

# Intel is recovering?

Dmitry Bodnar, Ph.D., General Director of JSC Syntez Microelectronics

*Over the past decade Intel has gradually lost its position of a world semiconductor leader remaining one of the few large companies capable of developing and manufacturing complex products using full cycle production at its own fabs. Appointment of Patrick Gelsinger as the head of Intel was positively rated by the company and the media. A year has passed since his appointment which is still insufficient for estimation of results but quite enough for assessing measures and actions taken to overcome the crisis.*

## Intel is at crossroads

For more than 10 years since 2009, the American semiconductor giant has experienced considerable difficulties in determining the technical development strategy due to the era of financial specialists who replaced technical specialists in the company's management [1]. Throughout the history of Intel, the tradition of the appointment of technical specialists in the head of the company distinguished them from others, even the most successful global and American companies took their experience and also started appointing technical professionals as the head of companies. Intel itself gradually moved away from its traditions, which led to a slowdown in technical innovation and a loss to its competitors not only in the development of new products (AMD) and technologies (TSMC), but also in leadership in semiconductor sales (Samsung). The era of financiers in the head of Intel cost the processor giant a lot.

At the beginning of 2021 the appointment of technical professional Patrick Gelsinger, who previously worked at Intel for 30 years brought back their talent tradition, but the prospects for restoring global semiconductor technology leadership were obscure. To move things in the right direction such a giant company as Intel required not only time, but also non-standard steps in all areas, and not just in the technical one. Some major figures in the global semiconductor industry were skeptical in Gelsinger's ability to return Intel to its leading position. For example, the opinion of the former head of TSMC Morris Chang about Intel's perspectives with the appointment of Patrick Gelsinger. The 90-year-old founder of TSMC considered the 60-year-old head of Intel "too old"

to restore the corporation to its former glory [2]. And this is claimed by a man who remained at the

head of TSMC until the age of 80! According to Intel's internal rules, company executives must leave their post upon reaching the age of 65. Thus, the new head has only 5 years to raise the company. But who else than Morris Chang better knows that these rules can be easily changed if necessary! The head of TSMC stepped down for the first time in 2005 at the age of 68 but was brought back into the company in 2009 during the peak of the global financial crisis. The second time he left the company was in 2018, when he was 80 years old!

At the end of 2020, before the appointment of Gelsinger, the question of restructuring Intel was seriously discussed with the allocation of chip production and product development divisions as independent enterprises [3]. However, the author of this article immediately after the appointment of a new head of the company not only ruled out such a possibility, but also assumed the use of outsourcing for the production of the processor giant's products using the most advanced 3-5 nm technologies at TSMC and Samsung [4]. Previous Intel executives not only refused to take this step, but also «pushed out» top managers who advocate such an approach from the company. The company had to make a choice: either not changing anything and continue the crisis course or start reformation. With the appointment of Gelsinger the second option was chosen.

Only a year has passed since the appointment of the new head and Patrick Gelsinger undertook so many big and unexpected steps, even more than three previous leaders of the company all together for a 10-year period. Some of them have not yet been implemented but have already caused a lot of

discussions in the semiconductor world. Perhaps he is lucky, otherwise how to explain cancellation of the European Commission's decision by the European court at the beginning of 2022 stating Intel to pay a large fine of 1.06 billion Euros for oppressive actions against AMD, which originally was decided 13 years ago and all that time unsuccessfully challenged by the company [5]. Last year 2021 Intel showed modest results, increasing sales by only 0.5% and once again lost the lead to Samsung [6], which however, was expected considering the growth in demand and prices for memory chips, that are the main products of the South Korean company. In this article, the author did not aim to analyze these results of Intel, but only its most important steps and decisions that can have a strategic impact on the company's prospects in the future. Let's talk about some of them in the next paragraphs.

### HR decisions

The first thing Gelsinger started with was the return of technical specialists, incl. former top managers who left the company during the era of financiers. This was most active when Intel was led by Brian Krzanich, who forced out techies and recruited specialists from outside. Some specialists returned to the company by the invitation of the new head, although they were already retired, and many of them had worked with Gelsinger even before he left Intel. And this is a clear sign of respect and trust to the new head of the company from his former colleagues. According to the head of Intel, in just nine months since he took office he managed to get "the most legendary team" in the history of the company. "All the key innovations in the semiconductor industry that have been proposed over the past thirty years have come to market from the members of this team, and they are all excited by the idea of reviving Intel with the motivation to catch up as quickly as possible", he says. According to Gelsinger, if he suggested that the developers take a day off, he would not be able to get them to do it.

