

## Chapter 4

### Intel or Motorola?

Hitachi was ahead of other companies in the development and mass production of calculator LSIs in the early 1970's, and we gained a market share of over 60% and rapidly improved the business performance. Hitachi's semiconductor sales volume in 1973 was the third largest in the world, surpassing Fairchild.

However, triggered by the fourth Middle East War that broke out in the autumn of that year, the market began to decline sharply from the next year, and a large restructuring accompanied by factory consolidation took place in 1975.

Both the Kofu Works and Komoro Works, which had been independent factories were downgraded as "Sub-factories" of the Musashi Works. The so-called "oil shock" caused a great deal of damage to Hitachi's semiconductor business.

Meanwhile, in the US, mainstream semiconductors began to shift to standard products such as microprocessors and memories, with Intel taking the lead, and Hitachi, which had the advantage of custom LSI, started to suffer from an adverse wind.

At that time, I was in the position of Manager of IC Development Dept. and had to challenge microprocessor development while handling new development projects of custom LSIs that rushed to us every month. The first microprocessor of Hitachi was 4-bit product which was compatible with Intel 4004. It was completed in June 1974, three years behind Intel, but the impact on the business was not a big one. It was rather a study material of "taking up microprocessor", so to speak. Participating in this project were Yuzo Kita of the Central Research Laboratories (CRL), Akira Nagase, Joe Nakajima, Toshimasa Kihara and others at the Musashi Works. Since they went on to shoulder subsequent microprocessor technology for Hitachi, the project itself was of great significance.

After that, with regard to the 4-bit microprocessor, the development was carried out by the calculator LSI development group as the center, and the original microprocessor named HMCS45 was commercialized in March 1977. Its business performance was reasonably good, by securing a small system market in Japan.

On the other hand, in the case of 8-bit microprocessor, the design of system architecture was most important rather than simple device design, and we thought that it would be difficult to tackle it with the resources of the semiconductor division only, which was mainly composed of device and process engineers. We decided to get the help of the system department group of CRL, and proceeded with the study of original products in the form of "Research Request" from the second half of 1972.

How should we proceed with the development of 8-bit microprocessor from now on? Should we challenge to proprietary development? Or should we take a second source strategy by cooperating with advanced manufacturers? If in the latter case, which is a more appropriate partner, Intel or Motorola? · · · Without a definite conclusion for quite a while, the days and months of agonies were elapsing.

Under such circumstances, the General Manager of Semiconductor Division was switched from Masami Tomono to Yoshinobu Imamura in 1973. Imamura had a sense of crisis about the situation at the time with a clear understanding that microprocessor business launch was an urgent matter for Hitachi semiconductor. In response to occasional hearings from Imamura, I explained the actual situation and decided to ask for his support. Also in consultation with my boss, Shotaro Shibata, I made a proposal of some sort of tie-up regarding 8-bit products with a leading manufacturer such as Intel and Motorola, while continuing the study on our own original development.

Imamura thought he should seek for some sort of partnership strategy by himself. His visits to American semiconductor companies were planned, with my accompaniment as the whole two weeks trip from 12<sup>th</sup> May through 25<sup>th</sup>. The visits were: WE, RCA, IBM, TI (Dallas and Houston), Motorola, Fairchild, HAL (Hitachi America) and so on.

Imamura's generous personality led to warm welcome from all the companies, with very lively conversations, and to strong relationship building between the top executives. Among them, Motorola gave us a special hospitality. After the greetings and business card exchanges with the top executives of Motorola semiconductor, the top of each division of MOS, bipolar and discrete products gave us detailed presentations on the market and technology trends. Regarding the MOS business, John Ekes, the division head, explained about 6800 microprocessor which was under development aiming at a microprocessor far exceeding Intel products (8080).

Then the discussion came to the topic on cooperative relations with Hitachi, and a proposal was made to deepen cooperative relations by the mutual visits from then on. Imamura responded with a very positive stance, and he said that he would like to work positively on cooperative relations in microprocessor.

