

Sharp Corporation: Developing Next-Generation Products¹

Haruo Tsuji, president of Sharp Corporation, budgeted \$1 billion for LCD-related product developments between 1993 and 1995. Tsuji explained Sharp's strategy:

At Sharp we intend to channel all our efforts into creating next-generation products by developing and exploiting key devices. For example, it would have been impossible to create the LCD Hi 8 *ViewCam* without new types of liquid crystal display. We will press forward with creation of the next-generation of outstanding new products to attract customers and stimulate new consumer demand -- products such as the new *ViewCam* that can transmit still-video images over ordinary phone lines, and personal information tools with built-in fax transmission capabilities.

Sharp's strategy of developing key devices for use in future products had resulted in a continuing introduction of new products. According to senior executive vice president Wada:

We may have a large number of products that are being revised or sold in a given year, but the major developments are not so many in number. Those products are primarily divided into high, middle and low-end products. They each have a different set of features that are required. If we have three new product in one season, it is not too difficult to manage. In the whole line-up of new products, there may be as many as 20 new products in a given year. There are usually 3 to 5 new products in a quarter.

Of the 8 best selling electric appliances for 1993, Nikkei Research Center found that four were Sharp products. Since the introduction of Sharp's *VIP* refrigerator in February, 1993, it had shipped 80,000 units by September, raising Sharp's market share in refrigerators 1.1%. Since the introduction of its wide screen TV, it had increased market share 0.9%. Nikko Research Center commented on Sharp's new products:

In 1992, Sharp introduced the LCD-*ViewCam*. The new video camera was based on the development of a low reflection LCD display that was not easy for competition to duplicate.

The *Awash*, introduced in 1992, was a new type washing machine based on sensor controlled positioning technology that was not easy for competition to duplicate.

The *VIP* refrigerator reduced the outside size without reducing internal dimensions by using new silicon dioxide pellets in a vacuum environment to reduce insulation thickness. Competitors would be able to follow with moderate difficulty.

The wide-TV set was introduced at the lowest price in the market by applying IC technology that was considered relatively easy to duplicate.

The company's new product development activity was orchestrated by Sharp's senior vice president for product development, Atsushi Asada. Sharp's "kinkyu" or "emergency program" system was applied to develop promising new products. The *VIP* refrigerator was one example of an emergency project to save space without reducing inside capacity, and to

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develop materials to cut heat and to allow for low cost production. The team members examined over 100 materials before coming up with silicon dioxide as a filler in a vacuum which reduced overall space without reducing capacity. The *Awash* was inspired after president Tsuji watched an elderly woman having to use a step to reach into the washing machine and use a hook to pull out clothes. The new washing machine is lower in height. According to Tsuji,

My company must put itself in the customer's shoes as it works to create next-generation products. We can neither look smugly down on users nor fawn upon them if we intend to turn out products they will regard as valuable. What we must do is build a kind of "creation-intensive" company capable of creating value.

Tsuji constantly walked into stores to see what was selling and was the promoter of product development from the users point of view. According to Tetsuo Tani, an executive director of Sharp:

The president spends a lot of time looking for innovations for new products. He is interested in understanding the consumer's mind. Finance is secondary in a consumer oriented company like Sharp. The president is always looking for technological innovations and trying to understand the mind of the consumer which will affect future demand. He is always suggesting that we do something, providing real leadership to the company. That is why Sharp is an innovative company.

According to Sumy Otani, general manager of corporate public relations, Tsuji even inspired the *ViewCam*'s development:

The vision for the *ViewCam* came from president Tsuji. Mr. Tsuji came out of the TV and video systems group, so he knows about these technologies and he knows how to organize and manage these development activities. Since the people know that he understands the business well, the top down approach works well here. He also encourages people to make suggestions from the bottom up. With regards to the development of the *ViewCam*, the person in charge of the TV and video systems group asked for help from the research and development group.

Sharp was a strong competitor in its markets as shown in Table 1. Examples of Sharp's market share positions include:

Color TVs	15.5%
VCRs	12.0%
Camcorders	15.2%
Home phones	22.0%
Electronic calculators	36.0%
Japanese word processors	20.2%
Plain paper copiers	6.9%
Microwave ovens	20.9%
Refrigerators	13.0%

Sharp held over 20 percent shares in markets like microwave ovens, word processors, electronic calculators, and home telephones. Camcorders were expected to reach such levels in 1994.

Sharp's Product Development System

Sharp was clearly recognized as one of Japan's most creative companies. Sharp's continued innovations derived from the company's ability to commercialize its technologies. The company's ability to rapidly develop and introduce new products began as a result of the 1970s calculator battles. As a late entrant, Casio had dramatically cut prices and forced Sharp to discard market research, demand forecasting and organizational planning in order to respond quickly. According to Asada "The current product development system grew out of the calculator development problem. Out of that battle came the view that we needed to emphasize the consumer's point of view."

Sharp's kinkyu system had its origin in 1972 with the development of the LCD for electronic calculators. It had a completion goal of April, 1973, and took about one year to accomplish. Ichiro Fujimoto, senior executive director in charge of corporate R&D, explained:

Kinkyu projects are funded by headquarters when the results are short term, the organizational impact is significant, and the potential for sales is large. Each proposal is assigned points by a review team that I chair. If the points are high enough, then the project is submitted to the monthly engineering meeting. We make judgments about the needed resources. Each proposal has its own proposed budget, but I will ultimately decide on the budget. Typically, three years after the project is completed, the business is asked to repay half of the investment of the kinkyu project back to headquarters.

The development of kinkyu projects typically took from one to one and a half years to complete. Senior vice president Wada provided another view:

We don't like corporate bureaucracy. We do everything we can to lessen or destroy bureaucracy. When Mr. Tsuji is reviewing a product's development, for example, and there is some need for help from another department, he will ask the general manager from that department what he is doing to help in this product's development. If he is not helping, Mr. Tsuji will tell him to get someone to help immediately. This way we break down any organizational boundaries. We don't like organizational barriers.

Longer term projects could be the responsibility of a business division's R&D group, and could get funding from the corporate R&D group. According to Fujimoto, "When we get involved, it means that it is a corporate-wide effort. For long term, basic research projects, we use our own judgment." If a project took over two years to complete, was not product-oriented, or didn't require multi-division involvement, then it would not qualify as a kinkyu project. Fujimoto further described the kinkyu projects:

Since each organization has its own boundary, the kinkyu project creates a driving force to make something happen. About 80 percent of the projects are product development projects. There are some component projects, with small unit prices, but sales are expected to be high. I have responsibility for these projects. The remaining 20 percent are for software development or service development for new businesses outside of my area.