Intel is also being strengthened by specialists from other companies, including its main

competitor, AMD. The goal is to strengthen the GPU and gaming graphics division, which is dominated by AMD and Nvidia. Ritchie Corpus, who has been with AMD for 15 years became Intel's Vice President of Gaming Ecosystem Business Development and Developer Relations, while Steve Bell after 13 years at AMD became Senior Director of Video Game Developer Relations. Rohit Verma, the lead architect of AMD discrete graphics chips, also left AMD for Intel. Rohit has previously worked at Intel for 14 years and switched to a competitor in 2013. Intel has repeatedly emphasized the intention to secure their position in the global market for discrete graphics cards, which for many years has been divided between AMD and Nvidia. Intel announced that in the first quarter of 2022 they are to bring to the market its gaming discrete graphics cards under the new ARC brand for desktop PCs and laptops. This product will be targeted at casual and professional gamers. This will be the third attempt by Intel to become a part of this market. Analysts predict that in 2023 Intel will outperform its competitors in the GPU market.

The company also stated its claims in the cryptocurrency mining equipment market. At the end of February, their extended presentation will be published. The new BZM22 processor, manufactured using 7 nm technology consumes half as much power as identical performance product from competitors [7]. HR reinforcement was required for such tasks.

The large-scale transformation initiated by Patrick Gelsinger also requires financial support and work with investors, which is the responsibility of the company's chief financial officer. To do this, David Zinsner (previously held a similar position at Micron Technology) [8] has been appointed as the new CFO of Intel. Obviously, for such a position Gelsinger needs a specialist who shares his views on the planned giant investments and is able to implement his plans.

### Technological Revival

Accelerated development of new technologies is what the efforts of the head and veterans of Intel are aimed to. Not so long ago, the company was the undisputed world leader in new technologies, and its current world flagships TSMC, Samsung, GlobalFoundries were far behind it. Intel is faced with the challenge of developing five new process nodes in four years, and by the second half of the decade to become the technological leader in the field of lithography. Previously, the company did not pay enough attention to EUV lithography, and this was one of the reasons for continuous lagging behind competitors. According to ASML, Intel entered into an agreement with them for the supply of a new generation scanner TWINSCAN EXE:5200 in 2025 and will become the first buyer of this equipment [9]. This unit is the pioneer of the new generation 0.55 High - NA EUV lithography with high aperture and with its help Intel plans to be the first to develop the 18A process technology (less than 2nm according to the current classification) in three years. But by the end of 2023, Intel plans to receive a pilot version of the TWINSCAN NXE:5000 high-aperture unit which will be used for experimental work and preparation of the technical process. The head of Intel during each of new quarterly event reports that the development of all perspective technical processes is progressing ahead of schedule and that the process keeps accelerating literally every month. Several teams are working on technical processes in the parallel. The failure of each one individually will not be able to affect the work of the others, which allows Intel to believe in its ability to develop five new technical processes in four years. In the past, the sequential workflow only exacerbated the delays in the introduction of progressive lithography, and now a lesson has been learned from these mistakes. Gelsinger plans to return Intel to the world technological leadership and get ahead of TSMC and Samsung by the middle of the current decade and proposes to evaluate the results not quarterly but at intervals of 2-3 years.

Intel's EUV lithography 4 process will be ready for production in the second half of 2022. It provides an increase in transistor performance of approximately 20% per watt. Intel 3 with additional features delivers another 18% performance per watt and will be ready for production in the second half of 2023. Intel 20A with RibbonFET architecture and PowerVia will deliver up to 15% performance per watt and expected to be ready for production in the first half of 2024. Intel 18A will provide an additional 10% improvement and expected to be ready for production in the second half of 2024.

Speaking about assembly processes, in 2023 the company plans to introduce new technologies Foveros Omni and Foveros Direct, which together with advanced chip manufacturing technologies should ensure correspondence with Moore's law of doubling the number of transistors every two years and bringing their number to one trillion.

Will Gelsinger and Intel achieve this? Considering that IBM, a Samsung partner, is also involved in this task to develop the 3nm GAAFET technology as well as the leader in EUV lithography - it looks quite viable. In addition, Intel will have a good opportunity to study the experience and eliminate all Samsung's GAAFET errors and ultimately reduce the time for developing new technologies.

