Teldok

February 1985

Reference Document D

Office automation and related technologies in Japan

Scantech Tokyo Office: Robert Kelley & Andreas Odermatt

Teldok

February 1985

Reference Document D

Office automation and related technologies in Japan

Scantech Tokyo Office: Robert Kelley & Andreas Odermatt

An introduction

In December 1981, TELDOK published a Reference Document containing a large number of case stories regarding selected office automation installations in Japan. The information was supplied by Scantech (Scandinavian Technology Transfer) -- by Tadashi Andoh and Andreas Odermatt at the Scantech Tokyo Office.

When the TELDOK Editorial Board later asked Scantech to update some of the findings from the earlier study, it was felt that each of several distinct technology trends in Japan warranted comment and desciption in more detail; and so, Robert Kelley and Andreas Odermatt with their Stockholm-based coordinator, Bengt Lagergren, agreed to cover more extensively the topics forming the first four parts of this Reference Document:

Japanese next-generation facsimile developments
Computerized translation
Speech technology
and Captain, the Japanese videotex system

To their report, Scantech has added a number of detailed appendices -- brochures, article reprints, etc. While these are not included in this Reference Document, they are stored at the TELDOK Secretariat.

We trust that you will find the material fascinating.

Bertil Thorngren
Chairman, the TELDOK Editorial Board

SCANTECH
SCANDINAVIAN TECHNOLOGY TRANSFER

OFFICE AUTOMATION & RELATED TECHNOLOGIES IN JAPAN 1984

Prepared for TELDOK by

Robert KELLEY
Andreas ODERMATT

SCANTECH TOKYO OFFICE

SWEDEN CENTER, 6-11-9 ROPPONGI, MINATO-KU, TOKYO 106, JAPAN. Telex:29157 Phone:(03)405 0391 / 403 1351
HEAD OFFICE KUNGSGATAN 24, BOX 7363, S-103 90 STOCKHOLM, SWEDEN Telex 10564 Phone (08)10 10 60

LIST OF CONTENTS

Preface..... 1
Summaries..... 18

Part I: **TELEFAX G-4**..... 20
Introduction..... 21

Section One: G-4 Facsimile..... 22
1. 1 Need for Standardization
1. 2 CCITT
1. 3 How CCITT Proposal for Facsimiles are Made in Japan
1. 4 Groups 1-4
1. 5 G-4 Issues
1. 6 Japan's Fundamental Stance Regarding the G-4
1. 7 Characteristics of the G-4
1. 8 Problem Areas
1. 9 G-4 Outlook for the Next 3 - 4 Years
1.10 Long Term Prospectives
1.11 Experiments with the G-4
1.12 Some Ideas as to New Fax Applications in INS Era

Section Two: Infrastructure..... 31
2. 1 Domestic
2. 2 International

Section Three: General Facsimile Related Trends in Japan..... 36
3. 1 Japan Inc.: Industrial Policy
3. 2 The Producers
3. 3 Production Forecast
3. 4 Price Trend
3. 5 Consumer Trend
3. 6 Computer/Fax: OA
3. 7 Position of Facsimile in Written Telecommunications
3. 8 Closing

PART II: **MACHINE TRANSLATION**..... 40
Introduction..... 41

Section One: Overwiew of MT Technology in Japan..... 42
1. 1 MT: Classification & General Approach
1. 2 MT: Present Position of R&D in Japan

Section Two: The Primary Organs of R&D in Japan..... 45
2. 1 Government
2. 2 Universities
2. 3 Private Sector

Section Three: The Case of Bravice International..... 52

Section Four: Potential & Topics for the Future..... 54
4. 1 Size of Translation Market in Japan
4. 2 Topics for the Future

