Aiming to Realize the Slogan "Cost is King"
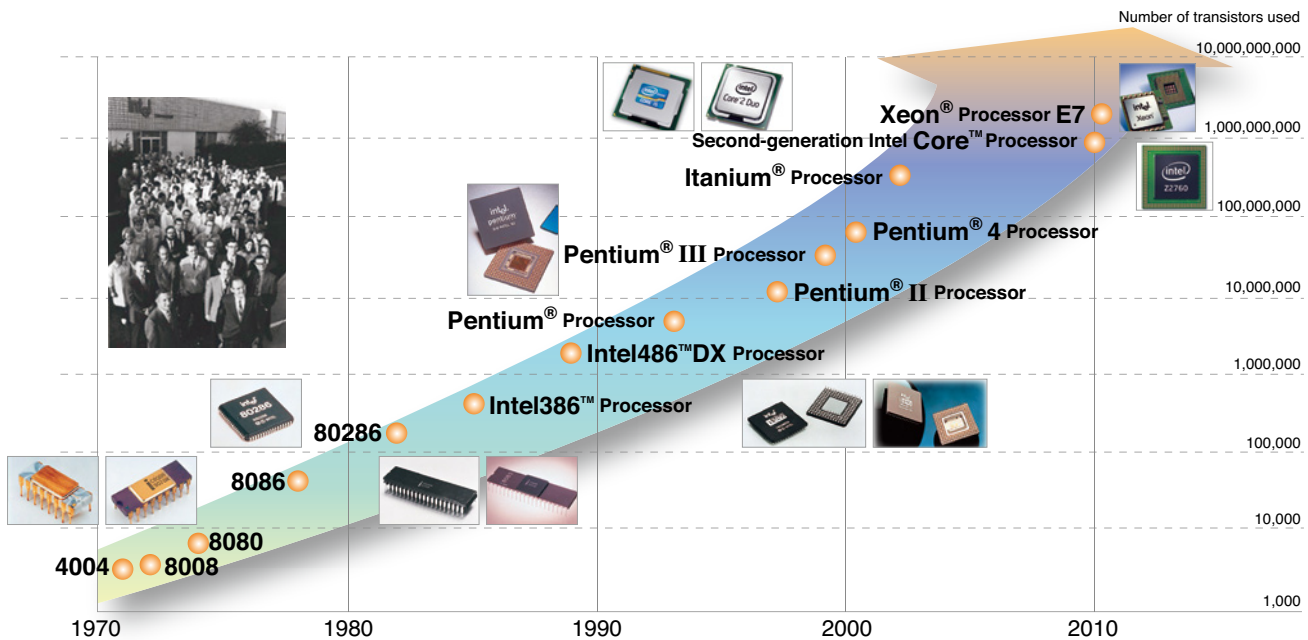## —Intel's Corporate Culture Underpins Its Growth

Guest: **Dr. Tsuyoshi Abe**

Director and Senior Executive Officer, Vice President
General Manager of Technology & Manufacturing Group Japan,
Intel K.K.

Interviewer: **Mr. Hisaharu Obinata**

President and CEO, ULVAC, Inc.

Intel is one of the world's most outstanding companies. Using as its guideline Moore's law, which was put forward by Dr. Gordon Moore, one of its founders, Intel has made extremely significant contributions to the advancement of semiconductor technology; the firm has continued as the top runner in the microprocessor market over 20 years. Underpinning this excellent performance is Intel's outstanding technological prowess and production philosophy, as well as its relentless focus on cost reduction. The driving force behind Intel's success is its corporate culture, which has been handed down from the firm's founders and practiced by their successors to this day. This is also the manufacturer's unique strength. This issue's "Exective Guest" is Hisaharu Obinata, President and CEO of ULVAC, Inc., visited Dr. Abe, Director Vice President & Executive Officer at the Tokyo office of Intel K.K. We asked him about a range of topics, including Intel's unique management philosophy and human-resource development programs.