### Outsourcing for advanced technologies

When Gelsinger took over his post Intel had recently struggled to launch a 10nm factory and was only third in the world behind TSMC and Samsung, which had already developed 7nm technology and were making good progress towards 5nm. Many have formed the reasonable point of view that Intel has lagged behind them forever. Previous Intel management did not want to listen to the proposal of their top managers, who offered to outsource advanced processes to TSMC and Samsung, like AMD did, but also pushed them out of the company, accusing them of lack of patriotism. Senior vice president Jim Keller had to leave the company because of these disagreements,

management didn't like his proposals for outsourcing. The new head brought him back to Intel.

Patrick Gelsinger made the decision to outsource to TSMC very quickly for products on 4-nm and 3-nm processes. He personally visited TSMC where he reached an agreement about that. Intel and Apple will be the first to access orders for these processes in late 2022 and 2023, delaying Qualcomm, Mediatek, Broadcom, Nvidia and AMD until 2024. And this causes concerns from their main processor competitor - AMD, they are seriously considering the option of leaving TSMC and transferring orders to Samsung. But rumors says that TSMC required advance payments from Intel for reserving a separate 3nm production line, as the American company concern is a third-party access to their technological achievements. In any case, such outsourcing will help Intel quickly update its product line, push out rival AMD and prepare its own 3-nm production, i.e. win on all fronts.

### Expansion of new factories and Foundry Intel IDM 2.0

The solutions proposed by Patrick Gelsinger in this area turned out to be the most unexpected and ambitious. This scale increased every month and the size of the proposed investments grew like a snowball. And this causes not only a surprise, but also some concerns. Obviously, this direction is a key to Patrick Gelsinger's entire strategy to transform Intel. He decided not only to restore the company's leadership in the most progressive technologies but also to expand its capabilities in some mature foundry technological processes.

Gelsinger's first unexpected step, a month after his appointment, was the announcement of the organization of a new line of contract foundry services in the company and the creation of a new legally independent enterprise Intel Foundry Services (IFS) led by Randhir Thakur, reporting directly to the head of Intel. This emphasized the importance of such a decision and the significance of the head of IFS at Intel.

In December last year, Bloomberg reported that Intel will invest \$28 billion in 2022 to increase production capacity in France (design center), Germany (silicon factory) and Italy (assembly factory) [10]. Patrick Gelsinger worries about Asian dominance as well as TSMC and Samsung in the semiconductor industry and is trying to balance the situation by building new factories in the USA and Europe. In total, over the next ten years, Intel intends to invest up to \$95 billion in the expansion of European production [11]. And the company can count on the full support from the European Union, incl. financial support.

However, the largest investment is planned in the construction of a production complex of eight plants in the US in Ohio [12]. The amount will be 100 billion dollars, and the complex will become the largest in the world.

The processor giant is trying to keep up with TSMC and Samsung, competing in record-breaking investments to expand their manufacturing capabilities, incl. international expansion.

However, such gigantic costs cause some concerns, because they can lead to an investment bubble in the face of a new recession in the global economy caused by the cyclical nature of its dynamics, the unpredictability of world politics, the impact of COVID-19 pandemic or any unexpected global cataclysms. The world has long been plunged into an avalanche of conflicts and unreasonable ambitions that do not promise anything optimistic.

### Roadmap for new products

Intel unveils product evolution for Data Centers and Artificial Intelligence (AI) from 2022 to 2024. In Q1 2022 Sapphire Rapids processor will be introduced based on Intel Xeon architecture on Intel 7 technology with big performance increase (30x for AI) and in 2023 Emerald Rapids product with greater performance, increased memory and security. Future Xeon generations will have a dual product roadmap based on Performance (P - core)

and Efficient - cores (E – core) products. This new range will maximize Intel's performance per watt, segment parameters and overall competitiveness in the industry. In 2024 Intel plans to introduce revolutionary new Xeon Processor based on E-Core Sierra Forest as a high-density and ultra-efficient product based on Intel 3 technology and plans to release a Granite Rapids update from Intel 4 to Intel 3 process. Raptor Lake products are coming in 2022 based on the Intel 7 process with a double-digit performance increase over Alder Lake. Meteor Lake and Arrow Lake based on Intel 4, but with some elements of the Intel 20A process will appear in 2023-2024.