A small kinkyu group could include as few as 20 people and a large group could have as many as 70 people directly involved. A special project number is assigned. Those budgets are the responsibility of Sharp's president. The group reported directly to the president. Otani described the special character of the projects:

The most significant characteristic of the kinkyu project is the power that is given to the project's head. Only the president can choose this person. His corporate power is understood by everyone. Team members just make other people follow. In most companies, the vice presidents or division managers are probably more important than the head of such a project. This is probably unique to Sharp.

Sharp's decision process for kinkyu projects is shown in Figure 1. Every March, each divisional headquarters proposed new themes for development. Of the 50 or so proposed projects, the senior managing directors decided which themes to pursue after open discussion. Once the decision was made at that meeting, it was announced in the company newsletter and applications were sent to every employee. Sharp developed its internal recruiting of kinkyu project members, called "Star 21", in 1992 as part of the 80th anniversary of the company. Star 21 was developed by vice president Katsura and his team for recruiting small groups. Interviews were carried out between May and June on holidays using the company's training facilities. Five out of six applicants were rejected, so the process was kept secret. Interviewers were limited to the top three people in the personnel department and the division manager who was to direct the new theme. It was believed that if someone learned who was applying, the system would collapse. Every July, Sharp announced the new kinkyu project participants. Otani explained:

We have heard about other companies introducing kinkyu projects, but we heard that they didn't work. One of the reasons for our success rests on the philosophy of cultivating new markets with the creation of new products. That idea is basic to Sharp's kinkyu project.

There were typically between 10 and 20 kinkyu projects underway at Sharp. These projects included the involvement of the corporate R&D group, the IC group, the LCD group, engineers from the business groups involved, the components group and others. It is a horizontal tie-up of groups. Participants exchanged views from the top, bottom, front, back and side views. They involved most of the technical groups in the company. The objective is to come up with the next-generation key device that can be used for future products.

The company had introduced many firsts to Japan like the world's first desk-top calculator as the first step towards a pocket sized computer. As shown in Figure 2, Sharp continues to introduce a steady stream of new products. Products like the electronic organizer, the \$10,000 HDTV with simple-type MUSE decoder, and the LCD Hi 8 *ViewCam* all came out of Sharp's kinkyu system. According to Sharp's senior vice president Wada described the decision process:

The product development committee will decide on priorities for new product development. The general managers will give their input to the development needs, but when the discussion gets intense, the young engineers are brought in front of the president. He then discusses the details with them. He takes such a keen interest that he knows the details very well. Sometimes we will discuss

the product concept, sometimes we will review the prototype. He then follows up by finding out how the product actually sells. So we are very product oriented.

Figure 1: Sharp's Kinkyu Project Planning System

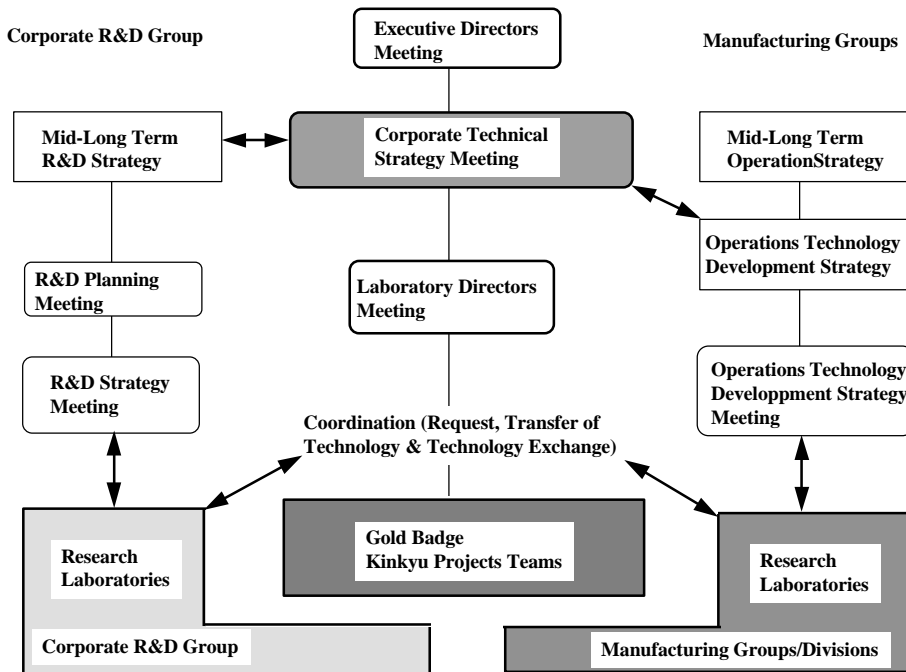


Figure 2: Sharp Corporation's Recent Product Releases

RELEASE DATE:	PRODUCT INTRODUCTION:
January, 1987	Electronic Organizer PA-7000: First kanji-based organizer.
April, 1988	Limited-Range Cordless Telephone CJ-S100: Included intercom.
July, 1988	Super-compact Word Processor WV-500: Used A4 batteries.
November, 1988	Fully Automated Hot Water Washing Machine ES-V458: Integrated water heater.
January, 1989	Dual-Swing Door Refrigerator SJ-38WB: First bi-directional door.
April, 1989	Upright Vacuum Cleaner EC-S35: Integrated telescopic hose.
June, 1989	LCD Projector XV-100Z: Flexible screen size.
September, 1989	Cordless Telephone & Answering Machine CJ-A300: Accessible from extension phone.
November, 1989	Lightweight Headphone Stereo Cassette Player JC-K99: World's lightest (99g) by using carbon glass fiber case.
June, 1990	Notebook Computer "All in Note": Integral hard disk.
September, 1990	Notebook Word Processor WV-700: Thinnest (30mm) and lightest (1.4kg).
	High-Brilliance LCD Projectors XV-H1: High luminance projector.
October, 1990	Home Fax UX-1: World's thinnest (39mm) space saving fax.
	Hyper Electronic Organizer PA-9500: Touch screen display.
December, 1990	Full-Color Facsimile JX-5000: World's first color fax.
January, 1991	Cordless Telephone with Answering Machine CJ-A350: First integrated scrambler.
March, 1991	HC LCD Video Projector XH-L100: First LCD projector for HDTV.
	Stylish Electronic Organizer PA-X1: Lightest organizer (99g) for women.
April, 1991	High-Resolution LCD Video Projector XV-S1Z: 650,000 pixel resolution.
May, 1991	Japanese Word Processor "Shoin" WD-SD70: Largest screen (17 inch).