PART III:		**VOICE TECHNOLOGY**	56
		Introduction	57
Section One:		Overview of Voice Technology	58
	1. 1	Voice Recognition Technology	
	1. 2	Overview of Voice Synthesis Technology	
Section Two:		Voice Technology: R&D in Japan	60
	2. 1	Government	
	2. 2	Private	
Section Three:		Introduction of Some Japanese Products	63
Section Four:		Applications	68
	4. 1	The Pros and Cons of Voice Technology	
	4. 2	Potential Application Areas	
	4. 3	Examples of Actual Applications	
Section Five:		Conclusion	71
PART IV:		**CAPTAIN**	72
		Introduction	73
Section One:		Videotex Protocols and CAPTAIN	74
	1. 1	Videotex Protocols	
	1. 2	Experimental CAPTAIN	
Section Two:		Commercial CAPTAIN	81
Section Three:		Information Providers	83
Section Four:		Future	85
	4. 1	Penetration	
Section Five:		CAPTAIN and INS	87
PART V:		**CASE UPDATE**	89
Case 1:		Nisshin Steel Co., Ltd	90
Case 2:		Nippon Seiko K.K	92
Case 3:		Tokyo Sagawa Express (TSE)	94
Case 4:		Kawasaki Steel Corporation	96
Case 5:		Kawasaki Heavy Industries, Ltd	97
Case 6:		MRD / Misawa Homes, Co., Ltd	99
Case 7:		Mitsui & Co., Ltd	101
Case 8:		Nippon Credit Bank, Ltd	103

PREFACE

The fundamental topic of this report is office automation and related technologies in Japan, and five sub-topics, as selected by TELDOK, were taken up: (I) Telefax G-4, (II) Machine Translation, (III) Voice Technology, (IV) Captain, and (V) Update of 8 of the 25 cases reported in "OFFICE AUTOMATION IN JAPAN", TELDOK, Reference Document C, February 1983. Below, a few words will be devoted to the current status of office automation in Japan with reference to some findings of the Japan Institute of Office Automation, and then a summary of our findings as to each of the five parts will be presented.

GENERAL COMMENTS ON OFFICE AUTOMATION IN JAPAN

Informatization of society/economy is now in process in the industrialized nations of the world, i.e., these nations are entering an era of "advanced information telecommunication". In this context, Japan considers automation (increasing value-added), particulary that pertaining to communications and networking, a very important factor for future security, and automation is proceeding in a wide range of sectors. However, as Japan has very little accumulated experience in the field of office automation, progress is slow and approach is experimental.

Each year, the Japan Institute of Office Automation (JIOA) conducts a survey in an attempt to monitor the progression of office automation in Japan. Approximately 300 firms of all sizes are sampled in these surveys. A comparison of the average number of office automation equipment per company in 1983 and 1982 is as follows:

	'83	'82
-GENERAL PURPOSE COMPUTER	2.38	2.33
-OFFICE COMPUTER	6.46	5.93
-PERSONAL COMPUTER	25.98	18.59
-FACSIMILE	24.56	18.72
-WORD PROCESSOR	11.21	7.12
-ON-LINE TERMINALS	138.91	88.50
-ELECTRONIC FILE	1.45	1.00
-ELECTRONIC SWITCHING EQUIP.	2.08	2.09
-PPC	37.91	28.67
-MICROFILM EQUIP.	7.27	8.38
-LOCAL AREA NETWORK	2.58	-
-SMALL PRINTING PRESS	5.91	5.19

The JIOA defines 6 stages of office automation and attempts to pin-point at which stage Japan is today: (1) study/standardization, (2) planning, (3) stand-alone utilization of

office automation equipment, (4) approach to office automation using only general purpose computer, (5) electronic-ization of data processing with general purpose computer while using other office automation equipment in parallel, (6) networking of general purpose computer and all other equipment. The survey revealed that 75% of the companies sampled fall somewhere between stages (3) and (5), that is, using various types of equipment and/or general purpose computer with very little inter-linkage.

From the standpoint of communications/office automation, three controlling factors which will, in ideal circumstances, progress in parallel fashion are: (1) infrastructure (i.e., available networks), (2) hardware, (3) office automation system of each firm. (see appendix 9 for interesting report on "Information Technology and Organisations" by Paul A. Strassman, Vice President, Xerox Corp., 1982).

As to infrastructure, NTT, the domestic telephone authority, has been expanding its network services to accomodate informatization needs. Some recent improvements are the implementation of a facsimile network, or the expansion of their digital data network (DDX), both of the packet switched and circuit switched type. In addition, KDD, the international telephone authority, is now considering adding a new circuit switched network, the VENUS-C. Thus, it can be summarized that diversification of services is occurring on the network side in order to cope with the needs of the informatization trend. However, it must be noted that this trend is on a short term basis and that, in the long run, the Information Network System--INS, which is now under experimentation on trial basis, concept, (that is, to integrate all networks under one digital optical fiber network), will take hold.

