9-Man Printer Company Seeks to Impact the World

Interviewer: Takamasu Kanji

WEDG Co. President Yoshida Naoki's business card, which looks like thin plastic film, carries his bust shot and a vivid landscape photo on the dark-blue, curtain-like background. A closer look shows a phrase in outline typeface, saying, "This card contains more than 25,000 letters." Another look through a magnifier confirms that the background pattern comprises iterations of his company's website address www.wedg.co.jp in a cramped form. The 14-letter URL string is written within 4 millimeters in width. The card also contains another phrase saying, "This card was printed by an ultra-precise, high-quality digital printer developed by our company."

WEDG, founded in 1999, is a venture business with a workforce of only eight engineers, including Yoshida, and develops precise printing technologies and printers. WEDG is very small in size but has contributed greatly to the innovation of performance of dye-sublimation – or dye-sub – printers. WEDG has won high marks for its technological development capabilities.

"I do hate imitating. I cannot control the urge to challenge if I'm told "you will be unable to do," says Yoshida, who was born in 1961.

Photo: WEDG Co.

WEDG President Yoshida Naoki's business card contains tiny iterations of the company's website address in a cramped form.

Almost all homes in Japan have their own printers together with personal computers (PCs). The younger the users are, the more they produce printed matter by themselves using color printers. Laser and ink-jet printers are seen often. How many kinds of printers are used in Japan?

Yoshida: Printing is a highly developed industry with a long history. I can say that now is the time when individuals have come to do printing by themselves for various purposes for the first time in history. Keeping pace with the spread of PCs, various types of digitally controlled printing methods have been developed. It is very difficult to say clearly how many kinds of printers currently exist, partly because of a difference in their categorization. Printing inks are made of dyestuffs or pigments while their forms vary from solid to liquid to powder. We usually think printing is done on paper. But as far as paper is concerned, many kinds of processed paper have been developed. Not only paper but a wide variety of materials such as plastics, metals and ceramics are usable as printing media. Each of them has its own characteristics and is used in variety for business and personal purposes.

The spread of PCs and rapid improvement of their performance, along with the wide use of the Internet, knocked out the centuries-old commonsense that printing is undertaken only by professionals. In recent years, individuals have rapidly come to do printing by themselves – from their own documents to images. Notably, manufacturers have come to offer color printers for computers at reasonable prices in the past decade. Prices of computer printers have kept declining while their printing quality continues to improve annually. Especially for personal purposes, the number of individuals doing printing themselves has increased sharply with the spread of digital cameras.

Would you brief me on the printing method applied to your company's dye-sub printers, which is said to have made it possible to do printing extremely precisely?

Yoshida: Among various computer printers for consumers, most widely used are those of the so-called ink-jet printing method, available at reasonable prices. This system propels tiny droplets of liquid ink in cartridges from a print head through minute nozzles onto paper and places extremely fine dots of 10 microns in diameter on paper to print. There are two different methods to spew droplets. One is to turn ink into high-temperature bubbles and the other is a piezoelectric type. Under the ink-jet system, color shading is adjusted with dot density. Besides the three primary colors of cyan, magenta and yellow (CMY) plus black, several other colors are available in ink cartridges nowadays in pursuit of clearer coloration. The greatest advantage in the ink-jet system is that color printing is possible on plain paper with ease. But its weak point is that ink clogging is unavoidable because liquid ink is used.

In contrast, our company's dye-sub printer system is a kind of thermal

Photo: Japan Economic Foundation

WEDG's dye-sub printer works twice as fast as before and permits borderless prints.

transfer printing. The printer's structure is simple and its maintenance work is easy thanks to a lack of ink clogging. This system is older than the ink-jet method. Everybody knows iron-on transfer of patterns on clothing such as T-shirts. This is called an iron print method. The thermal transfer system's principle is almost the same as with the iron print.

There are two methods of thermal transfer printing. One is known as a thermofusion type, which is often called thermal transfer printing, simply. This system transfers pigment ink coated on thin film (ink ribbon) to media such as paper and plastics through a thermal head. This is used usually for single-color printing such as faxes and barcode labels, but we have technology enabling full-color printing, using the three primary colors. The other one is a dye-sub printer that precisely controls the thermal head's temperature, evaporates CMY ink coated in thin film form, and transfers the three colors, one on top of another. The final process is to print transparent high-molecular ink on the surface and thus produce a protective coat.