June, 1991	Laptop Word Processor with Super-Clear Outline Fonts WD-A550: First cordless input unit.
July, 1991	Sensor System Oven RE-SE1: One touch cooking. Wall-mount Color LCD TVs 9E-H Series: First 8.6 inch wall mount.
August, 1991	Fully Automatic Bubble Action Washing Machine: First bubble action. Pocket Cordless Telephone/Answering Machine Combos CJ-A30/31
September, 1991	Notebook-Size UNIX Workstation UN-10: Most compact & lightest.
November, 1991	Laptop Japanese Word Processor WD-A551: Post card writing. S-VHS VCR with Build-In Satellite Broadcast Tuner High-Brilliance LCD Projector XV-A1Z: New micro-lenses.
January, 1991	16.5 inch Color TFT LCD Panel: First wide-vision panel.
February, 1992	Twin Lens 8mm Camcorder VL-MX7: First twin lens camcorder.
April, 1992	36-inch HDTV with "MUSE" Decoder 36C-SE1: 1,125 scanning lines.
June, 1992	Personal Wordprocessor WD-A750: Pen operation system. Personal Computer Shoin PC-WD1 Series: Combined WP/PC.
June, 1992	Twin Lens 8mm Camcorder VL-HX1: Super-wide angle, superimpose, and picture switching functions.
July, 1992	Hyper Electronic Organizer with Superior Management Capabilities PV-F1. Limited Frequency Radio Transceiver CB-T10: Prevent eavesdropping. Wide Vision TV with Built-In Satellite Tuner 28C-WD2: Low priced with 16:9 aspect ratio.
August, 1992	Compact and Lightweight LCD Video Projector XV-P1: One-third size and weight.
October, 1992	LCD Camcorder with 4-inch Color LCD Monitor VL-HL1: First 4-inch Color LCD monitor.
January, 1993	VIP (vacuum insulation panel) Refrigerator: 445-liters at 350-liter size.
February, 1993	Headphone MiniDisc Player MD-S10: Smallest and lightest.
March, 1993	Headphone MiniDisc Player MD-D10: Uses LCD for title display. Energy -Efficient Solar-Powered Home Heating/Cooling Air Conditioner AY-C28FSL: Space saving, solar indoor unit.
May, 1993	Color Image Scanner/ Transparency Scanner JX-325: One-third scanning time.
June, 1993	Pen-Based Word Processor WD-A770/780: Industry's first swing top pen design.
July, 1993	Portable CD Radio Cassette/Players for home karaoke fans. 4" Color LCD TV 4E-C3: uses high brightness, low reflection screen. 10.4" Active-Matrix Color LCD Display for multimedia video images.
August, 1993	Three Sharp LCD ViewCam models with expanded functionality.
September, 1993	Two 24" Widescreen TVs with Built-In Broadcast Satellite Tuners and VCR: First 24" with Built-In VCR.
November, 1993	Portable Mini-Disc Recorder MD-M11: Editing functions with text data recording.
January, 1994	Five-Door Refrigerator SJ-45M: Zero ozone depletion.

Sharp's Customer Orientation

In 1975, the baby boomers became the target of Sharp's *new life* strategy. In 1984 and 1985, however, the baby boomers' families began taking over and Sharp's products didn't sell well. That required Sharp to develop a new concept and a new strategy. The company set up a research project, which became the creative life planning group, to determine Sharp's future market strategy. Otani explained the results of that research:

We noticed that each person had a number of "windows" to look out. One woman was a wife and mother and student. She played these different roles and each role represented a different window

for self expression. We decided that we needed to develop products for each of the "scenarios" that she viewed. We had to visualize each scene.

A second problem was that our visual products division was in Tochigi and the audio products division was in Hiroshima. We needed an organization that would combine the two divisions in order to talk about audio-visual products. That required some center or organization that could integrate products.

The third problem was that our senior managing director, like Mr. Tsuji, needed some *brain* in the organization to think about what the organization should be doing. As a result of these three problems, we established the design center. There are various reasons for stimulating the organization to do some new things and some organizational unit needs to be responsible for doing that. To coordinate divisions, executives have the ability to do that. What the company lacked was a life style center.

The creative life-style planning group now has two centers, one in Osaka and one in Makuhari. They review the designs and may revise them to be more customer oriented. They do market surveys in the US, Europe and Japan to understand life styles. Their design center was now considered the brain of the company. President Tsuji, while he was senior managing director, was the first director of the center. Mr. Tani was now in charge of the center.

Prior to establishing the creative life-style center, Sharp used Dentsu, Hakuhodo or McCann Erickson advertising companies to monitor housewives and consumers, and to talk about products. Once the products were in the market, advertising firms asked consumers what they thought about those products. That was the common industry practice at the time. Sharp wanted more information. According to Otani:

What we wanted to know was how people spent their time from morning to night. For that research, we set up our center to find out how people spent their time, to find out what they cared about, and then to develop products for them. For example, suppose that a young person did not want to give up his music. They may want to hear their music all the time. They may buy a radio for a given purpose. We wanted to find out how they think and how they decide to buy a product. We identified about five major markets. Housewives had to produce food in time for dinner, so we tried to determine how we could help them produce good food in a shorter amount of time. Students wanted to talk to their best friends all of the time, so they wanted a message playback system to stay in communication. Such product ideas came out of our study of consumer behaviors.

As a result of Sharp's creative life-style research, the company developed a new strategy. Otani explained:

We identified different roles that people played. For example, we considered the most sophisticated people in a market to be *professionals*. The next level of consumer is the *sense leader*, the next level is the *sense follower*. At the bottom of the market is the *no-sense consumer* or the mass market. Matsushita and Sanyo target the mass market. Sony and JVC target the professional. Sharp wanted to target the sense leaders, those that influenced others to buy new products.

In order to identify the sense leader, we would call the person who bought a product. We would ask who recommended the product and they might say that their older brother recommended the product. Then they would call the older brother and ask who had recommended the product to

them. He might say that his friend had recommended it, so we would ask for the friend's telephone. The objective was to identify the original source of the recommendation. We found that such people typically read professional magazines and had a reason to recommend a product. We would try to locate about five such people and would invite them to meet with company employees. We discussed our products and talked about their hobbies and establish relationships with "sense leaders." Finding these people was a very time consuming process.

We are the professionals on the manufacturing side. Sense leaders are the professionals on the consumer side. If we can establish communications between the two sides, it is more exciting for both of us. That is how we started this process eight or so years ago. For each scene, there are different sense leaders. Back then we had about 50 such people, ten groups of five people looking at five windows. Today we have about 600 such people involved in about 120 groups. The most difficult part is in finding these people, but it is a lot cheaper than hiring Dentsu or one of the market research firms.