For accelerated computing and graphics products, Intel plans to generate \$10 billion in revenue by 2026. These products are based on Xeon platform with up to 2.8x performance improvement and the new Falcon Shores architecture in 2024, combining X86 and Xeon, with a 5x improvement in performance per watt, compute density and memory capacity.

### Intel invests in RISC-V

Intel is expanding to become the leading U.S. chipmaker by ecosystem investments and closer ties with RISC-V architecture developers. The chipmaker innovation fund, co-created by Intel Capital and Intel Foundry Services (IFS), invests \$1 billion in intellectual property, software, chip architectures, and advanced assembly technology [13]. The goal is to speed up development and reduce the time to introduce new processors. The Intel Foundation is also highlighting IFS' broader goal of reaching multiple architectures with instructions beyond X86, including ARM and RISC-V, thereby attracting fabless companies to compete with foundry giants TSMC and Samsung. Intel's decision also reflects the growing dynamic of RISC-V architecture. They announced partnerships with RISC-V developers including Andes Technology, Esperanto Technologies, SiFive, and Ventana Micro Systems. The company will also join RISC-V International, a global non-profit organization based in Switzerland. Intel claims to be the only manufacturer to offer IP,

which is optimized for X86, ARM and RISC-V. By doing this, the company recognizes that RISC-V is joining X86 and ARM as the leading chip architecture. Partners will work with Intel to optimize their projects for Intel technology processes.

Intel says the collaboration will allow its IFS business to produce a wider range of RISC-V IP cores optimized for different market segments. "In partnership with leading vendors, IFS optimizes IP for Intel technology processes to deliver the best on-chip RISC-V IFS experience for all core types, from embedded to high-performance." In support of its RISC-V initiative, Intel also announced plans to partner with several cloud providers to create an open chiplet platform that favors a system-in-a-package rather than a system-on-a-chip architecture. This ideology has been actively supported by Intel especially for the foundry service, since Intel's advanced assembly technology is noticeably ahead of its competitors TSMC and Samsung. System-in-Package designs contain accelerators and multifunctional chips, such as CPU cores and GPUs, within a single package. This allows manufacturers to separate dies into individual chips. Then chiplets can be optimized for a particular function, allowing advanced IP and workflow customization, Intel said. "Many cloud service providers are looking to build specific computing machines that include accelerators to improve data center performance for workloads such as artificial intelligence," Intel said in a statement. "The tight integration of the accelerator chiplets in the same package with the data center CPU provides significantly higher performance and reduced power consumption compared to placing the accelerator cards next to the CPU boards."

Intel also announced some plans to develop "an open interconnect standard that will allow chiplets to communicate with each other at high speeds." The chipmaker claims that this open approach will allow manufacturers to combine interacting chiplets from different factories and process nodes in a single package using several different technologies. Intel's long history as an IDM

manufacturer of complex products allows them to do it faster and better than competitors.

Analysts point out that Intel's decision to focus on the RISC-V architecture puts the company in the next phase of competition with ARM and NVIDIA. "Intel's billion-dollar investment is unprecedented and will potentially change the industry landscape," Karl Freund, chief analyst at Cambrian-AI Research, wrote in *Forbes*. "The timing couldn't be better as the potential sale of ARM to Nvidia, which was recently put on hold, prompted many developers to look for an alternative to ARM technology, and RISC-V is exactly that technology."

Support from Intel and the failure of the Nvidia-ARM deal mean the semiconductor industry has gone from two to three competing chip architectures. And this is what Intel is able to push forward (not TSMC and Samsung) and what will give an advantage to them in the foundry business.

### Intel acquires Tower Semiconductor

In July 2021, The Wall Street Journal reported that Intel is in negotiations to buy GlobalFoundries for \$30 billion. [14]. While both companies declined to confirm this, there was no doubt that Intel was looking to acquire one of the foundry companies to expand its manufacturing capabilities. Although the Arab sheikhs from the UAE (owners of GlobalFoundries) have been ready to sell the company because of annual losses for many years, but apparently, they couldn't reach an agreement. The task of choosing and buying a new object was only a matter of time. Except for the USA, Europe is one of the territories for Intel's manufacturing expansion. On February 15, 2022, it was reported that Intel was buying Israeli foundry company Tower Semiconductor for \$5.4 billion [15]. Israeli company's share price skyrocketed 66% on that news and Intel's increase was 1.4%. The choice of the Israeli company Tower Semiconductor is not surprising. Intel has factories and development centers in Israel, and recently the head of the company, during his visit to Israel, said that the construction of a \$10 billion semiconductor