The History of Microprocessors

Number of transistors used

Xeon® Processor E7
Second-generation Intel Core™ Processor
Itanium® Processor
Pentium® 4 Processor
Pentium® III Processor
Pentium® II Processor
Pentium® Processor
Intel486™DX Processor
Intel386™ Processor
80286
8086
8080
4004   8008

10,000,000,000
1,000,000,000
100,000,000
10,000,000
1,000,000
100,000
10,000
1,000

1970   1980   1990   2000   2010

Source: This chart has been created by ULVAC based on Intel materials.

The Birth of Big Data Leads to Competitive Advantage

Obinata: Previously, we asked you to give a lecture under the title "Big data driving big growth". Full of interesting stories, the lecture was really instructive. I've been looking forward to today's discussion. Let me go straight to the issue and ask you how big data can be used effectively.

Abe: Big data is highly likely to become the focus for corporate competitive advantage in the years to come, and as Internet use further spreads, the volume of data being handled will become increasingly larger. If considerable amounts of information are archived, these archives will provide information with high prediction power. A major American search site will become the world's largest archivist, where users can search useful information they want to obtain. Since the number of Internet users will grow further, increases in IT investments will have positive correlations with growth in the number of Internet users. So, the semiconductor market will also grow exponentially.

Obinata: At one time, the semiconductor industry was said to be a mature industry, but it still has the potential for further growth, doesn't it?

Abe: The point at which a sudden rise takes place is called the "tipping point", and the semiconductor industry will soon reach such a point.

Obinata: The phrase is really encouraging for semiconductor equipment manufacturers like ULVAC. It really fires us up .

Abe: According to a research firm, last year the semiconductor market was worth $330 billion dollars, and growing at an annual rate of a little more than 5%. In the future, the semiconductor industry will grow non-stop;

by 2020, when the Olympic Games will be held in Tokyo, the market is expected to have expanded by about 50% compared to the current level. There are lots of industries out there, but semiconductors will be the top runner, and the industry is expected to continue growing in the future.

Obinata: The semiconductor industry will become one of the key targets for ULVAC's business. We really have to develop semiconductors into an even greater pillar of our business.

Intel's Strength is Reinforced by its Corporate Culture

Obinata: Intel has stayed in first place in the microprocessor (CPUs for personal computers) market over 20 long years. What are Intel's strengths compared to its competitors?

Abe: Intel was founded in 1968. At first, it was a manufacturer of memory chips (DRAMs). But in the 1980s, Japanese semiconductor manufacturers dominated the market, forcing American companies to struggle.

Obinata: Indeed, there was such a period.

Abe: I joined Intel in 1985, when American manufacturers were in right in the middle of this struggle. Under those circumstances, Intel chose to abandon memory chips and specialize in microprocessors. As the term "Intel architecture" shows, our greatest strength is that Intel produces all products in-house to meet the market's needs, from silicon to architecture, software, and packages. Going forward, Intel will continue to exist as an "integrated device manufacturer (IDM)".

The major reason for this is that Intel has a strong corporate culture. The corporate culture left to us by

Gordon Moore and Robert Noyce, both founders of Intel, and Andrew Grove, who joined the company later, still remains Intel's ethos. This corporate culture is called the "Six Values" (see the Column), and it's no exaggeration to say that they're our most vital assets. Our operations are global; we have plants located in America and Europe etc. and downstream processes in Asia, and we have people of various nationalities and ethnic backgrounds engaged in these operations. Our people speak different languages and believe in different religions, but we find shared values as we had work together, and this is what the Six Values mean.

Another strong point is our contribution to society. The greatest reason the PC business has achieved such growth (in turn allowing Intel to contribute to society) is that we made our horizontal division of labor model known worldwide.

The 1960s and 1970s were the era of mainframes (large, general-purpose computers). During that period, all products—from processors and boards to operating and other systems and applications—were covered by single companies. In the 1980s, with the emergence of PCs, companies shifted to a horizontal division of labor. This allowed companies in various areas of expertise to get into the PC business. Open platforms prompted manufacturers to incorporate a whole range of innovations into PCs, and this in turn added more value to PCs. This could never have happened if Intel had been going at it alone, as we had been doing before the 1970s. This expansion of the field would also be one of Intel's social contributions.