As the teams of sense leaders continued to grow at Sharp, they have become increasingly sophisticated. Otani continued:

The group size now depends on the product. We have a group that now manages this type of research. We started with ten people each in Osaka and Tokyo, but have grown the group since then. The ages of sense leaders range from 17 years old to 75 years old. What is important is the description of the sense leader: five aspects of the person. One relates to the person's wealth and their attitude to money. A second relates to their health. The third relates to the family history. The fourth relates to a person's style and looks. The fifth relates to their philosophy and how they view life.

There is quality of a person as a whole and quality of a product as a whole. The money aspect relates to pricing of the product. Health relates to the performance of the product. The history relates to the brand image. The individual style has to do with design. Philosophy relates to the product's concept. The most important part is the concept. That is what the creative life-style center works on. The pricing, performance and styling are the responsibility of the divisions. Our public relations office is responsible for the corporate image and identity. This responsibility is very clear and there is nothing like this concept in other companies.

Meetings with the sense leaders typically lasted about two hours. It included five people from the company, including the manager and his younger people. After every meeting, a memo was sent to a top officer to initiate action on the recommendations. On occasion, Mr. Tsuji sat in the meetings and listened from the corner.

Three years ago, the center became one of Sharp's headquarters functions with a vice president in charge of the activity as shown in organization chart in Figure 3. Asada was in charge of the function and had close ties with the president. Mr. Asada was one of the inventors of the calculator and had a Ph.D. in physics. He was also the father of Sharp's LCD operations and was a key person in the company. With his leadership, the organization had an important impact within the company even though its number was relatively small. "That is why we call this the brain of the company," explained Otani.

With the globalization of Sharp's business activities, the needs of foreign customers had to also be met. Wada explained:

We are watching overseas markets closely. We have been successful in expanding our overseas position, especially in Asian countries other than China and India. But now I believe we are entering a new phase of global competition. Our previous focus covered a market of one billion people: Europe, the U.S. and Japan. But today, there are large new markets opened up like China with 1.2 billion people and India with 850 million people. Russia has maybe 250 million. The free market has expanded from one billion to 2.5 billion people. This growth is mostly in developing countries. Countries in Latin American and Pakistan are sending a lot of missions here with the view of inviting us to set up factories. So this is a totally different world. What they want is different from that of the U.S., Europe and Japan. These emerging markets, like China, Southeast Asia and India, are growing between six and ten percent per year. So the rules are changing and we must meet their requirements. You have to come up with the right product for them. The type of products that sell in Japan will not sell in Thailand. The real challenge is in figuring out how to meet those local needs. We want to maintain Sharp's brand image and technical competence in those market, so we don't aim to introduce products at the lowest end of the market. At the same time, we have to produce products that are not as expensive as we can sell in Japan.

We will set up a factory in India to produce a video cassette recorder. We found that they appreciate Sharp's technology, but want products that are different from what we now produce. We have to produce a product that is suitable for people with lower incomes and different tastes than Americans. We have to use local design engineers that can make good use of components and materials sourced from local factories in order to cut costs. In fact, our factory in Malaysia uses non-Japanese components valued at 85 percent of the cost of our locally produced VCR. That means that we outsource the majority of our components locally. That is an example of our strategy for using local suppliers to cut costs.

We established the creative life group to study new trends, especially among young people who are the trend setters. We have also set up product design groups in our different market areas. They often propose products for development. We have a group in the Philippines that have been very good at developing products for that market. They like it loud in the Philippines. Our basic audio technology comes from Hiroshima where we have our communication center for the business group. We are putting emphasis on high volume and high power sound for that market.