Just at this time, although both companies had different circumstances, they both wanted partners on microprocessors. As a result of this visit, friendly relationship between the two companies was deepened and we would move on to a technical alliance, but it was still some time later. Photo 4.1 below is when Imamura visited the Motorola headquarter factory in Phoenix.



Photo 4.1 Yoshinobu Imamura (center) visiting Motorola in May 1974  
To the left Toru Abe, and to the right the author

As was mentioned earlier, the studies on proprietary 8-bit products were progressing within the company, but there seemed to be no chance of winning in terms of performance, compared either to Intel 8080 or Motorola 6800. One of the reasons was that both Intel and Motorola were developing NMOS based products, but Hitachi's products were based on PMOS. It may be said that the sweeping victory with calculator business by PMOS LSI technology backfired in this case. With this background, many discussions were conducted, such as comparing on technology basis and strategic scenarios from the viewpoint of management. As a result, the discussions gradually converged as, "For 8-bit microprocessors, it is difficult to win with the original products, and it is almost indispensable to partner with Intel or Motorola."

In October of 1974, with the above situation as the background, Shotaro Shibata, Deputy Division GM, and I made a trip to visit US makers and thereby making up the microprocessor development strategy. It was a business trip from October 2nd to 14th, visiting only the microprocessor manufacturers. We visited Intel, Motorola, Fairchild and a few other companies. Intel had already commercialized 8080 in June of this year, and Motorola was close to the announcement of 6800 products. On the other hand, Fairchild was developing a microprocessor called F8, but it was nearly a year behind Motorola, and it was still a "paper machine" at this stage, and so we decided not to go further with this.

First, Intel visit was on October 9th. The purpose was to confirm Intel's policy towards technology licensing. From their side, President Robert Noyce came to talk with us by himself. See photo below.



Photo 4.2 Meeting with Intel on October 9, 1974. Robert Noyce at front row left, Shotaro Shibata at second row left, the author at second row right

We could feel a firm conviction of Noyce on microprocessor in his mild expression. His comments through the talks are summarized as follows.

- ★ Intel's business is through the product sales, and they do not intend to make money on know-how and patent licensing.

- ★ Software is important in microprocessor business. Making merely hardware makes no sense.
- ★ Compared with custom LSI, delivery is not usually a problem and customers do not request for second sourcing
- ★ It is hard to believe that Intel's business will improve by having a second source.
- ★ However, we will consider if there is some proposal from Hitachi side (including product purchase etc.), Intel would consider about the proposal.

In his explanation, there was no clear statement as to "yes or no" about the second source, but when we considered his talks overall, we had to judge it as "No", even though he told it in roundabout way. I talked with Shibata, my boss, and decided to abandon further opportunities of partnering with Intel.

Next, Motorola visit was on October 11, two days later. In this case, Schrenzel, the top liaison officer, was the organizer and welcoming mood had been built up on their side. As soon as the meeting started, they proposed an agenda including the discussions on the 6800 second source and the introduction of Hitachi's automatic wire bonding machine. At the time of the previous visit of Imamura, GM of Hitachi Semiconductor Division, we had presented on the automatic wire bonder called CABS (Computer Aided Bonding System) and its contribution to the productivity and quality improvement. This bonder was developed by our Equipment Development Department led by Jun Suzuki, and was the best performing automatic bonder in the world at the time.

In the afternoon, Cometz in charge of marketing of the Microprocessor Division of Motorola gave us a detailed explanation about 6800, stating its good marketing situation with favorable acceptance from more than 200 customers that they delivered samples to. He said that even though the market share at this point was dominated by Intel 8080, they were confident to get the share of more than 50% in 1976, two years later, due to its advantage of single 5-volt operation and the good usability by the product feature. In addition, the statement was made, in more than expected manner, that they would welcome Hitachi as the second source, which would give them additional competitiveness against Intel by giving customers a sense of security by the second source strategy.

Motorola was extremely positive about the second source strategy, whereas Intel was negative about it, in clear contrast between the two companies. After returning home, we immediately reported this to Imamura and he agreed to move forward. The consensus was made among the Hitachi executive management that we would pursue the cooperation with Motorola.