Intel's "Copy Exactly" Method Contributes to the Huge PC Market

Obinata: When Intel manufactured memory chips, PC manufacturers would seek an alternative source of supply. Intel's memory chips could be replaced with chips made by other companies, so if they didn't need Intel memory chips any longer, PC manufacturers eventually went to suppliers that offered lower prices. This kind of experience pushed Intel toward specializing in microprocessors, where PC manufacturers couldn't seek alternative sources of supply. At the same time, this specialization enabled Intel to establish the world's highest level of production technology and build up sufficient production capacity. The result, as I read somewhere, was that Intel achieved tremendous success with its microprocessors.

Abe: That's right. That kind of "What should we do, what should we not" decision is fascinating, isn't it? In order to survive in the competition, businesses must have core competencies, which give them a competitive advantage.

At Intel, our strengths lie in the area of microprocessors, and this leads to the development of not just PC manu-facturers and end users, but also to the development of society as a whole. We leave other areas to businesses that

[Column]
The Roots of the Six Values
The origin of Intel's corporate culture, known as the "Six Values," dates back to the "Eleven Values" set out in 1974. In addition to "Discipline", "Risk tracking", and "Results orientation", all of which have been handed down even to the present day, values such as "Openness" and "Problem solving", which represent the management philosophy of those days, still live on in the minds of Intel's employees today. "Quality" and "Customer orientation", both included in the current Six Values, were learned from Japanese companies' superior manufacturing-control methods.

can show their stuff in those areas, rather than trying to cover the entire spectrum on our own. So, we contribute to society both directly and indirectly. On the other hand, our social responsibilities are heavy and broad-ranging.

To meet this heavy social responsibility, we have a business philosophy called "Copy Exactly", which applies to the vertical start-up of plants. I think Intel's the only manufacturer in the world that applies this principle. We have a plant in Oregon that develops next-generation processes. This plant aims to establish production technology for mass production, like manufacturing processes and procedures and production equipment. The production technology and equipment created at this plant are "copied exactly" to provide other plants with production technology and equipment for full-scale mass production, thus contributing to supply the huge PC market. Establishing this business model in the true sense means meeting the social responsibilities of Intel as a business.

Intel's Management Has Made the Right Decisions at Critical Business Turning Points

Obinata: Intel must have experienced several critical turning points in the past, but how did the company get through them?

Abe: I have three answers to your question. One concerns the shift from memory chips to the microprocessor business in 1985. Intel was indeed at a strategic inflection point (SIP) in that year. Any business grows from infancy, and without exception it reaches a period when its growth stops. We were being basically driven to the wall. Under those circumstances, Intel's management made the decision on whether we should keep producing memory chips or stop.

The PC market at the time was small, so shifting to microprocessors alone involved considerably high risks. Some of the top managers were of the opinion that we should stay in the memory-chip business, but in the end, the management decided to shift to microprocessors. If they'd had decided to just stick it out with memory chips, Intel would probably not have become what it is today.

Dr.**Tsuyoshi Abe**

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Genenral Manager of Technology & Manufacturing Group Japan,
Itel K.K.

1985	Graduated from Kinki University, Dept. of Engineering, Electrical Engineering course.
1985	Joined Intel Japan K.K.*, and has held various management positions in microprocessor system development, system support for embedded board computers, engineering training, and application engineering for PC, server, and embedded application.
1999	Became PR manager and served as a spokesperson representing Intel K.K.
2002	Named General Manager of Intel Architecture Technology Group, Intel K.K.
July 2005	Named General Manager of Marketing Headquarters, Intel K.K.
May 2007	Named General Manager of Technology & Manufacturing Group, Intel K.K.
April 2009	Named Director and General Manager of Technology & Manufacturing Group, Intel K.K.
May 2011	Named Director and Vice President, General Manager of Technology & Manufacturing Group, Intel K.K.
Oct 2012	Named Director and Senior Executive Officer, Vice President, and General Manager of Technology & Manufacturing Group, Intel K.K.

