We are dealing with a variety of computer-based business using an ON-line system that connects the main or branch offices. Throughout this country, installing a control computer in Osaka (where the head office is located). Since the introduction of CWQC (Company Wide Quality control) in 1976, the importance of data analysis have been more and more recognized, and computers are now increasingly employed in this field. The statistical package, purchased as software for the above-mentioned business, on the programs developed by us are not able to cope with the diversified needs at present. Taking those situations into account, we have made the investigation and studying of new statistical analysis and business graphic systems since 1981. In this connection, we introduced the SAS software as a new system next year, and endeavored to increase its prevalence throughout our company. In this report we refer to the results we have obtained.

1. Utilization rate of statistical analysis systems

Fig. 1 shows the chances in use of statistical analysis programs as of 1981 when the survey was started. The use of computers for statistical analysis rapidly increased since 1979. The number of jobs in 1981 is nearly 17 times more than in 1977. The fields of utilization are various such as analysis of building construction information, experimental measurement data, questionnaire data and control data, including the fields of technology and office work. As the usage is diversified and becomes highly technical, the conventional systems are unable to satisfy the requirement, because of their insufficient capabilities with respect to programs and graphical expression of analytical results.

![Figure 1](image1)

**Figure 1** Changes in use of statistical analysis programs

2. Functions required for the statistical analysis systems

(1) Surrounding conditions for utilization
Before the investigation and introduction of the new system, we checked the items that may cause hindrance to the use of conventional systems. (Table 1). The analysis of the extracted causes by the relative projection and DEMATEL (Decision Making Trial and Evaluation Laboratory) method brings about the following. (Figure 2, 3)

1. The influences with respect to systems are most important factors. That is, there are too many systems used and each system can cover only a limited range.
2. The education, PR in assisting system can be mentioned next.

![Figure 2](image2)

**Figure 2** Relative projection for effective use

![Figure 3](image3)

**Figure 3** Results of analysis by DEMATEL method

(2) Necessary functions

We have checked the necessary functions in order to cope with the statistical analysis needs at enterprises and revealed the present situations of our company. The 5 items can be mentioned as the necessary functions as follows:

1. Easy data arranging
2. Easy graphing and tabulation
3. Upgrading of statistical method
4. Improvement of instructions and directions
5. Better maintenance of software
### Table 1 Problems for effective use of the system

<table>
<thead>
<tr>
<th>Category</th>
<th>Problem</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Device</td>
<td>A</td>
<td>There are too many systems.</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>There are accessories that can cover only limited ranges.</td>
</tr>
<tr>
<td></td>
<td>C</td>
<td>Some are unsatisfactory in system process.</td>
</tr>
<tr>
<td></td>
<td>D</td>
<td>Hard to use manual because of software for which no manual is available.</td>
</tr>
<tr>
<td></td>
<td>E</td>
<td>Data representation methods are different from each other.</td>
</tr>
<tr>
<td></td>
<td>F</td>
<td>Hard to make a chart or graph to be used along with analysis.</td>
</tr>
<tr>
<td></td>
<td>G</td>
<td>Some manuals are not perfect.</td>
</tr>
</tbody>
</table>

(Note) The markings are used in Figure 2 and Figure 3.

Particularly, data arranging function is very important because of the following reasons. Judging from our experience, it must be a great factor for determining the success of statistical analysis systems.

3. Investigation and evaluation of new statistical analysis systems

Regarding these necessary functions, we have evaluated the three representative programs related with statistical analysis of our company's and found that there are weak points in the part of data arranging which must be most important. (Table 2)

### Table 2 Development of functions required for statistical analysis and the present situations of our company

<table>
<thead>
<tr>
<th>Function</th>
<th>Required</th>
<th>Situation of our company</th>
<th>Overall evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data accessing</td>
<td>A</td>
<td>Analysis of statistical data</td>
<td></td>
</tr>
</tbody>
</table>
| | B | Creation of new worksheets 
| | C | Transformation of data | | |
| | D | Analysis of trend of data | | |
| New filing | E | Transformation of raw data 
| | F | Transformation of raw data attributes 
| | G | File control of results 
| | H | Using with an access point of data | | |
| Data extraction during execution | I | Analysis of selective data 
| | J | Analysis of formulation 
| | K | Analysis of results of analysis | | |
| Statistical tests | L | Chi-square test 
| | M | Analysis of general test 
| | N | Analysis of variance | | |
| Optimization analysis | O | Calculation evaluation | | |
| Decision making method | P | Decision making evaluation | | |
| Instructions & directions | Q | Help in use 
| | R | Product description 
| | S | Instructions to use the system efficiently | | |

Key: A-Data arranging B-Graphing & tabulation C-Statistical method D-Instructions & directions E-Maintenance & control

1. The function is used in all analysis ranging from basic analysis to multi- variate analysis.
2. The function is necessary for interface with another application as in business information system, etc.
3. It is required to be capable of persistent analysis such as additional analysis of the results of analysis.