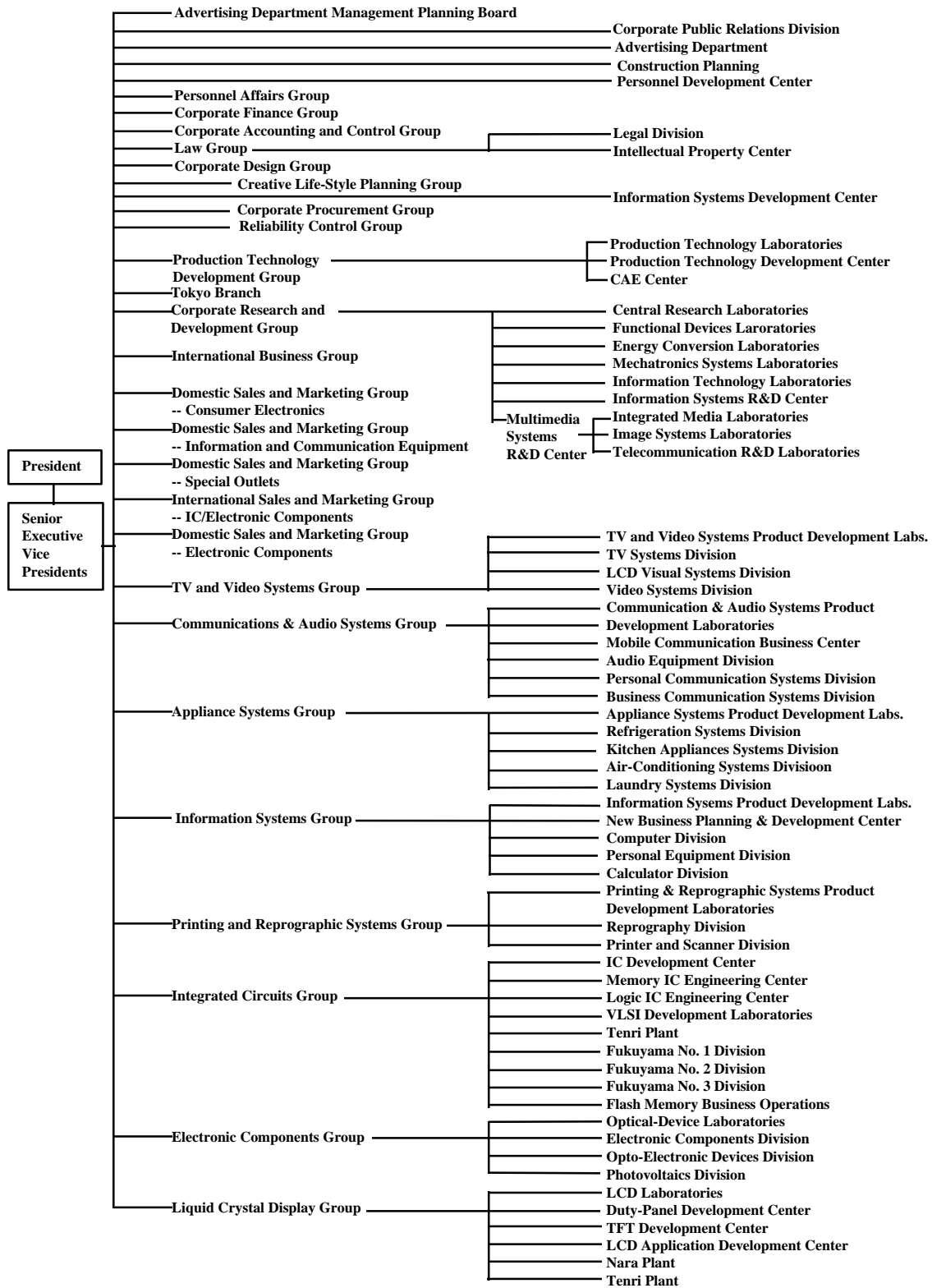
Sharp TV & Video Systems Group

Sharp's TV & video systems group includes the TV systems division, the LCD visual systems division, the video systems division, and the TV & video systems laboratory. The television business division's products are centered around color TVs and video-based media and services such as satellite and multiplexed videotext, CATV, and home computers.

From this foundation, we constantly strive for improved performance in all aspects of technologies and systems, from design and development through production and shipping. We have established rigorous inspection procedures driven by the newest and most powerful production systems and computers as well as implemented flexible manufacturing structures applicable to products from large-screen TVs to personal TVs. For the future, we will, of course, work for improved image quality and resolution, and will be improving products with even greater reliability.

Figure 3: Sharp Corporation's Organization Chart

As of October 1, 1994



In the video systems division, Sharp was working toward full automation of its production lines using a wide variety of automated equipment and robots. At the same time, it has introduced ultra-precise processing technology at the micron level for the manufacture of recording/playback heads and the machining and assembly of tape drums -- key components in video units.

The LCD visual systems division was currently producing the most popular of flat panel displays. With over 40 percent of the world's supply of LCDs, Sharp created new video information products. Sharp introduced a 21 inch TFT color LCD prototype at the LCD International exhibition in Tokyo for 1994. Big-screen LCDs in excess of 40 inches were under development. Sharp had won Germany's "Eduard Rhein Prize" for its 14 inch TFT color LCD, the equivalent of the Nobel prize in the A/V field in Europe. Sharp developed and manufactured a wide variety of LCD-based products from highly innovative concepts. Examples are the compact, lightweight, big screen LCD SharpVision projection TV, the Sharp LCD Color TV, the Japanese word processor with pen-based command systems, and the Hi-8 LCD *ViewCam* with a 4" LCD monitor.

Table 2 shows the products being produced by the group in December, 1993. With current production of over 200,000 units per month, over 67 million color TVs had been produced since 1960. The majority of color TV production had now been shifted overseas to Malaysia, Spain and the USA. Over 300,000 VCRs were being produced monthly with over 30 million units produced since 1979. As with color TVs, VCRs were now produced in the UK and Malaysia. The most sophisticated products, like camcorders and LCD products, were mostly produced in Japan. The group employed 2,390 people in April 1994. The number of employees in key department include the following:

Engineering-related departments (940 employees)
 Planning/Designing (130 employees)
 Production departments (890 employees)

Table 2: Production (Tochigi plant opened in 1968)

Production:	Daily	Monthly	Total	Domestic (initial)	Overseas (initial)
Color TVs	10,000	200,000	67,320,000	27,821,000 (1960)	39,499,000 (1969)
VCRs	15,000	300,000	38,109,000	30,309,000 (1979)	7,800,000 (1981)
Camcorders	3,500	70,000	2,535,000	2,535,000 (1985)	
LCD <i>ViewCam</i>	3,500	70,000	432,000	432,000 (1992)	
LCD video projectors	-	5,000	233,000	207,000 (1989)	26,000 (1990)
LCD color TVs	-	15,000	-		
Displays	-	10,000	-		
Domestic Manufacturing Collaborators: 11 companies (3,200 employees)					
Overseas Color TV and VCR Production Bases: 13 plants in 11 countries.					
Malaysia color TVs: 2,200,000/year					
USA color TVs: 1,100,000/year					
Spain color TVs: 600,000/year					
U.K. VCRs: 500,000/year					
Malaysia VCRs: 1,600,000/year					

The *ViewCam* Development

Sharp's *ViewCam* was the world's first camcorder to feature a built-in large-size color monitor, opening up a new world of *shooting, viewing, and having fun* with video. The original VL-HL1 *ViewCam* was introduced in October of 1992 in Japan. In place of the typical viewfinder, the user watches a color LCD monitor mounted next to the camera body. The monitor can also be used for on-location playback of footage just recorded. Attaching the optional tuner enables users to enjoy live TV broadcasts or prerecorded tapes. The original *ViewCam* was priced at \$2,199, compared to traditional video cameras without large screens that sell for under \$1000. The company had shipped a total of 470,000 of its original LCD Hi 8 *ViewCams* within the first year, and was producing 70,000 units per month by 1994. According to Isao Kuwata, general manager of the video systems product planning department:

The *ViewCam* created a new product category: the all-in-one display/camera/ recorder. This broadened the user base to new market segments, with 60.9 percent going to first-time purchasers as compared to the industry average of only 50 percent first-time purchasers. Over thirty-five percent were selling to people in their 50s and 60s.

A *Popular Science* review of the product gave high praise:

Sharp's *ViewCam* video camera...helped change camcorder habits in much the same way Polaroid Corporation transformed snapshot photography decades ago -- it made the viewing experience instant. The *ViewCam*'s color active-matrix liquid crystal display (LCD) frees you from peering into the eyepiece-viewfinder or connecting the camcorder to a television set. With the LCD, the picture can be shared with others as the event is being recorded or immediately after rewinding the tape.

Also important is a built-in speaker; thus making a private earpiece optional. You can even take the camera along on trips and use it to watch prerecorded movies on 8mm videocassettes.

Conventional camcorders were mostly sold to families with small children who made videos of children growing up, or of family events, or of vacations. The *ViewCam*'s ease of use was expected to revitalize the market. According to Kuwata:

The market size was an uncertain element when we started. In 1990, it was 1.8 million units and fell to 1.44 million units in 1991. Then it fell to 1.16 million units in 1992. The *ViewCam* came to the market in September, 1992. It has expanded the market to 1.25 million units in 1993. We expect the market to expand to 2.0 million units by 1995. We hope to see the market grow to 3.0 million units per year.