Completed studies in Management of Technology at Graduate School of Engineering Management, Shibaura Institute of Technology in March 2007

* Feb., 1997 Intel Japan K.K. was renamed to Intel K.K.

The second turning point came after the year 2000 passed. In 2001 and 2002, the semiconductor industry experienced a serious depression.

In 2001, when the "dotcom bubble" burst, the semiconductor industry was in a recessionary phase. What Intel did at that time was to make huge investments (including research and development costs) representing 40% of its sales in those days.

Obinata: That was remarkable.

Abe: We were pretty heavily ridiculed because we spent funds amounting to 40% of our sales on investments. One critic said, "Intel is betting $10 billion on a gamble". In a way that's characteristic of Intel, we were convinced that the economic slump would end someday and that it was time to prepare for the next boom.

During periods of economic downturn, businesses often tend to think negative. Since Intel is a manufacturer, it's important to increase our production capacity. Intel's core competence is that we have the world's most advanced process technology and production capacity. Making large investments means increasing production capacity to prepare for the next growth in demand. The important point is not to miss opportunities. I admit I'm saying this is with the benefit of hindsight, but everything went extremely smoothly. As the economy recovered, and demand became stronger, we didn't miss out on the opportunities. We made handsome profits and obtained ample cash reserves, and this enabled us to make the next tranche of investments. A positive spiral of growth began. Investment is indispensable to Intel's growth.

Obinata: In fact, it's really hard for corporate managers to take the plunge and invest in hard times, even though they know they should.

Abe: The third crisis for us was that, in the first half of the 1990s, Intel set up the Intel Architecture Laboratory (IAL). This was a really unusual organization, a king of "central research institute", you could say. The aim was to establish platform leadership.

At that time, the PC market was growing steadily, but PC platform manufacturers spent all of their time competing fiercely with one another, only to find that even though the specifications for microprocessors were developing according to Moore's law, the peripheral equipment was failing to catch up. In other words, it was like having a V8 engine in a compact car. Even though they were producing powerful microprocessors, they couldn't convert the benefits of their products into PC end-user value. That was why Intel established IAL.

Intel developed new standards and opened them up to other manufacturers. Making them open ensured that Intel established technology leadership in the PC industry. IAL led Intel to become the leader of the PC platform industry.

In those days, this initiative was called the "Port-of-choice strategy". The question is "how to build a good port". If many good ships (people and technology) from the world over call at a port, the port becomes prosperous. Sailors (engineers) can exchange information there, making the port an even better one. That was what IAL aimed at. That strategy really took effect, but Intel made its defining specifications open to other manufacturers and didn't not charge them. This was also significant. If we'd charged, the strategy wouldn't have been so successful.

Obinata: Ordinarily, manufacturers could never be so open. All these strategies were unique to Intel, and Intel proved they'd made the right decisions.

The Spread of the Latest Terminal Equipment Expands Demand for Servers

Obinata: Recently, the focus of interest has shifted from PCs to tablet computers and smartphones, and new information-terminal equipment is attracting a lot of public attention. How do you view such world trends in terms of Intel's future business plans?

Abe: Currently, tablet computers and smartphones are driving the PC market.

In the past, it's been said about three times that PCs are hopeless. The PC market is not falling sharply; but it's bumping along at the almost same level as before. But because of the strong growth of tablet computers and smartphones, the PC market inevitably looks as if it's in trouble. In particular, Intel has an over 80% share of the PC microprocessor market, but we will of course concentrate our energies on information-terminal equipment such as tablets and smartphones as well. This represents a major change at Intel. In his recent lecture, Intel's President Brian Krzanich didn't mention PCs at all. He talked about the new terminal equipment such as the Internet of Things (IoT), smartphones and tablet computers etc.

In fact, Intel has only a small share of these markets, but if new tablet computers and smartphones are put on the market, servers sell well. For example, if 400 new smartphones appear on the market, one new server is needed for cloud computing. Some 100 new tablet computers require one new server. If the number of downstream clients such as smartphones and tablet computers increases, so does that the number of upstream servers used for cloud computing. So at Intel we're beside ourselves with delight. Every cloud has a silver lining—though for us it's more like a golden lining!