The size of a dot printed by a dye-sub printer generally measures about 80 microns, much larger than one from an ink-jet printer. But the gradation of each dot can be subtly changed by finely controlling the temperature of the thermal head, realizing a clear color print almost comparable to silver halide photography. And, by coating the surface with transparent high-molecular ink, printed material is saved from color degradation and its water resistance improves, thus enforcing its durability as a whole. However, this printing system needs paper coated with resin. These characteristics of a dye-sub printer are fit for precise printing such as photo printing and layout paper printing for publications. Dye-sub printers meet the needs of consumers who want beautiful printing now that digital cameras are being used widely. Since the founding of WEDG, we have devoted ourselves to the development of dye-sub printers.

What kind of technological development did WEDG achieve with the dye-sub printer?

Yoshida: We focused our efforts on the development of technology to precisely adjust temperatures of the thermal head in an instant. We could make it possible to precisely control the color gradation of each dot in more than 256 stages at a high speed by altering the thermal-head temperature between 36 C and 700 C in one-1,000th of a second.

The decisive factor was that we could develop through our own efforts a mathematical function for the control of the thermal-head temperature and, based on this, develop software and a specialty chip. This is a kind of large-scale integration (LSI) chip that is categorized as an application-specific integrated circuit (ASIC). It is a complex of circuits altering the distribution of temperatures in a certain time. All of us at WEDG spent half a year and a sizable amount of money to develop the chip.

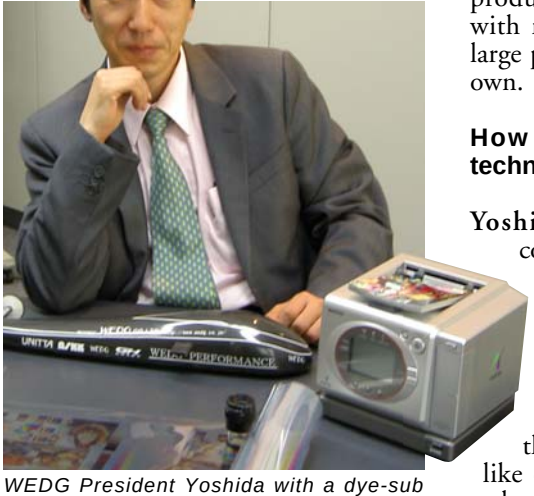
A precise control of temperature in a short time would allow a single color to produce 256 shades. Theoretically, three colors would produce more than 16 million colors. The printing speed has been cut to about half that of the existing system with the help of our own corrective method. The Mega Pixel II printer based on technology two generations older than this chip won the Innovative Digital Product Award from the Digital Imaging Marketing Association (DIMA) of the United States in 2002. This means that the product was chosen as one of

the 15 most excellent products developed that year in the digital imaging field. We were very happy that our technology was appreciated abroad.

Another achievement was the development of technology that made it possible to materialize truly borderless prints. Photo shops offer what they call borderless prints. But, in fact, most of them are made from developing paper with perforated lines, torn along the perforations after printing. Under the dye-sub printing system, each time each of the CMY colors is printed, the printer comes and goes over printing paper, requiring the two sides of the paper, back and forth, to be fastened. So, it unavoidably leaves unprinted borders. If overlapping ink dots are misaligned by about 60 microns, color drift would occur. Unprinted borders are areas to prevent this.

We developed a method to wind up printing paper around a drum and rotate it. Under the method, the paper is locked up while the printer moves around unprinted portions. This saves paper, and dust is screened out by keeping the paper on the drum inside the machine. So, clear and sharp prints are always available. And no perforation cutting is required, producing no paper waste. I can say this is a considerably epoch-making technology.

Photo: Japan Economic Foundation



WEDG President Yoshida with a dye-sub printer

Other companies, including Sanyo Electric Co., produced under their own brands print-only models containing these technologies as dye-sub printers, for example a 4-inch by 6-inch size model.

How did you develop such an extremely precise controlling technology with only eight engineers?

Yoshida: Production of printers requires a comprehensive control technology comprising mechanism, hardware and software. Our team is formed with engineers who have different areas of expertise. We have technologies ranging from positioning in microns to time control in one-1,000th of a second. So we do not outsource any of our development work but develop on our own. WEDG does not have its own brand for the general public because its corporate size is very small. But I can say WEDG is characteristic in that the eight members of our team produce prototypes, develop elemental technologies, undertake product development in partnership with major manufacturers and make large printers for business use on their own.

How do you manage the technological development team?

Yoshida: In many cases of design concepts, for example mechanism, I am usually the initiator of an idea. I usually draw a sketch and then let an expert good at drawing detail design to work out its specifics. It may sound presumptuous, but I can say that I initially draw a solid figure like one by Leonardo da Vinci. As technological development sometimes faces obstacles, team members pool their wisdom to consider how to resolve them each time.

Where did you learn a wide range of technologies needed to take the leadership of a variety of engineers?