In order to promote the SAS prevalence campaign, we worked out the plan with reference to the idea of marketing strategy, that is, the development of 4-P strategy — Product, Place, Promotion, and Price. The important points for prevalence, as we mentioned earlier, are PR, education and support system. The initial activities were the announcement of the introduction of SAS by the company bulletin, distribution of brochures and operation manuals, and explanatory meetings held in all offices. The activities are outlined in Figure 4.
according to the educational system of our company. (Figure 5)

Table 3 The 4-P strategy for the prevalence of SAS

<table>
<thead>
<tr>
<th>Year</th>
<th>1982</th>
<th>1983</th>
<th>1984</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strategy</td>
<td>BASIC, CRF function</td>
<td>CRF function</td>
<td>CRF function</td>
</tr>
<tr>
<td>Release of function and related data</td>
<td>Buildin &amp; recover data</td>
<td>Operational &amp; recover data</td>
<td>Data data</td>
</tr>
<tr>
<td>P &amp; E</td>
<td>FR to common bulletin</td>
<td>FR to the top</td>
<td>FR to common bulletin</td>
</tr>
<tr>
<td>Software</td>
<td>SAS manual</td>
<td>SAS manual</td>
<td>SAS manual</td>
</tr>
<tr>
<td>Education</td>
<td>Information system lectures</td>
<td>Information system lectures</td>
<td>Information system lectures</td>
</tr>
<tr>
<td>Consultation</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

As a result, about 1500 persons, 15% of the total employees of our company ranging from the management to the new employees, have attended the lecture meetings in 3 years after introduction of the new system. (Figure 6)

The second feature is the follow-up survey by questionnaire after lecture meeting which is utilized for the activities mentioned below.

1 SAS explanatory meetings held at all offices
   The SAS explanatory meetings were held at all offices during the period from April through June 1982 just after introduction of the new system. Those who attends the meetings classified by main and branch offices are shown in Figure 7. Regarding the number of attendants per 100 employees, the future increase for Tokyo and Osaka office was the problem to be solved.

![Figure 6: Attendants of the SAS lectures](image)

![Figure 7: Explanation meeting for SAS](image)

Furthermore, the analysis of the contents of the answers has enabled us to pick up the items to be reviewed. (Figure 9) As a consequence, we have decided to keep...
the following points in mind for the SAS lecture meetings in future.

* Attending importance to the actual operation of the system.
* Taking some length of time for individual consultation regarding analysis.
* Increasing the number of attendants from Tokyo and Osaka Offices.
* Limiting the number of attendants to 10 persons per lecture.
* Explaining the procedure for use of computers.

![Figure 9 Items required to be improved](image)

2 SAS lecture meetings at all offices


to business purposes were held at all offices by 18 times, 2 or 3 days each, receiving 206 attendants in total since March 1983. Judging from the results of questionnaire, we could read the intention to use the SAS to cope with the problems they have. (Figure 10)

![Figure 10 Schedule of using SAS](image)

3 CWQC education

The CWQC education is held 2 or 3 times a year spending 2 or 3 weeks for each schedule in order to improve the scientific control capability, in which the emphasis is placed on scientific consideration based on data. In this education system, the 100 attendants are separated into groups each of which consists of 5 ~ 10 persons, in they are assigned to do the practice of application of the statistical method through the subjects of business. In this system, all the attendants stay in a place outside the company so that they can use the SAS around the clock using the terminal equipment.

4 Information system education

For the superintendent information system, the lecture meeting is held for 2 days receiving about 20 persons per lecture in an attempt to bring up the leadership in the use of work place information. All the attendants are assigned to do the simple SAS training and to review the results so that they become able to correctly evaluate the utilization of information. Similarly, for the new employees and trainees, 3-day lectures based on the SAS training are held so that they can act as key men for the utilization of information in each work place.

3 Training of instructors and cooperative staffs for the operation of SAS

To cope with the diversified needs due to increase in use of SAS, we have to build up our capabilities and skill. Inside the company, a weekly study meeting in our department, monthly open study meeting, and meeting for SAS operation inside the information center are held in order to improve the utilization techniques and the environment for use of the system.

Outside the company, the staffs of this department attend the meeting for study of technical knowledge such as statistical methods, while they are endeavoring to make exchange of opinions with universities and other enterprises through the Japan SAS Users Association, etc.

This department dispatched one person last year to the North Carolina State University for the 2-year study of computers and statistical analysis at the graduate school of the university. We will utilize this type of education system by dispatching our staffs for the purpose of studies inside and outside this country in order to increase the number of experts on skillful persons.