As these information terminals spread out across the market, there are 2.6 billion Internet users, including PC users, in the world today. The number is expected to grow to 3.6 billion in three years and to four billion, over half of the world population, in 2020, which is when the Tokyo Olympics will take place. Our first and foremost goal is to establish the best worldwide supply chain.

Using Intel's Twin Strengths of "Competition" and "Sharing" to Suit the Situation

Obinata: Kazuya Saito (executive officer and manager of the Research and Development planning department), who is the general manager of ULVAC's research and development unit, will join today's discussion.

Saito: I'm glad that I can join you in today's discussion. Intel established IAL and made its platforms open to other manufacturers, but specifically, please tell us what part you played in that process.

Abe: When we take a new step, we don't make the decision by ourselves. We ask two to three influential companies in the industry to join us in making a decision. This is an important procedure for us. If Intel makes a decision alone, it could lead to conflict between Intel and others. If we invite others to join us, we can get a united front going. This enables the latest technology to spread throughout the market quickly. Otherwise, technology wouldn't spread so quickly, however excellent it is.

If one creates something new, everybody feels like shifting to it immediately. The quicker the shift is, the faster its benefits are returned to the users, but it usually takes unduly long before a decision is made. Everyone is in general agreement, but it takes time to agree on specifics. We're better at developing and spreading what will become the de facto standards.

Saito: That is why it's important to adopt the opinions of others and establish platforms that lead them.

Abe: In doing so, we listen to the opinions of extremely influential companies and factor them into our standards. That's how we can develop specifications that can be used at least for ten years. Our practical approach is that all we need to do is to expand them again ten years later.

Saito: Intel really tries hard to share business profits rather than monopolize them. But since we are doing business, it's also important to put ourselves in the most advantageous position.

Abe: How should we use "competition" and "sharing" so as to suit the situation? I think Japanese businesses should take a more nuanced approach on this.

Obinata: I see. That has a whole lot of implications indeed. So, Intel keeps its corporate strengths firmly and works together with other companies, while at the same time clarifying where it competes and where it shares.

Saito: This way of thinking can be applied to joint

Hisaharu Obinata, President and CEO, ULVAC, Inc.

Fab D1X, Oregon, U.S.A.

development projects, too. In reality, we tend to hold each other in check, and so we could achieve greater results if we could strike a balance between competition and sharing.

Providing the Latest Technology is Important. But Cost is Even More Important.

Saito: Recently, Intel has unveiled a range of wearable devices. How do you plan to develop them in the future?

Abe: The Intel Atom processor is designed for smartphones and tablet computers, but the low-power Quark processor will play a central role if the focus of production shifts to wearable devices.

　　The Edison is basically one whole computer in the size of an SD card. The future goal is to make it even smaller.

　　A silicon transistor can be made smaller, and the way to do that is to put more effort into its packaging. It could fit into a button someday. With that, it would be a wearable device in the true sense of the word.

　　The question is not only how small wearable devices

are but also what they can do for the end users, in what form of application. But Intel doesn't do operating systems or applications; we're simply a manufacturer of microprocessors. Under these circumstances, what Intel emphasizes is security. With so many people connected to it, the Internet must be an infrastructure that can be used with a sense of security. What we consider as our mission is to ensure the security of the Internet. Security's becoming important even for gadgets like smartphones and tablets. People must be able to use platforms with a sense of security.

Saito: The goal for wearable devices is to make them compact and reduce their power consumption, but what is your view of the possibility of various sensors being combined. And what about the costs involved?

Abe: We have to put more effort into achieving innovation in packaging. At the same time, cost is an issue to be addressed. Cost is an issue for all manufacturers, not just Intel. "Cost is King." I could go further. "Cost is God."

Using the World Café Method to Ensure Knowledge-sharing Among Departments

Saito: Indeed, cost management is essential.