plant has begun in this country with the support of its government. [16]. Obviously, Intel is trying to create its flagship semiconductor ecosystem in Israel and the acquisition of Tower Semiconductor fits into this strategy. The Israeli company also has factories in the USA, Japan, which will not only optimize Intel's supply chain, but also give it more flexibility in the distribution of production capacity in both the USA and Israel. Among Tower Semiconductor's client there are companies from the automotive and smartphone market, which should also benefit the parent company. Obviously, before the launch of the Intel production complex in Ohio in 2025, the factories of the Israeli company will meet the growing world semiconductors demand and full entry of Intel into a new foundry business.

But some experts do not support the purchase of Tower Semiconductor and consider it as untimely and inconsistent with Intel's main goal - to become a global technology leader, since the Israeli company does not have advanced technological processes, but mature ones only.

### Diversification of product application spheres

The automotive sector has never been an active area for Intel products. To enter it, the company acquired another Israeli company Mobileye in 2017, one of the world leaders in the production of computer video systems, mapping, localization and computer process control in the automotive sector. The company develops software for processing data collected from sensors and cameras installed on the car, in order to further use them for accident prevention and for the development of driver assistance systems. The key system is a smart video camera that can determine the distance to objects on the road, follow the road markings and give an assistance on avoiding road collisions. Mobileye achieved record year-over-year revenue in 2021, with expected earnings increase over 40% in 2021 compared to 2020. Its 7nm chips were manufactured by TSMC due to lack of such a process at Intel, but after its development it will be transferred to the parent company. At the end of 2021, Intel made a decision to start preparation for

Mobileye's IPO and expects its market capitalization of \$50 billion while intending to retain a majority ownership [17].

Intel predicts that semiconductor components will take about 20% of the vehicles cost by 2030. That is why the Israeli companies Mobileye and Tower Semiconductor are so important to the American giant.

Cars are becoming electric, safer, smarter, and connected to the Internet. Automotive semiconductor demand is expected to double and reaching \$115 billion by 2030. As a result, Intel Foundry Services (IFS) is forming a specialized automotive group to provide a complete solution for automakers with three specific priorities:

- open central computing architecture
- car-grade Foundry platform
- transition to advanced technologies

These tasks will be carried out in a close contact with Mobileye specialists.

### Conclusions

All these steps and actions would be enough for any other head of a large company for a 10-year period. But Patrick Gelsinger at Intel undertook them within just one year after returning to the company. Unlike previous Intel financial executives, he is a deep technical professional and a successful manager, and his efforts are aimed at pulling the company out of the crisis through not only the most advanced technical innovations, but also the creation of new business directions (by not just repeating the ways and methods of well-known companies and competitors), selection and training of personnel, focusing on their succession. The author hopes that he will be able to return the traditions laid down by previous successful Intel leaders like Robert Noyce, Gordon Moore, Andrew Grove, and confirm this in the coming years with practical results. It seems that this has become the purpose of his life.

The only question is whether Patrick Gelsinger's policy of considerable spending on the revival of Intel is reasonable and whether

shareholders who can be potentially left without profits in the coming years want to accept it. They have not received much profit from the company's securities in recent years. And the market is still anticipating some certainty with Intel. Intel's expected sales in the coming years are really not very impressive so far: growth by 1.7% in 2022, growth by 6-9% in 2023, and growth by 10-12% in 2025-2026. This is clearly lower than competitors' forecasts. There are different opinions regarding the prospects of the processor giant: from cautious pessimism to optimism. But experts note that the company's strategy makes a strong impression, and the main question is in its implementation.

This is one of the main challenges for the new head of the company. Intel's competitors TSMC and Samsung have higher shareholder confidence since over the past 5 years TSMC's share price has grown 3.15 times, while Samsung's by 1.76 times, and Intel's only by 1.36 times, and in 2021 they grew by only 2.3%. And during some periods of the past five years, they even showed negative dynamic relative to March 2017 [18]. In addition, Samsung's family organization structure and ownership bring its own specifics for making strategic decisions. Besides, Intel's main processor competitor AMD keeps rising, and its market capitalization after the formalization of acquisition of Xilinx for the first time overtook the competitor and reached \$197.75 billion, against \$197.24 billion for Intel [19]. But we remember that before its rapid rise five years ago, AMD was generally on the edge of bankruptcy, and only the efficient actions of the new leader saved the company.