On the other hand, 5 trainees are dispatched every year to the information center from main and branch offices as a part of the information system education mentioned earlier. One of them is assigned to work for this department and is expected to achieve sufficient knowledge of the SAS in 2 years. After returning to the original department, he works as a senior staff for information analysis of main and branch offices.

Also, the new employees dispatched to the information center for 4 months are about 30 persons. These of them are assigned to work for this department and are trained to become familiar with the operation of SAS so that they can work as junior staffs for information analysis at main and branch offices.
(4) Strengthening of the support system

This system was started with 3 persons, gradually increasing in the number of staffs, who are in charge of activities such as the development of analysis and forecasting systems, consultation about information analysis business, and various SAS lectures. Thus, we set up the information center function centering on the consultation about the use of information by 10 persons through close cooperation with the general affairs department in July last year, where the SAS is utilized as a powerful tool for information services.

5. Results

After introduction of the SAS, we have promoted the prevalence activities for 3 years. For the utilization rate, the rate of utilizing statistical programs is now nearly 13 times higher compared with the rate before introduction of the system as shown in Figure 11. It seems that the SAS has secured its position as one of the most important systems of our company.

(1) Effective use of information

The SAS has begun to be used for the non-typical analysis of company data bases for the information system of the entire company. At the same time, we can often see many people ranging from 10-year-old young office girls to executives who operate the terminal equipment in the company. (Figure 12)

(2) Utilization of system language

Since the SAS has excellent flexibility with respect to data conversion and file editing functions, it is utilized as a tool for program language and system tests. Particularly, the SAS shows items capability when used for the purposes of analysis and estimation.

(3) Upgrading of SQC (Statistical Quality Control)

The SAS is very useful for the effective use of statistical methods and the execution of efficient quality control. Accordingly, the SAS education has been employed in the lecture course of CWQC since last year, and many examples of SAS utilization have been introduced by the departments of the company through the announcement of examples with respect to SQC. It is not too much to say that SQC gives rise to wider utilization of SAS and the effective use of SAS will lead to the improvement of SQC.

6. Future problems

The SAS has brought satisfactory results in the effective use of information, etc. However, there are some problems to be solved regarding the SAS. Last year we conducted a fact-finding survey to know the skill of users and to find the future trend of the environment for utilization, thereby gradually clearing the points of problems. In the survey, we received the answers from 237 persons, mainly from those who attended the lecture meetings in 1983.

(1) Training of assisting and instructing staffs at main and branch offices

The utilization rate of SAS after the lecture meetings is 30%. (Fig. 13) It is rather as high as 23% even when the information center is excluded. And we understand that this percentage means "survival".

The following are the answers from the general users (48 persons) excluding the information center.

Figure 13 Utilization of SAS after lecture meeting
1. About 40% of the users have a feeling that the SAS is not easy to operate, but all of them want to continue using the SAS. (Figure 14)

2. About 85% of the users are assisted for the operation of the system somehow or other. (Figure 15)

3. There are relatively many cases that the users are assisted by those available nearby. (Figure 16)

Future Use

Wishing to use if possible
Wishing to use
Easy to use
Difficult to use
Improvement of SAS

Figure 14 After use impression of SAS

Figure 15 Results of assisting the users

Figure 16 Details of assistance

Judging from the above, it seems important to perform the educationed training in accordance with the actual situations of the branch offices.

(2) Setting up an in-company SAS users association

Divide the SAS function into 3 categories such as graphing the SAS tabulation, basic statistics, and complicated analysis, then it is clear that different offices are in need of different functions. (Figure 17)

Also, the addition of SAS functions and the chances to know the examples of utilization are needed, of which 63% of them desire to have an "all the persons concerned" type of meeting like the users association. (Figure 18, 19)

(3) Brushing up the skill of instructors

As the users improve their skill, the level of consultation naturally goes high. Consequently, it becomes necessary to brush up the skill of the instructors through study meetings inside and outside the company.

(4) Internal and external data filing

It is very important to file the information useful for the persons inside and outside the company to make their determinations. Upgrading of the tool will be meaningless unless it comes along with the improvement in quantity and quality of the information on which the tool depends. It is therefore essential to properly collect and file the information.

Conclusion

In this report, we have referred to the processes ranging from the investigation of statistical analysis systems to the prevalence of the SAS, and the points of resultant problems. As a whole, we have a feeling that the SAS is a system which can be widely used not only for statistical analysis but for data processing purposes.

Regarding the SAS, we desire that a stable supply system including both quality and price is maintained. Also, we hope that requests for the functions are made through the agent in Japan. A great deal of our activities grows up with the growth of SAS. We are intending to positively utilize the SAS for the non-typical analysis of internal and external information accumulated by the company information system completed last year.

We believe that the SAS holds a key to the successful improvement of DSS and IC functions in future.