Yoshida: I learned electronic engineering at an industrial high school. I did not attend any university or college but got employed. I was first hired by a major manufacturer. Later, I found a job at a technological development firm to be involved in various development jobs. I could learn high-level controlling technologies there at that time when faxes were under analog control. And I was sent to a plant to produce mainframe computers and was involved in development work. So, in the course of my contact with computers and their peripherals, probably I was able to learn various technologies each time.

You have continued to do on-the-job studying. Is it in your nature to love manufacturing?

Yoshida: When I was a primary school student, I liked reading encyclopedias, particularly one with many figures. I was such an extensive reader that I took books into the toilet to read them. I also loved breaking down mechanical things such as a bicycle or a radio. When I was a junior high school student, I installed a small engine on a bicycle or assembled an ultra-light bicycle. I was also an amateur radio operator and purchased electrical parts at the Akihabara electronics complex in Tokyo to produce various things such as a communication machine .

I hear you have a taste for radio-controlled machines.

Yoshida: It was more than 10 years ago that I learned from television that

Waseda University's team had continued to win in robot sumo contests. It prompted me to take part in the competition and I won. I have since won for the fourth straight time. In a recent case, I heard that a team from the United States had continuously won radio-controlled model car races. I participated in the competition and won. The model car I produced was powered with six 1.5-volt dry cells. It developed a speed of 120 km per hour in the first 200 meters of running. Equipped with a suspension system, the car can, theoretically, produce a maximum speed of 180 km per hour. I have won four races in a row at the competition. The robot and the model car are produced late at night for personal enjoyment. I do not like imitating but love challenging inventions.

How many patents have you acquired?

Yoshida: We have established patent rights in three cases. We have won the patents not only in Japan but in most countries of the world, including the United States, European countries and China. The figure is small, but each of the patents is a basic one. I think it would be very difficult to produce counterfeit printers by imitating the patented technology. This is because printer production requires overall technologies covering mechanism, hardware and software.

What is the size of WEDG's business?

Yoshida: Annual sales stand at more than ¥300 million. Sales of products like business-use printers account for 55%, commissioned technological development 25% and royalties 20%. Most of WEDG-brand products are produced on orders for business use. WEDG remains in the background for products for the general public, and major manufacturers use our technologies in their products.

What does the corporate name WEDG mean?

Yoshida: I was responsible for development at the previous company I worked for. But the company went under in the aftermath of the collapse of the information technology (IT) bubble. After spending two years to reconstruct the company, I invited four of my colleagues to launch a venture business. A key motive behind it was my desire to transmit Japan-originated technologies to the world by myself. I like a wedge as a tool very much. It is a tool of really simple structure but is capable of developing power 100 times stronger. If a stone wedge in a pyramid is taken out, a passage is clogged up. I have gained that knowledge from an encyclopedia. A wedge is a really interesting tool. I hit on the idea of the corporate name WEDGE in English. I also wanted to make the company a key part although it is small in size. But a business magazine-publishing house has already registered the name of WEDGE with the registry office. So, I dropped the letter E from WEDGE to make the corporate name. A dictionary shows the letter E is also dropped from the famous brand WEDGWOOD. Then I thought WEDG is OK.

How do you assess the current level of production technology in Japan?

Yoshida: My impression is that there have been fewer Japan-originated interesting technologies since the collapse of the IT bubble. Game consoles and printers are probably the only exceptions. This is partially because, from the viewpoint of small manufacturing firms like us, circumstances are not favorable for makers to develop ideas into technologies. It has become very difficult for small-scale manufacturers to rack up profits and build up internal reserves to continue R&D. It is easier for IT-related businesses than manufacturers to go public on the stock market. But I wonder if the stock market itself has turned into a place more like a casino. It is almost impossible for manufacturers to list their stock unless they have a large volume of sales.

What direction do you expect to pursue in future corporate management?

Yoshida: I do not believe printing onto paper will disappear from this world. We have recently launched a new thermal-transfer technology that speeds up writing into and erasing from media that can be rewritable as many as 1,000 times. It is a product for Ricoh, intended for production control mainly at factories producing Rico-view brand products. It has been said for a long time that resource-poor Japan needs to develop technologies and produce value-added products. I think this technology will contribute to preservation of the environment such as by saving resources and reducing carbon dioxide.

This is only a single example. I would like to leave some impact on the world through manufacturing technologies and thus gain appreciation from the rest of the world that things are uninteresting without Japan. I do strongly hope to continue manufacturing in such a direction.

This is a matter of no direct link with business affairs. But I have always considered on a global scale and harbor a desire to shorten the time as much as possible to make today's dream a reality. For example, I would like to bring off a space elevator or an ultrafast train at an early date. I think they must be much more interesting than printers. JS

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