The loss of shareholder confidence is the worst thing that can await the company and its head, preventing the big plans of Patrick Gelsinger from being implemented. So far, his grandiose plans with large financial costs do not cause much optimism among them. During a meeting with investors and shareholders in February this year, Patrick Gelsinger presented a roadmap for the development of Intel, its products and technologies until 2024 [20], but the company's shares price on NASDAQ dropped. The company and Gelsinger need at least local success in the race with their

competitors. At during the decade of 2010s, previous Intel executives have never come close to a similar plan for transforming the company and a chance for rebirth. And good leadership can do wonders.

The era of personnel errors in leadership and the crisis of the last decade did not pass without a trace for Intel. And 2022-2023 period can be a decisive for Gelsinger's ability to implement the strategy, restore shareholder confidence and optimism, and stabilize the company's course. Rapid growth of the global semiconductor market and its potential in the next three to four years, as well as the fact that all large companies keep investing in production expansion are the factors in favor of Intel. The governments of the United States, the European Union, and Israel also confirmed their willingness to participate in financing projects to create new productions. The company itself, within national programs for the sovereignization of production, began to work with the Pentagon on the development and production of military products, which is a new practice for Intel. All this also favors Intel.

I would like to wish the head of Intel good luck in realizing the most challenging tasks of this decade, which will be deciding factors for the company and its future. This will be a benefit for the entire global electronics industry.

### Source literature

1. Боднарь Д. «Золотые» кадровые ошибки Intel и российских госкомпаний. *Электронные компоненты*. 2021. №2.
2. 90-Old-Year TSMC Founder: Intel CEO too Old to Make the Chipmaker Great Again. *Hardware Times*. December 12, 2021//www.hardwaretimes.com.
3. Боднарь Д. Полупроводниковая микроэлектроника – 2020. Часть 1. Мировая пандемия COVID-19 – форс-мажор для мировой экономики, но не микроэлектроники. *Электронные компоненты*. 2020. №12.
4. Боднарь Д. Intel повышает ставки и планирует выиграть. *Электронные компоненты*. 2021. №4.
5. Суд отменил миллиардный штраф Intel по антимонопольному делу 2009 года. РБК Инвестиции. 26 января 2022 г.//quote.rbc.ru.
6. Gartner Says Worldwide Semiconductor Revenue Grew 25.1% in 2021, Exceeding \$500 Billion For the First Time. *Gartner*. January 19, 2022//gartner.com.
7. Новый процессор Intel поднимет майнинг Bitcoin на новый уровень. Компания выпустит самый энергоэффективный CPU для ASIC-систем. *IXBT.com*. 21 января 2022 г.//www.ixbt.com.
8. Intel переманила нового финансового директора из Micron. *3DNews*. 11.01.2022 г.//3dnews.ru.
9. Intel and ASML collaboration to drive High-NA into manufacturing in 2025. *ASML*. January 19, 2022//www.asml.com.
10. Intel to Expand in France, Germany and Italy in Comeback. *Bloomberg*. December 23, 2021//www.bloomberg.com.
11. Intel to Invest Up to \$95 Billion in European Chip-Making Amid U.S. Expansion. *The Wall Street Journal*. September 7, 2021//www.wsj.com.
12. Intel's \$20 bln Ohio factory could become world's largest chip plant. *Reuters*. January 22, 2022//www.reuters.com.
13. Intel Launches \$1 Billion Fund to Build a Foundry Innovation Ecosystem. *Intel*. February 7, 2022//www.intel.com.
14. Intel Is in Talks to Buy GlobalFoundries for About \$30 Billion. *The Wall Street Journal*. July 15, 2021//www.wsj.com.
15. Intel to Acquire Tower Semiconductor for \$5.4 Billion. *Intel*. February 15, 2022//www.intel.com.
16. Intel to invest \$600 mln to expand chip, Mobileye R&D in Israel. *Reuters*. May 2, 2021//www.reuters.com.
17. Intel to take Mobileye public in 2022 at estimated \$50b valuation. *The Times of Israel*. December 7, 2021//www.timesofisrael.com.
18. *Fusion Media Limited*//investing.com.
19. Intel сдает позиции. Впервые в истории она стоит дешевле AMD. *CNews*. 16 февраля 2022 г.//www.cnews.ru.
20. Intel Investor Meeting 2022. *Intel*. February 17, 2022//www.intel.com.