　　To change the subject; to produce these results, it's also important to address administrative issues like improving the skills of individual workers. Have you figured out good ways to hand down individuals' institutional experience to the next generation?

Abe: That's a very good subject. In fact, we're also faced with the issue of "tacit knowledge versus explicit knowledge". A lot of Japanese businesses are based on tacit knowledge. The apprenticeship system encourages apprentices to learn by watching their masters and acquire skills from them. To put it differently, knowledge is less documented here. On the other hand, explicit knowledge means documentation. We're addressing the issue of how we should share tacit knowledge, though the initiative is limited to our department.

The first step is to "know each other". Since a person's knowledge is limited, people from different departments are gathered together to find out who knows what.

If you know who knows what, you can ask for the help of the person who knows when the need arises. It's important to know who knows what beyond departmental boundaries. This concept can be found in server architecture as well. Servers have a mechanism defined as transactional memory, and this is exactly what the concept means. It refers to a mapping function that shows what sources are available and where.

Obinata: An organization can't work effectively unless its employees know who can handle what and where they can be found.

Abe: In particular, there aren't so many personnel changes between departments in Japanese businesses, though it might look as if there are lots. If you're stuck in the same department from day one, there's no way you can learn what personnel are available in the larger organization. Destroying this kind of environment is one of the manager's important tasks.

In my department, I'm doing this using the World Café method. For example, I prepare five tables and have about ten people sit at each table. I give them a common subject for discussion, say, cost reductions. They discuss about cost reductions at each table. Each team expresses its opinions about cost from a different point of view. Then each team is reshuffled with some of its members replaced with people from other teams. When you change tables, your opinions are tested by the possibilities and ideas you find being put forward there. This process produces very good things, because possibilities and ideas are reviewed from a whole range of different people's perspectives. You ought to try it out.

Investment in Personnel Enables Companies and Their Personnel to Grow Continuously

Obinata: What do you do to develop human resources and raise employee morale?

Abe: I may be flattering myself, but Intel is serious about training its employees. Intel has founded a virtual university called "Intel University" within its organization. Intel University offers over 100 training courses, which can be taken by any one of our 100,000 personnel, from new employees to managers. At Intel, we call this the "LCE (learn, connect, experience) model".

The idea is to improve one's job skills to achieve one's goals by learning, being connected, and experiencing. To that end, we have the "10%, 20%, 70% rule". Learning alone achieves 10% of the entire goal. Cooperation among departments achieves another 20%. Finally, in order to really achieve the remaining 70%, you have to do it yourself (experience). So at Intel, managers pay a lot of attention to staff who've completed this training; for example, they give opportunities to their staff to soon use what they've learned.

The primary mission of a business is to keep going, but just keeping going means that you're getting 50 points out of a possible 100. You get the remaining 50 points for keeping growing. A business can't grow unless its employees grow. The ideal is to start a positive spiral of employee growth, bringing about the company's further growth, which in turns brings about further growth for the employees. If we can achieve this, we will be invincible as a company. This is directly connected to motivation. Individual employees grow with their company, and the company grows with its employees.

In the 1990s, Prof. Peter M. Senge at the Massachusetts Institute of Technology put forward his definition of "learning organizations".

He said that a business is an organization in which the individual staff members continually expand their capacity to create the results they really want; they do this by having the ability to design the organization to match the intended or desired outcomes and recognize when the initial direction of the organization is different from the desired outcomes, and they take the necessary steps to correct this mismatch. He defined the competitive advantage of a business as arising from continuous learning by both the organization and its individual members. This idea resembles Intel's culture. Investing for personnel, training them, and improving their skills develops the business as well as its employees, which leads to motivating the business and its employees to aim higher.

Obinata: This year, I'm trying to invigorate ULVAC's organization by calling on our employees to avoid being the proverbial "frog in the well that knows nothing of the great ocean". I've learned a good lesson from you. Thank you for having such a meaningful conversation with us today.

The photo shows (from left) ULVAC Executive Officer Saito, Intel Vice President Abe, and ULVAC President Obinata.