When the video systems division was reviewing different ideas for the new camcorder, president Tsuji sent down the word to "use liquid crystal display in a camcorder." This was a difficult challenge since the LCD screen was difficult to see in bright light or from an angle. It also had to be thin and light for ease of carrying. This required a totally new type of low reflection LCD and a new system to allow the LCD screen to flip 140 degree and

maintain an upright picture. The responsibility for the development was placed in the hands of senior executive vice president Asada. Kuwata explained:

To achieve our goal, we had to conduct basic research. So the development was far more difficult than that for a conventional product. Theoretically, we felt it possible to reach our goal in six months, so we formed a kinky project team to achieve commercialization in October 1991.

The major difficulty at that time was thought to be the technology for reducing reflection of external light. This problem was solved by applying a special, anti-reflective coat to the surface of the liquid crystal panel itself. This lowered the previous reflection rate of 23.3 percent to an astonishing 2.6 percent, about one-tenth of what it was. This solved the problem of outdoor visibility.

Next, it was necessary to make the screen itself brighter and easier to see, and to make the whole unit lighter and more compact. Using the new type of backlight system, it was possible to attain twice the brightness of conventional panels. A reduction of panel thickness of one-third that of conventional products was also achieved.

Improvements in low-reflection, high luminosity, compactness and lightness lead to the new LCD panel. While developed for the LCD Hi-8 *ViewCam*, it has now been applied to the high performance liquid crystal portable television.

The LCD panel improvement, however, turned out to be the easier problem to solve. The most difficult problem turned out to be the design of the mechanism and software that allowed the LCD unit to flip over 140 degrees:

You can't do that with a CRT display because the lines are scanned from the top-down. With the LCD, you can change the direction of scanning from bottom-to-top when you turn the LCD upside down. It was difficult to develop the circuit for that. We now have the patent for that circuit. The LCD also has other capabilities that are limited with CRT components.

On August 20, 1993, Sharp Corporation introduced three new LCD *ViewCam* models. All models incorporated special features including:

Built-in 4-inch thin-profile LCD screen for use in bright locations. The large LCD eliminates the need to use a viewfinder. Its pivoting screen allow one to even monitor self-videos. It also allows instant playback for everyone to see.

Sharp's light weight, *ultra-compact lens system* uses a quarter inch CCD (charge coupled device) that displays approximately 270,000 pixels for the first time in the industry. The lens is only 43.5 mm in overall length and features a smooth operating 8 to 1 variable zoom.

High brightness is achieved using *fuzzy logic technology* for auto white balance, rapid full-range auto focus, and balanced exposure using neural logic technology.

Two new lower priced *ViewCams* dropped image stabilization, strobe and freeze frame feature. But the new models retained the look and feel of the original, including the power zoom and the pivoting lens that enables users to direct themselves in a group picture, do video dictation, or comb their hair using the lens in lieu of a mirror. The swivel lens also lets you hold the camera over your head in a crowd, for example, while monitoring the

action. It also has a masking feature for wide-screen viewing. The new *ViewCam* models offered more sophisticated video, using the Hi8 System and a high-density CCD with over 400 lines of horizontal resolution, power zoom, and full-range auto focus. The top-end VL-HL2 featured high image quality combined with enhanced functionality. The lower priced VL-EL 10 offered simple, straight forward operation. And the economic VL-EL300 was a compact (three pounds), highly portable unit. This lowest cost model was priced at \$1,199.95, with a street price in the U.S. of around \$800. According to Kuwata:

When we introduced the *ViewCam* on October 26, 1992, we had already determined the basic direction for the next models to be developed. The final design was decided after we completed a consumer satisfaction survey. After the first batch of 3000 products were shipped, the next batch of 5000 units included the customer satisfaction survey to be filled out by the purchaser after one month of use. It is quite detailed. We get about a 15% return by offering a telephone card for those that return the survey. The information contained in the sheet is analyzed and summarized. After the survey is completed we don't continue sending these out.

Through 1993, Sharp had sold 470,000 *ViewCams*, including 250,000 in the domestic market and 220,000 through export markets. The sales of *ViewCam* sales were:

	Domestic	Overseas
1992	120,000	15,000
1993	250,000	220,000

Competitive Responses

The major competitors in the video camera market were Sony, JVC and Matsushita. Sony was currently number one, Sharp was number two, and Matsushita was number three. JVC admitted that they lost share in 1993. Kuwata was optimistic about Sharp's product leadership:

We surpassed Matsushita this year to move into second place although they have not yet admitted that they lost share. We are approaching a 25% market share and project 40 percent by the first half of 1994, depending on what our competition does.

The market was currently divided into view finder and LCD type video cameras. If you look at what is happening to market position, consumers prefer the LCD screen to the viewfinder. Sharp owned 100 percent of the LCD type segment through 1993. As a result, Sharp had moved into third place in 1993 with 15.2 percent of the market. Kuwata explained the shift:

If you set 1992 sales at 100 percent for view finders and LCD, the viewfinder segment has fallen to 70 percent while the LCD segment increased to 200 in 1993, or nearly 25% of the market. The viewfinder segment is going to be further reduced in 1994.

The people that have taken pictures before are now playing with the new functions. We want to add functions to this to improve communications. If we can add new functions, we can increase the size of the market again.

Sharp continued to increase capacity of its Tochigi plant to 800,000 *ViewCams* in 1994 and planned one million in 1995. According to Daiwa Institute of Research's Yoshimasa Takashina, LCD-equipped camcorders will likely outpace sales of conventional camcorders. Sales of camcorder units with LCD monitors in Japan were estimated to grow from 310,000 in 1993 to 600,000 in 1994.

In 1993, Sony held a 41.2 percent share of the domestic camcorder market. Until the *ViewCam*'s introduction in 1992, Sony Corporation had held over 75 percent market share of the small format 8mm video camera market. Sony had gained its strong position with the development and application of the charge coupled device (CCD) to 8mm format cameras in 1983. Sony Corporation and Fuji Photo Film Co. Ltd. responded to Sharp's *ViewCam* with the introduction of their own LCD-based camcorders in February 1994. Sony's smaller, light weight (under two pounds) Handycam *Snap* was priced at \$1,200. The Sony *Snap* was half as wide and a pound lighter than Sharp's latest VL-EL300 *ViewCam*. The smaller size of the *Snap* allowed for one-handed operation, unlike the larger *ViewCam* which is awkward to use without both hands free. Sony supplies a sun shade for the screen if you're viewing the picture in bright light, though the view finder could be used without the screen. Sharp offered a sun screen as an option. While the Sony was easier to carry, the *ViewCam* offered more advanced filming capabilities.

