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Description	シンポジウム

New Opportunities in the Changing R&D— Environment of Japan

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1. Introduction

Scientific exchange between researchers of Siemens and their partners in Japanese companies and academia has been constantly increasing over many years, reflecting the developments that are taking place in the scientific world. The great importance given to this exchange is expressed by setting up a liaison office of the Siemens Corporate Research and Development in Tokyo, which has been given the task to coordinate and to further improve the interactions with the Japanese R&D scene. Although at present it is not planned to set up a corporate laboratory in Japan, various other forms of interaction are vigorously pursued and considered important for fulfilling the mission of the Corporate R&D Laboratories.

After shortly introducing the worldwide activities of Siemens, this presentation will focus on the expectations for easier and closer international cooperations that have been created by changes in the Japanese R&D environment.

2. Siemens Activities Worldwide

Since its foundation in 1847 by Werner von Siemens, the company has been active in the fields of electrical engineering and electronics, and has continued to grow as an international enterprise to employ in 1989 some 365,000 people worldwide who produce sales of DM 61 billion (Yen 5.6 trillion). This places Siemens in sales volume somewhere between Matsushita Electric and Toshiba. Siemens is a generalist in the electro market, with activities covering the whole range of industrial products:

- Energy and Automation
- Electrical Installations and Automotive Systems
- KWU (Power Generation)
- Communication and Information Systems
- Telecommunication Networks and Security Systems
- Medical Engineering
- Semiconductors

A breakdown by geographic area shows that international sales account for 53% of worldwide sales, with the largest share of 29% being contributed by European countries without Germany. 11% are contributed by North America, about 1% by Japan.

In 1989, Siemens spent 11.2% of sales or DM 6.9 billion (Yen 0.63 trillion) on research and development, about 7% of which was performed at the Corporate R&D laboratories in Munich, Erlangen and Princeton (USA). These figures show the great importance Siemens places on R&D for securing its future business.

Of the nearly 41,000 employees in R&D, nearly 20% are working outside of Germany. A guiding principle here is the thought that R&D has to be where the market - and the production! - is, to ensure a smooth and efficient flow of information between the different parts of the company.

The mission of the Corporate R&D can be summarized in the following four points:

- Research and basic development for material, product, and system technologies in strategically relevant areas
- Consulting to top management and divisions regarding R&D
- Fundamental issues in the area of R&D
- Protection of intellectual property;
Coordination of standardization activities.

By classifying research projects in the categories of exploration, feasibility, and transfer with varying degree of involvement of the relevant business units, the whole range from basic to applied research is covered.

The technological development in Japan in fields like microelectronics, new materials or robotics is of such importance that it can not be disregarded without great danger for the overall competitiveness in the world market. For this reason, a close observation of the developments here belongs to the mission of the Corporate R&D as stated above. However, with just 1% of the worldwide turnover in Japan and a mainly sales and service oriented operation here, an own R&D laboratory would lack the close connection to production necessary for an efficient operation. Therefore, closer relations with Japanese R&D institutions are promoted through cooperations and the exchange of researchers. A liaison office, representing the Corporate R&D in Japan, has been set up for supporting the various programs, and for improving the flow of information between Germany and Japan.

3. Characteristics of the Present R&D-Environment in Japan

It is obvious that a successful strategy for joined R&D projects and for the exchanges of researchers with Japanese laboratories depends crucially on a sufficient knowledge of the Japanese R&D environment. In fact, a major reason for unsuccessful attempts seems to lie more often than not in misunderstandings concerning motivations and goals of the parties involved rather than in inappropriate research facilities or in generally incompatible research environments.

With considerable cultural differences which influence the approach to R&D and its interaction with other parts of the technological system, good explanations of the Japanese R&D-environment seem to be rare and often outdated for many years. For this reason, the present opportunity to formulate tentatively - and to discuss - some general perceptions concerning the Japanese R&D environment is highly appreciated. The following features seem important:

- technological strength is based on a highly and homogeneously educated work force, a consequent technology strategy, and the utilization of all relevant information available
- a step-by-step approach to technical innovation is preferred to big leaps into unknown fields
- a general focus on products and producability can be observed, which permeates even basic research activities; the production engineer is of special importance and is involved from quite an early stage of the development
- with the emphasis on production and the willingness to utilize all information available, a very high level has been reached in applied R&D; less emphasis has been placed on basic research
- this last point is underlined by a roughly 80/20-ratio between private and public spending on R&D, considerably higher than in western countries, since companies naturally tend to be more application oriented.

With the economical success as a prove for the high level of achievement in various fields of technology, one should expect large numbers of foreign researchers coming to Japan to profit from the Japanese R&D-environment. The actual numbers, however, indicate a quite different picture. In 1988 there were 10 times as many researchers going from Japan to Advanced Countries than vice versa, with a ratio of 11.7:1 for the US and 8.4:1 for West Germany. It is interesting to notice that although numbers in both directions are increasing, these ratios have even worsened since 1986.

The reason quoted most frequently for this imbalance is the language barrier. But with the increasing English language competence in Japan and the strong tendency of good scientists to go where the good science is, this problem should be possible to overcome. Besides the language barrier, however, there are other reasons for this imbalance which can be found in the points mentioned above:

- a step-by-step, product-oriented approach leads to technological knowhow that is much more difficult to transfer than some "big-leap"-invention;
- as a larger part of the good research is performed in industrial laboratories, access to good R&D is more restricted than in other countries.

4. New Opportunities

In the last few years, the R&D-policy of the Japanese government has been emphasizing (a) internationalization and (b) basic research. In this way, a number of new opportunities for an increased participation of foreign companies in Japanese R&D-activities has been created. Of major interest in this context are the admission of foreign companies to MITI projects, the initialization of international research projects and the creation of institutions like the Research Center for Advanced Science and Technology at Tokyo University or - to mention just one other example - the ATR in Kyoto.

This has definitely influenced the general perception towards the participation of foreigners, and with a stronger emphasis on basic research it is increasing the number of laboratories that might be suitable for cooperation due to their pre-competitive character.

However, to be able to make good use of these new opportunities and to prevent misunderstandings and disappointments, a few things have to be remembered:

- There are two major motivations for a R&D-policy emphasizing internationalization and basic research:

internal: since a high level of competence has been achieved in various fields, the need for own basic science to guarantee future competitiveness is strong;

in some fields international cooperation is sought to be able to catch up faster.

external: in the overall political and economical context, the technology trade should be more balanced to counter "free ride"-accusations.

These points may influence considerably the efficiency and openness of specific research programs.

- In preparing a joint project it is very important to be aware of differences in basic attitudes, which are usually taken for granted and which are difficult to make explicit. An example is the concept of "university", which has a quite different tradition in Japan and in the West, and which influences considerably e.g. the concept of basic science either as a "truth finding-process" or as a very early part of product development.

Research in an industrial context has always to do with new opportunities to make new and better products. It can not be seen as an isolated activity, but it is integrated in the overall production process. It seems that through different approaches Japan and the West have optimized different parts of this process in different ways. By exposing intelligent people to new ways of doing things, a regular exchange of good scientists could help to do more than just create new knowhow. Both sides should profit through such an exchange. However, a good scientist is first and above all interested in good science, so to get this process started, an adequate R&D-environment is necessary. We will try to make good use of the opportunities that are in the process of being created.