On January 20, 1975, Schrenzel, representing Motorola, visited Hitachi with his team. On Hitachi side were Sato, GM of the Musashi Works, Shibata, Deputy GM of Semiconductor Division, Suzuki, Department Manager of Equipment Development and I, Department Manager of IC Development. The main theme was the concrete negotiation on the technical exchange of 6800 microprocessor and automatic wire bonder (CABS). The top-level talks progressed smoothly, the homework was organized, and it was agreed to move forward to the next step as soon as possible.

After the several follow-up meetings, the next big event was the visit by Motorola team in May 1975. Not only the external liaison group, it was the whole team visit including microprocessor group and

intellectual property group. Naturally, on the Hitachi side, too, we responded in all-cast including the overseas operations group and IP group of the headquarters as well as the semiconductor business division and the factory operations.

The negotiation meetings that started on the 19th continued for four days. In fact, prior to this, the formal product announcement of the 6800 microprocessor had been made in November of the previous year, which was gaining high reputation in the market, and the Motorola team was highly elated. It was an appeal with a tone that, "At the moment, Intel is leading the market, but 6800 is far exceeding both in architecture and device technology. We believe that we should be able to increase our share rapidly by teaming up with Hitachi. Let's do it together!"

The top meeting was held to summarize the four-day negotiation with the attendance of five members from Hitachi; Imamura, Shibata, Miki, Overseas Operations Group of Headquarters, and I. The members from Motorola were led by John Ekes. A major framework of the cooperation was settled in this meeting, and we generally agreed to move forward to make a contract based on the conclusion of the meeting. And we gathered momentum in the both companies to compete against Intel by this alliance centered around 6800. According to the time table which was agreed on, we were to proceed on administrative processes as soon as possible, to complete the contract and kick it off by the end of August.

However, an unexpected situation occurred at this point.

The personnel change of GM of Hitachi Semiconductor Division was carried out in June, 1975, which was the next month after this top meeting. Imamura who opened up this way of alliance with Motorola became the Group General Manager and was replaced by a person, tentatively called Mr. A. He moved from Heavy Electric Business Sector as the GM of Semiconductor Division. As he had been on the user's side in his previous position, he had a good understanding about microprocessor and recognized its importance. But he was very cautious and rather skeptical about the partnership strategy with Motorola, which we had been working on. He argued, "The advanced user divisions within Hitachi, such as the Kanagawa Works and the Oomika Works, are all exclusively using Intel processors. Are you going to ignore this situation and work with Motorola?" The situation almost came to resetting of the whole scenario.

However, at this point, "The die had already been cast", and we were at a point of no return. We explained to him that, "There is no other way judging from the contact results with other companies including Intel, and that it will be possible for us to catch up Intel if we put our effort with Motorola whose architecture is excellent." And we managed to get his approval.

After Hitachi replaced the top management of the semiconductor, the tempo of discussions between the two companies slowed down, and it was not possible to close the contract by the end of August as originally scheduled. However, in September, finally the top talks with the new regime were held and the pending issues were cleared. Following these twists and turns, Hitachi's executive committee and the board of directors approved the technical partnership in November of 1975. Motorola also finished their process almost at the same time. It took a whole one year since the first visit of Imamura, and the Hitachi's microprocessor strategy was finally solidified by this settlement. The movement based on the contract started at both companies from the beginning of

1976, and Motorola-Hitachi allied forces formally started.

Hitachi's microprocessor design force at that time was what we should call "the selected few". It was literally "a few", but it was also "the best". Yoshikazu Hatsukano, Senior Engineer, led the team of engineers including Kazuo Minorikawa, Joe Nakajima, Toshimasa Kihara and others.

They became pioneers of Hitachi's microprocessor business. In August of this year, the Hitachi version of the 6800 microprocessor was introduced to the market with the name of HD 46800 as the first product introduced from Motorola. It was a product based on 6 $\mu$ m NMOS technology, and it was a start with a knockdown method using Motorola's chips.

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