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Merck's Success in the Japanese Liquid Crystal Market

Liquid crystal displays are a key component of the information society. They are found in many places in cars, measurement equipment, portable computers, and portable communication equipment. A typical state-of-the-art active matrix colour liquid crystal display today has a diagonal of 10 in, 550 × 650 pixels, and costs about US\$ 1200 each in industrial quantities. In many products the liquid crystal display is the dominant component in terms of value. Each pixel has its own transistor control circuit which at the moment uses amorphous silicon thin film transistor (TFT) technology. Very soon, however, polycrystalline silicon will be used instead of amorphous silicon. Since polycrystalline silicon is the same as that used in ordinary silicon VLSI, all other electronic circuits including the CPU can then be integrated onto the substrate of the liquid crystal display. Therefore, very soon, the business of all those companies will be threatened, who at present purchase liquid crystal displays externally, and build a product around it (see also: *IEEE-Spectrum*, May 1995, pages 62–69).

Japanese companies today produce more than 80% of the world market of liquid crystal displays and invest more than US\$ 2.4 billion per year in their production facilities and R&D. In the wider flat panel display area, which also includes plasma displays and electroluminescent displays among others, the investments were of the order of US\$ 5 billion. South Korea has in the meantime made very great efforts to catch up, and invests more than US\$ 2 billion per year. American and European companies are almost unrepresented in the flat panel display market, which is estimated to be worth about US\$ 11 billion and is growing rapidly.

An exception is Merck, a German chemical company with a history going back several centuries. As a supplier and partner with East Asian liquid crystal display producers, Merck develops, produces and supplies a large proportion of the world supply of liquid crystals in the

An interview with K. Diehl, President of Merck Japan, by Gerhard Fasol*, Institute of Industrial Science, University of Tokyo

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world. Early on Merck founded a Japanese subsidiary, which has specialized mainly on two high-tech chemical products: liquid crystals, especially products for the use in active matrix colour displays, and pearl pigments, which can create hundreds of different colours using interference effects. Merck is now represented in most East Asian countries with subsidiaries, partnerships, research laboratories, and factories. The consolidated sales of the whole Merck group in Japan alone is over US\$ 500 million. Merck places strong emphasis on R&D: 25% of the employees of Merck Japan work in the R&D sections.

Since 1990 Mr Klaus Diehl has been President of Merck Japan Ltd, and has worked for more than fifteen years in leading functions within the Company, contributing substantially to its success. Mr Klaus Diehl has kindly agreed to communicate some of his experience of leading a European high technology company in Japan in this interview with Gerhard Fasol. Dr. S. Naemura, Manager of the Liquid Crystal Technology Center of Merck Japan Ltd, also joined the interview.

Fasol: Could you explain the activities of Merck Japan?

Diehl: An important activity is the development, the marketing, and the sales of liquid crystals and pearl pigments in Japan and in South East Asia. In addition, we and the Merck group also sell numerous chemical and pharmaceutical products partly through subsidiaries and partner companies. Merck Japan today is one of the most important companies within the worldwide Merck group of companies. But let me start with the history: Merck has been active in Japan since the Meiji period (1868–1921), and in 1968 we founded Merck Japan. Then, in 1975 when the regulations limiting foreign investment in Japan were relaxed, we were allowed to build our own supply centre in Atsugi. Soon it became clear to us, that in Japan we have to provide much more customer service than anywhere else in the world, and therefore we started to establish our applications laboratory for pearl pigments here in Atsugi. In 1979 we also built our applications centre and a quality control centre for our liquid crystal materials. In 1983 we established our pigment factory and our R&D laboratories for liquid crystals, so that we can react more quickly to customers' requests. We produce almost 100% of the liquid crystal mixtures for the Japanese market here in Japan. The final products are prepared here using hundreds of different liquid crystal components. The know-how is mainly contained in the mixing process steps, in the cleaning processes, in methods to obtain a gas free product, and in the methods to obtain the physical and chemical properties of the product, which the customer requires.

Fasol: What are the main factors of success of Merck Japan?

Diehl: To produce products which completely satisfy the customer requirements, and to solve the problems of the customer as a package. In order to achieve this, it is essential to have research, development and application laboratories geographically close to the customer. It is impossible, to do this from a long distance. The main requirement is



K. Diehl, President of Merck Japan

to satisfy the customer, then market share and profits will follow. And of course, we need well-qualified and local specialist staff. Therefore it is very important to offer our staff the possibility of attractive career options within our company. In the case of Merck Japan, only two out of five directors are German, three are Japanese – Japanese Directors are in the majority! And in the management overall, we have seven Japanese Managers and only four German Managers.

Fasol: This is very interesting, many Japanese companies are thinking very differently on this point.

Diehl: And we need experienced expatriates, which do not change every three or four years. When a new expatriate starts, he or she has to start again right at the beginning. In the USA or in Europe people can change every three or four years, but not here in Japan. To say this frankly, American companies are making big mistakes in the personnel management: they are exchanging Managers after much too short intervals. And we definitely also need the support from the company headquarters at home in Europe.

Fasol: Do you mean, that the headquarters have to understand the local conditions here in Japan?