Sony offered only two modes, 118mm telephoto and 38mm wide-angle, which makes a *Snap* noise during mode changes which is recorded. The *Snap*, which looks like an old boxy Kodak Brownie, used a three inch (diagonal) color LCD screen with the lower resolution Video 8 format cassettes. Matsushita Electric Industrial Co. followed in July, 1994 using a VHS video format. Japan Victor Company (JVC), of which 52.4 percent is owned by Matsushita, was the last to respond with a VHS video recording system. The lower resolution of the Video 8 is slightly better than VHS formats used by Matsushita and JVC. Sharp and Fuji Photo Film used the Hi-8 system, an 8mm tape developed by Sony.

This requires an external microphone which attaches to a weak rubber connection. The *Snap* also offered only an A/V Out connection to attach to an external monitor. The *ViewCam* offered standard RCA jacks for both A/V In and Out connections. Sony's *Snap* provided an optical viewfinder. This allowed the LCD screen to be turned off during shooting to extend battery power. The *Snap's* rechargeable lithium ion battery lasted about 45 minutes with the screen on and 75 minutes with it off. The *ViewCam's* slightly larger nicad battery life lasts about 45 minutes. The *Snap* also allowed AC power to be connected with the battery being charged at the same time. The *ViewCam* required removal of the battery for changing or AC operation. Since the 8mm format allows three hours of programming per cassette, extra batteries are essential.

Matsushita was Japan's second largest camcorder maker, using the VHS-C system. Both Matsushita and JVC offered lower priced viewfinder camcorder models which allowed their 8mm format tapes to be played in standard VHS video players. According to Kenichi Kitayama, director of Matsushita's VCR and camcorder business, "If you shoot with a VHS camcorder, you can easily play the cassette back with a VCR at home. We will appeal to the

compatibility of VHS camcorders and VCRs." JVC had priced their camcorder at \$1,450, including a TV tuner for local TV broadcasts.

Planning for the Future

In November 1992, Sharp opened its multimedia development headquarters. In celebration of its 80th anniversary, Sharp signified a new departure with a futuristic international communication center, the Sharp Makuhari Building. This building functioned just like the central labs in Tenri and Europe and the US. President Tsuji envisioned it as the center to "drive Sharp towards the integration of image, information and communication for the 21st century." He expressed a determination to gather all existing technology required to participate in the multimedia era.

We no longer use such categories as consumer electronics products and information and telecommunications, because we believe such products categories as multimedia will merge existing categories. It would be difficult to create next-generation products and systems if we continued the compartmentalized thinking of the past.

Apple Computer and Sharp Corporation worked jointly on the development of the personal digital assistant. Apple completed the software development for communication and Sharp developed and produced the hardware. Apple provided the total concept and lead the product development team. Sharp had the LCD and miniaturization technologies. Tani commented on Sharp's strategy:

Multimedia is becoming an important area. We are going to link many small products with the network. When we think about the computer market, we have grown up from the calculator business to the electronic organizer, and now the *Zaurus* or Apple Newton. This has not been a success yet, but in the future we see the integration of pictures, voice and data communications. Those will be central to technological innovations in the future.

Otani demonstrated Sharp's newly introduced personal notebook, the *Zaurus*.

We have introduced our *Zaurus* for 50,000 yen (\$500). It is a pen system that allows us to have a calendar, memos, schedules, etc. and has 72 hours of operating time with a memory backup. With an adapter, it can be hooked up with a fax modem. You can automatically transfer data to another machine without needing a hardwire linkage. The main memory is about one megabyte, the scheduling section has 190,000 bits of space, the telephone section has 375,000 bits, but you can increase it by inserting a memory card. This was introduced in November, 1993. It can go up to 16 megabytes of memory by using flash memory cards.

The Apple *Newton* is heavier and has more functions. It was introduced in Spring, 1994. The fax modem will be built in and the price will be more, about \$800. We think that is too expensive, but the reading and writing software is most difficult. It includes automatic learning for reading and writing which is more advanced than our system.

Sharp saw the portable computer terminal business as an entry vehicle into the multimedia market. "Rather than use a big net, we would like to make a hole in a small area," said multimedia business manager Hashimoto. To make a hole with the new portable

terminal tied to a network requires high level communication technology, both wire and wireless. Fujimoto was responsible for Sharp's approach to multimedia:

In Multimedia, we are not concerned about industry definitions. We are simply making two approaches to attacking this market, top-down and bottom-up. The bottom-up approach is to start with existing products like the *ViewCam* or *Zaurus* and adding something extra to put it in the multimedia stream. We have equipped the *Zaurus* with the 232 C communication terminal, and have developed hand writing technology that recognizes characters. This can be transferred to another *Zaurus* using infrared communication. That has become the world standard for infrared communications. We have developed the ability to send a digital facsimile from the *Zaurus* through telephone. We have developed a printer that communicates with the *Zaurus* by infrared. We also have an infrared communication link for PCs using Windows. These are examples of bottom up approaches.

Another bottom-up example is the *ViewCam* Teleport. You can take a picture and send it through a telephone line to another *ViewCam*. You can send your child's picture to the grandparents. The wide-screen TV is another, displaying news announcements on the screen as they occur. This can also be used for advertising.

The facsimile machine is expensive for home use, so we tried to make it more useful by making it a home copier. You can detach the reader from the machine and make it a copier. Sharp was the first, but Toshiba now has a similar one. In addition to the fax/copy function, it also has a recording function using an IC. You have instant access without message deterioration with use.

During the opening of the Makuhari Building came the announcement that the company would also change its approach to product development. Before, the company looked for seeds by examining new materials. Now it is trying to envision new products and take a needs oriented approach to development. The company is not abandoning the old systems and announced in November the development of a new plastic LCD that can bend. President Tsuji gave direction to come up with new products to use this new component. *ViewCam* is an example of a seeds oriented product. Critics argue that Sharp has not created new markets since it introduced the calculator. They questioned whether the needs oriented approach would really make a difference. Sharp had not been considered a fashion leader in product development.

Overall operating profits were 2.1% of sales, the highest in the industry. While this is down from the 4.4% profit margin of 1990, it is still better than in 1986 and 1987. According to Otani:

We have to think about the 21st century from here on out. What is important about young people under 20 is their philosophy. People without a concept are running towards new religions, or following people that are the current fad. They just go enmass in one direction. It is important to make products to meet the needs of these people. Finding a concept that fits these people is very complicated. Until now, what was needed in the planning group was technology and perhaps economics and literature majors. From here on, we probably need philosophy majors and psychologists, a different kind of person to think about new products. Engineers will always be needed since any concept must be backed up with technology, but additional people are needed. Software people are going to be needed for future planning.

