in conducted research was loyalty. The ability to re-purchase a device with AMD inside was 61% - definitely yes and 30% - probably yes. High customer loyalty will significantly affect the company's future sales and by this increase the market share. The readiness to recommend the company to others has been measured using Net Promoter Score (NPS). For all respondents NPS is equal to 78. Results between 60-80 are treated as very good. Most Passive group among respondents were Ryzen 3 users and Critics was at dissatisfied users. Company should make appropriate adjustments to move the Passives to Promoters group as well as decrease the Critics to minimum. Next conclusions of research are as follows:

- very competitive prices and better price/performance ratio when compared to Intel,
- it's hard to evaluate if the latest AMD Zen processors are more aging resistant,
- AMD Zen processors can be a very good proposal for gamers as well,

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- HEDT market segment is currently dominated by AMD company,
- AMD Zen processors truly benefits when operating in multi-core optimized applications,
- APU's are best processors with integrated graphics on the market.

The overall experience with AMD processors that had premiere in 2017 was very good for 65% of respondents.

8. Conclusions

The most important conclusions after statistical data analysis of Intel and AMD corporation in years 2016-2020 supported by data from Germany retailer – Mindfactory.de and steam community:

- significant increase in the quality of products offered by AMD through the introduction of new processor microarchitecture in 2017 and its continuous improvement in next years,
- clear stagnation in the development of the technological process for industry leader – Intel corporation in years 2016-2020,
- decreasing Intel's sales to AMD in all customer segments on example on weekly sales in Mindfactore.de: entry level segment 77% AMD and 23% Intel, mainstream segment 84% AMD and 16% Intel, performance segment 90% AMD 10% Intel, enthusiast segment 75% AMD and 25% Intel, HEDT segment 78% AMD and 22% Intel,
- very effective management and cooperation with key business partners by AMD company in improving the quality of their products and generating revenues increases in the coming years (2016 – 4,31$bn and 2019 – 6,73$bn), the biggest share in revenues got processors and graphics (4,7$bn in 2019),
- Intel's big problems and delays in implementing the improved 10nm technological process of microprocessors in own factories despite huge revenues (70.8$bn in 2018) and investments in R&D (13,5$bn in 2018),
- AMD's large dependence on its key partners, mainly the factories (GlobalFoundries Inc., Taiwan Semiconductor and Tongfu Microelectronics Co.)
- starting to decrease profits by Intel in 2019 when compared to 2018,
- increasing of AMD share in processors among 90 million community – steam during 4 months in 2019/2020 up to 2%.

Reviewing annual data and analysis of sales and the market in which both corporations operate helps in obtaining the answer to the main research object. The analysis indicates a weakening of the current market leader in favour of the developing and very competitive in its activities – Advanced Micro Devices. The next step was to check how the customers of AMD perceive their new processors. It turned out, that

processors based on Zen microarchitecture were evaluated very positively among users. We can highlight the most important conclusions of the conducted research:

- the confrontation of the factors that affect satisfaction and their actual evaluation by AMD Ryzen users was positive, mainly for factors like: multi-core performance and quantity of cores and threads, expect for slightly weaker single-core performance with main prioritize to improve it in the future,
- factors that have proved to be less important for users of AMD Ryzen and to a lesser extent affect satisfaction are: integrated graphics and overclock posibility. The evaluation of these factors was on mid-level but their prioritize is not very urgent and should be improved in further future,
- CSI for all respondents is on high level and its equal to 73%,
- dissatisfied respondents complained mainly on software provided by AMD and on not good work culture of their processor such as high operating temperature and power consumption,
- NPS for all respondents is on high level and its equal to 78 points,
- overall experience of users with AMD Ryzen processors was at least good for 97% of respondents.
- in opinion of 99% respondents, AMD's Ryzen processor have better price/performance ratio compared to Intel's,
- in opinion of 52% respondents, AMD's APU based on Zen microarchitecture is outperforming Intel's proposition and is very good alternative for low-budget graphic cards,
- in opinion of 56% respondents, AMD's Ryzen processor are not only for applications where multi-core performance is needed but also for operations based on single-core performance such as computer games,
- in opinion of 62% respondents, HEDT market segment is currently dominated by AMD's Threadripper proposition.

The most respondents of research have expressed their satisfaction while using AMD processors based on Zen microarchitecture. The latest proposition of the company from Sunnyvale and their plans for further development encouraged users to continue using AMD's technological products in their future purchasing choices regarding desktops and laptops. No doubt an important factors besides the good quality of products offered is a very competitive price compared to Intel's products. Of course there are much more factors that have influence to the final success of AMD and which Author have tried to indicate and on example of these actions we can list 10 following determinants of entrepreneurship development in the desktop processor industry:

1. Effective cooperation with key business partners and taking care of relationships with them, the ability to conduct effective negotiations.
2. Constant development with timely introduction of modern solutions to the market.

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3. Investing in development to ensure the best quality of offered products.
4. Tendency to take risks and remove all barriers that limit the market due to the incompatibility of technological solutions.
5. Aggressive competitive activities, i.e. lower price of offered products, better quality or more advanced technology.
6. Developing the supply chain to meet the increasing demand on central processing units with delivery on time to distributors around the world with efficient use of resources.
7. Taking care of good reputation and image among the clients of company with building long-lasting relationship.
8. Innovative activity and taking part in the development of a given market.
9. Adapting attractive offer to each market segment and taking advantage of opportunities.
10. Satisfaction and loyalty as a tool supporting product development and building positive relationships through regular feedback.

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