Diehl: No. The European headquarters can never understand the local conditions here in Japan well enough. The Managers in the company headquarters in Europe have to listen to the experts here in Japan who know the Japanese market well.

Fasol: What is the advantage of operating research laboratories here in Japan, where the costs are high?

Diehl: We have to be close to our customers. Other reasons are the high motivation of Japanese scientists and the long working hours. Time is the most critical factor for our success. Therefore we have to perform research and development here, even if the costs are higher. To a large extent our success depends on our speed. In the past the size of a company was a decisive advantage, but today it is the speed.

Fasol: You have emphasized the role of the R&D laboratories in satisfying customer requirements, but do the laboratories also have a strategic function?

Diehl: Of course, yes. For example, we use our research laboratories for cooperations with customers, universities etc., but also for basic research. In the last years, for example, we have applied for 25 patents here in Japan for inventions we have made here in Japan in the area of pigments. In the area of liquid crystals, the Merck group at present owns more than 2000 active patents, and a substantial number originate from our research laboratories in Merck Japan. In the pigment area, Merck Japan has developed several unique products. For example, pigments for automobile paints, or special pigments for cosmetics; these products have originated in Merck Japan, and have been adopted by the world-wide Merck group.

Naemura: In the case of liquid crystals our main area is active matrix displays. Our main products are 'super twisted nematics', but we still work on conventional 'twisted nematics'.

Fasol: What are the main challenges for research in this area?

Diehl: Liquid crystal displays are an established technology, and they will certainly remain so for the next ten or twenty years. The challenge is not only to satisfy the ever changing requirements of our customers due to new types of displays, but also to be always in advance of our competitors.

Naemura: Despite liquid crystal displays being an established technology, the requirements and construction details change all the time.

Diehl: An exciting development will certainly also be liquid crystals for flat television screens.

Fasol: How do you see the future of Merck Japan? We often hear, that South East Asia will soon be the most important economical region in the world?

Diehl: It is a fact, that in the year 2000, in only five years, 3.5 billion people will live in Asia, and of those around 1 billion will be able to spend money on consumer products. 400 million will even be able to spend similar amounts as people in the rich countries. There will be about three times more consumers than in 1993. This gives you just an indication of the enormous economic potential of the South East Asian economical area. We have our own subsidiaries in all important Asian countries, and we have production facilities there. We already have a liquid crystal laboratory in Korea, so that we can produce even very small quantities quickly for our customers there, and we also have a liquid crystal laboratory under construction in Taiwan, and a further one in China is in the planning stage. The market for liquid crystals is in Asia. Europe and America have

missed their chance in this area of industry, and in Asia, 90% of the flat-panel display production is controlled by Japanese companies.

Fasol: Many people and companies in Germany seem to concentrate on China...

Diehl: The Chinese market definitely has great potential. But I doubt that China will dominate Asia in the technological area in the near future. Maybe it will become a great consumer of technology, but I believe that Japan will also in the future play a dominating and leading role. Merck is convinced of this. I think, that we should not overlook the Chinese market, definitely not, but we cannot neglect the Japanese market. That would be the biggest mistake. Japan will remain the centre of high technology.

Fasol: Is it not easier to sell products in China than in Japan?

Diehl: Of course. But today and in the future: if you cannot sell your products in Japan, you are out of business in the high technology sector. In high-tech chemistry and in other high-technology areas, you cannot concentrate on countries where it is the most easy to sell. In these areas it should be the highest priority for companies to be present in Japan, and to sell their products successfully in Japan.

Fasol: Thank you very much for this discussion.

Table: World wide investments in R&D and production facilities for flat panel displays in 1994. Similar to the manufacture of integrated semiconductor circuits, the fabrication of flat panel displays requires very massive investments. For 1995 the world wide market is estimated to be about US\$ 11 Billion. (Flat panel displays also include plasma displays, electroluminescent displays and others in addition to liquid crystal displays.)

Investments in production facilities and R&D for flat panel displays (1994)

Japan	US\$ 5.04 Billion
South Korea	US\$ 2.05 Billion
European Union	US\$ 0.31 Billion
USA	US\$ 0.20 Billion
World	US\$ 7.6 Billion

* Gerhard Fasol is Associate Professor at the Institute of Industrial Science of the University of Tokyo, and is only the second non-Japanese to be awarded a 'Sakigake 21' research project of the Research Development Corporation of Japan (JRDC). His research is in the area of new microelectronic and optoelectronic devices. He can be contacted at University of Tokyo Institute of Industrial Science, 7-22-1, Roppongi, Minato-ku, Tokyo 106, Japan.

LIQUID CRYSTALS ON THE WORLD-WIDE WEB

The International Liquid Crystal Society now has a presence on the World-Wide Web through a server established at the Liquid Crystal Institute, Kent State University, Ohio, USA. The address of the server is:

<http://alcom.kent.edu/ILCS>

Information available at present includes members' addresses, forthcoming meetings and positions vacant. It is expected that additional material will become accessible in the future.

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Information on positions available, and updated membership data base entries (members please check) should be sent to Peter Palffy-Muhoray.

BOOKS

Liquid Crystals

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