Nikkei Sangyo's newspaper article noted that Sharp's current weakness was in communication technology. Sharp's telephone experience was not considered adequate and Sharp required new technological alliances. In 1992, the company entered the small power transmission market but depended on Nippon Musen for software for cordless systems, low powered and wireless technologies. The company did not have the know-how to cope with the processing of complex code that enables the reduction or prevention of noise in communication. As a result, Sharp was developing strategic alliances with a number of major companies. Wada explained:

We have a top down approach that is focused on building the infrastructure for product development and in making large technology investments, like image compression technology in multimedia. In the bottom up approach, we have a lot of products that can be used to approach the multimedia market, like the video cam. We can use it to transfer still pictures over the telephone up to six of seven times per minute, now. With the cooperation of AT&T, within a year we hope to increase this capability to 15 pictures per second. That is getting close to television reception. We are now developing the basic technology that will allow us to develop such capabilities. We are jointly developing these capabilities with AT&T. I expect that we may find some other areas for joint development.

Flash memory has potential. We are now expanding our production and developing the second generation flash memory with Intel. This is strategic cooperation with the world famous microprocessor company. They are the best imaginable partner for us. We are always extending feelers for potential cooperation. I'll give you the news release.

Wada was also applying the new technologies to its existing products:

We are now trying to combine the paging function with the Zaurus, so that you can send four or five lines on the pager screen so you don't have to go to the telephone to get the message. We have also included fax capability in the Zaurus, and infrared communications. It can transfer information between computers and send Fax over the telephone lines. It is handy and portable, but is already in the market. It is sold in the U.S. as an electronic organizer called the Wizard. We don't really have a competitor in the market with the same type of product. These product has created a lot of good will in the market.

We also have miniaturization technology that allows us to develop very light-weight and portable products. Our PHS, personal handy phone, is an example. We are one of many suppliers of this product OEM to NTT. Sharp's is the preferred PHS. In the PHS market, there are 43 models being produced by 29 vendors. Sharp's two models account for between 60 and 70 percent of the market. Our models weigh about half as much as other models at 200 grams. Because it has NTT's brand name, consumers don't realize that they prefer Sharp's models. The smallest cellular phone is 95 grams. Its so small that women lose it in their purses.

Table 1: Market Share for Major Electronics Products and Components (reported in 1994)

Consumer Electronics and Home Appliances (domestic units or sales, change in share↑↓ in 1993)

Color TVs 1. Matsushita 21.0%↓ 2. Sharp 15.5%↓ 3. Toshiba 14.5%↓ 4. Sony 14.0%↑ 5. Hitachi 10.5%↓ (8,143,000 units shipped) ↓1.9%	VCRs 1. Matsushita 23.0%↓ 2. Sony 14.0%↑ 3. JVC 14.0%↑ 4. Sharp 12.0%↑ 5. Toshiba 11.0%↓ (4,486,000 units shipped) ↓2.4%	Camcorders 1. Sony 41.2%↓ 2. Matsushita 25.0%↓ 3. Sharp 15.2%↑ 4. JVC 7.0% 5. Fuji Film 4.0%↑ (1,169,000 units shipped) ↑3.4%	LCD TVs 1. Casio 51.8%↓ 2. Sharp 18.2%↑ 3. Epson 13.6%↑ 4. CVM 7.3%↓ 5. Seiko 5.5%↑ (1,100,000 units shipped) ↑22.2%
Home Phones 1. Sharp 22.0% 2. Sanyo 21.5%↑ 3. NTT 16.0% 4. Matsushita 11.7%↑ 5. Sony 8.0% (1,410,000,000 yen sales) ↓4.8%	Refrigerators 1. Matsushita 20.0%↓ 2. Toshiba 16.0%↓ 3. Hitachi 16.0% 4. Sanyo 15.0%↑ 5. Sharp 13.0%↑ (4,127,000 units shipped) ↓3.6%	Air Conditioners 1. Matsushita 17.0%↓ 2. Mitsubishi 13.5%↑ 3. Toshiba 13.0%↓ 4. Hitachi 11.0%↓ 5. Sanyo 10.0%↓ (5,048,000 units shipped) ↓19.3%	Microwave Ovens 1. Matsushita 26.3%↓ 2. Sharp 20.9%↑ 3. Mitsubishi 11.5%↑ 4. Toshiba 10.9%↑ 5. Hitachi 10.1%↓ (2,730,000 units shipped) ↓0.7%

Information & Office Systems and LCDs

Facsimiles 1. Ricoh 16.5%↓ 2. Matsushita 16.0%↓ 3. Canon 15.0%↑ 4. NEC 10.5%↑ 5. Toshiba 8.0%↓ (1,900 million yen sales) ↓3.6%	Plain Paper Copiers 1. Ricoh 31.5%↑ 2. Canon 27.8%↓ 3. Fuji Xerox 23.3%↑ 4. Sharp 6.9% 5. Konica 4.8%↓ (620,000 units shipped) ↑5.0%	Electronic Calculators 1. Casio 52.7%↓ 2. Sharp 36.0%↓ 3. Sanyo 1.9%↓ 4. Canon 1.8%↓ 5. Toshiba 1.8%↓ (77,800 million yen sales) ↓15.7%	Japanese Wordprocessors 1. Sharp 20.0%↓ 2. NEC 14.5%↑ 3. Toshiba 13.8%↑ 4. Fujitsu 13.5%↑ 5. Casio 13.0%↑ (2,220,000 units shipped) ↓4.3%
Personal Computers 1. NEC 52.7%↓ 2. Apple Computer 12.2%↑ 3. Fujitsu 11.3%↓ 4. IBM Japan 8.1%↑ 5. Seiko-Epson 6.7%↓ (2,460,000 units shipped) ↑10.0%	Office Computers 1. NEC 28.5%↑ 2. Fujitsu 27.0%↓ 3. Toshiba 9.7%↑ 4. IBM Japan 9.4%↑ 5. Mitsubishi 8.4%↓ (163,700 units shipped) ↓14.0%	Projection TVs 1. Sharp 54.0%↑ 2. Pioneer 18.0%↓ 3. Mitsubishi 12.0%↓ 4. Hitachi 10.0%↓ 5. Other 6.0%↓ (50,000 units shipped) ↓9.1%	LCDs 1. Sharp 39.1%↑ 2. Toshiba 11.5%↑ 3. Seiko Epson 9.8%↓ 4. NEC 8.8%↑ 5. Optrex 7.1%↓ (480 billion yen sales) ↑8.3%

Source: Nikkei Sangyo Shimbun, June 22, 1994.