On the hardware side, many improvements are being made on existing telecommunicative equipment, including both terminals and electronic switching/exchanging equipment, and other new equipment, such as the teletex/fax "mixed modal" machines, are being developed and worked on.

From the systems point of view, networking, or inter-linkage is very limited so far. However, as can be seen in figures 3 and 12 below (the figures provided in the preface were all taken from JIOA), local area networking can be anticipated to progress rapidly in the future, evolving into a wide area network by the end of this decade.

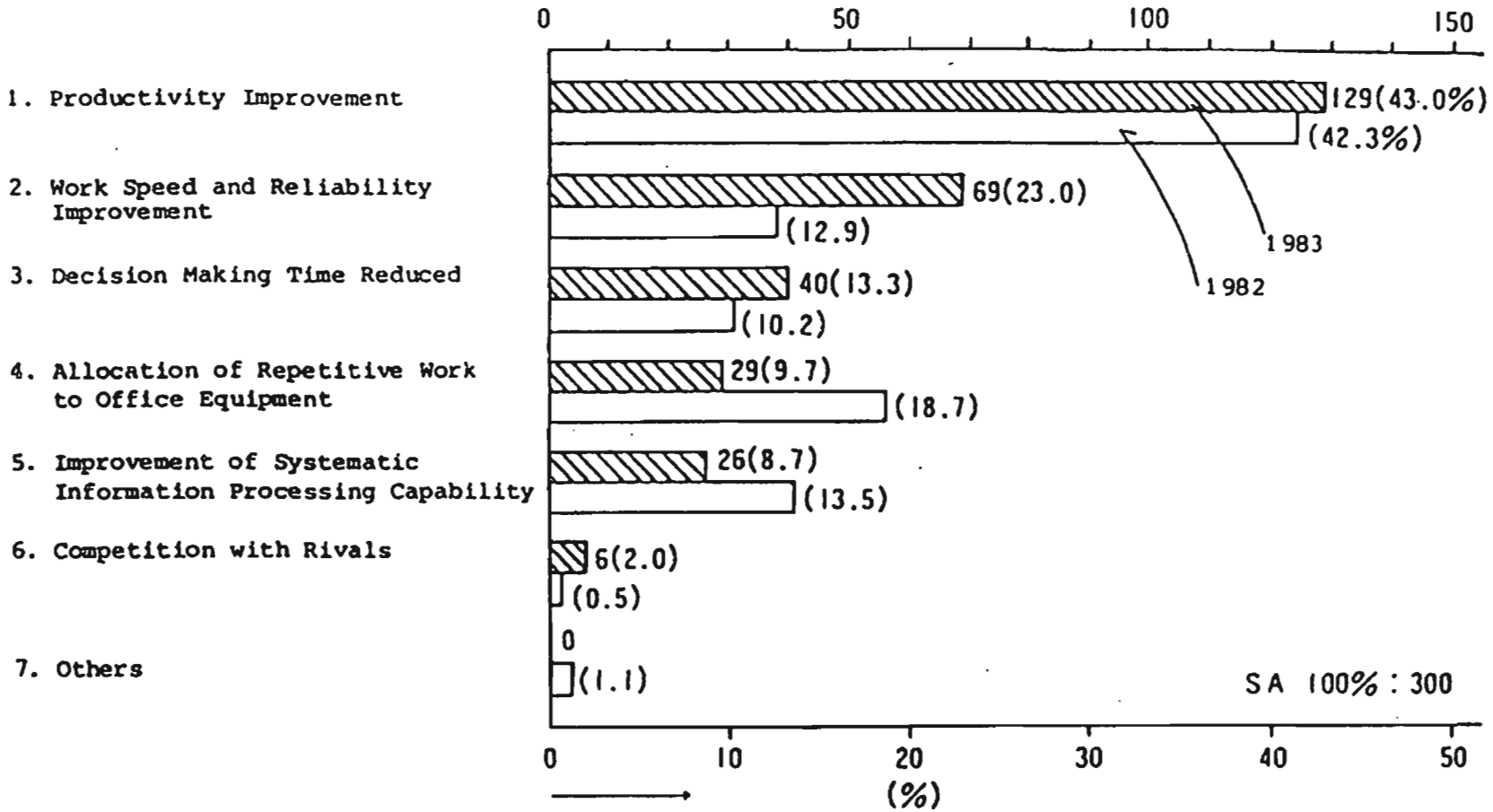


Figure 1: Background Factors Necessitating OA

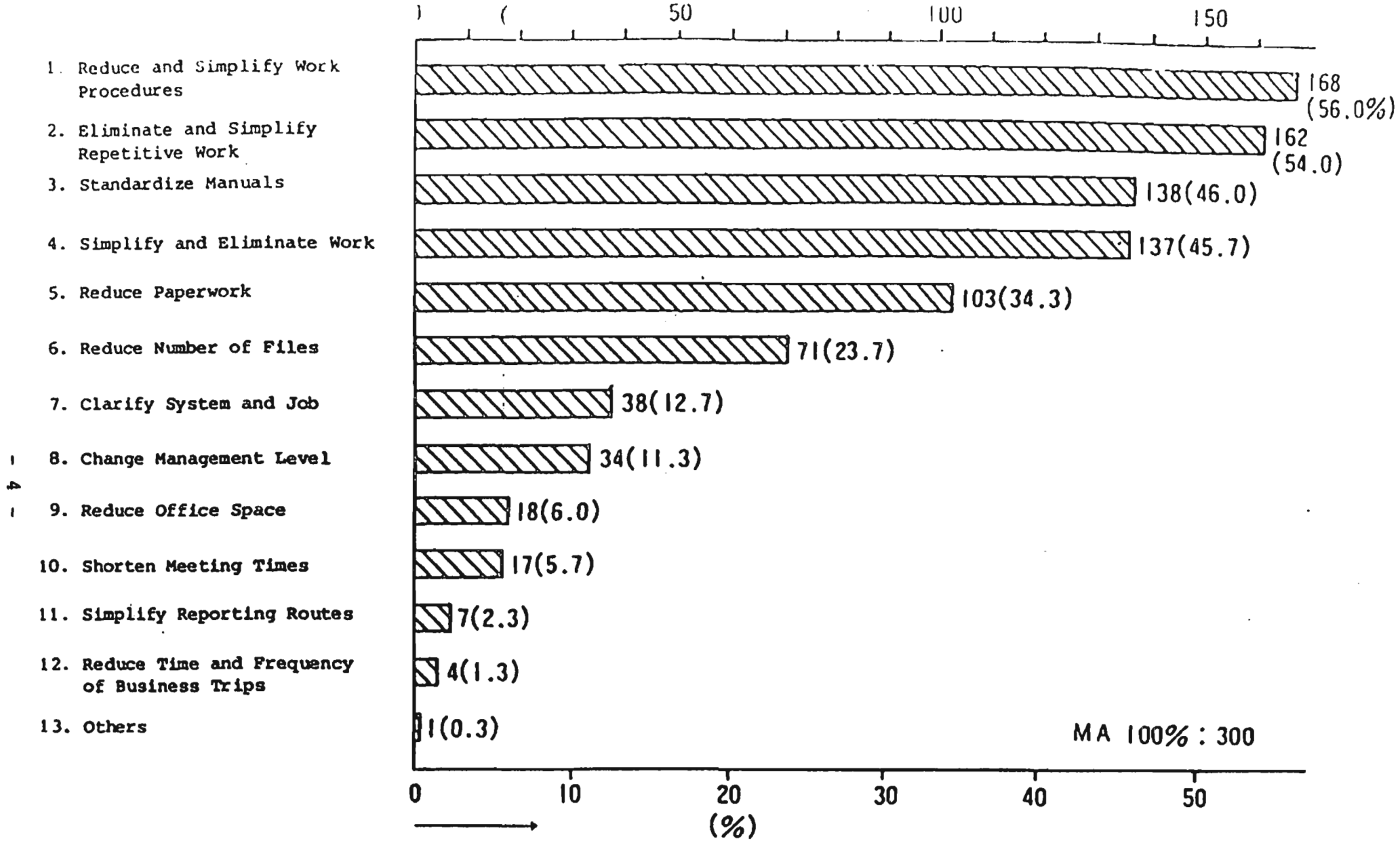


Figure 2: Goal of Office Work Improvement

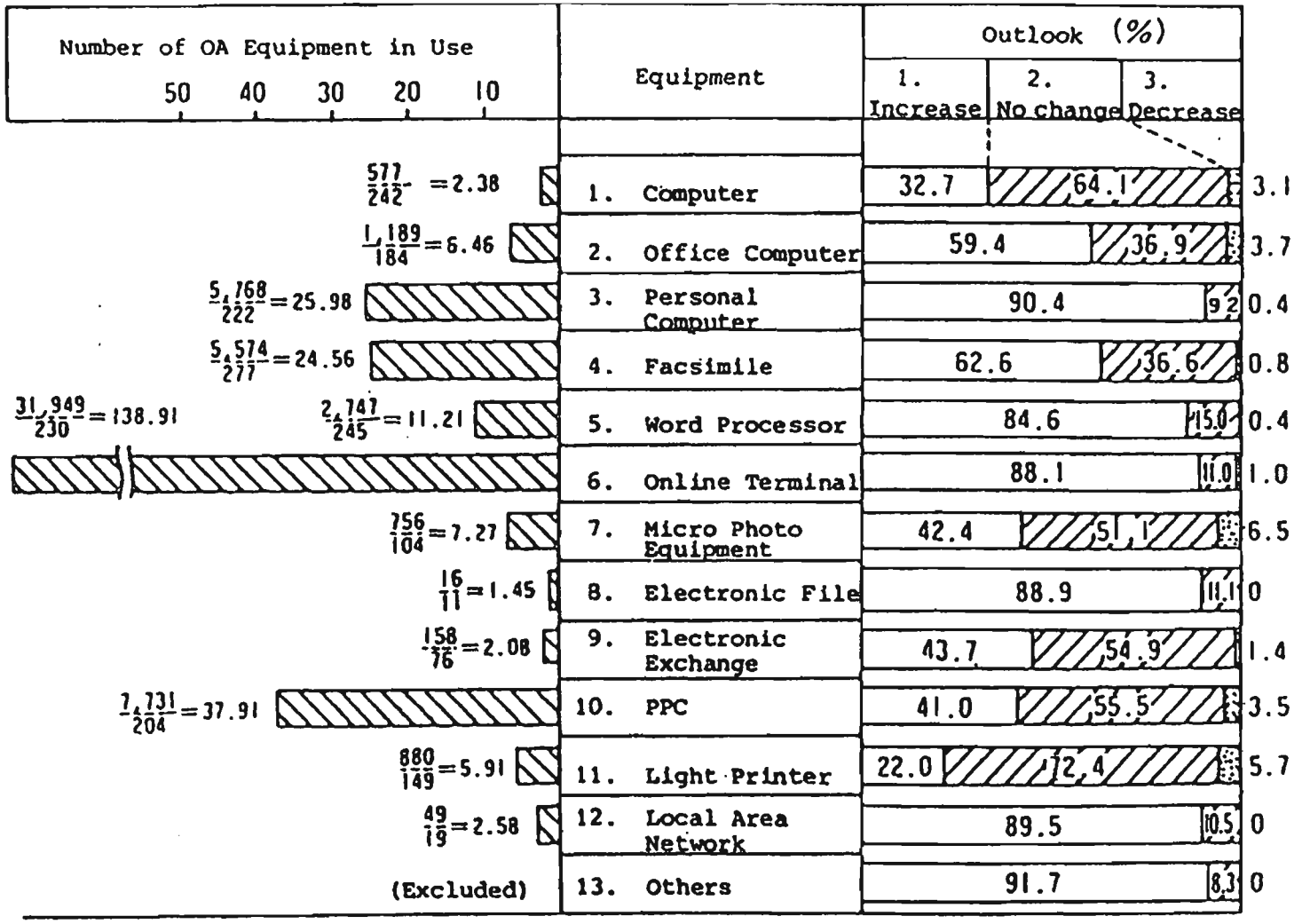


Figure 3: Number of OA Equipment in Use and Forecasting

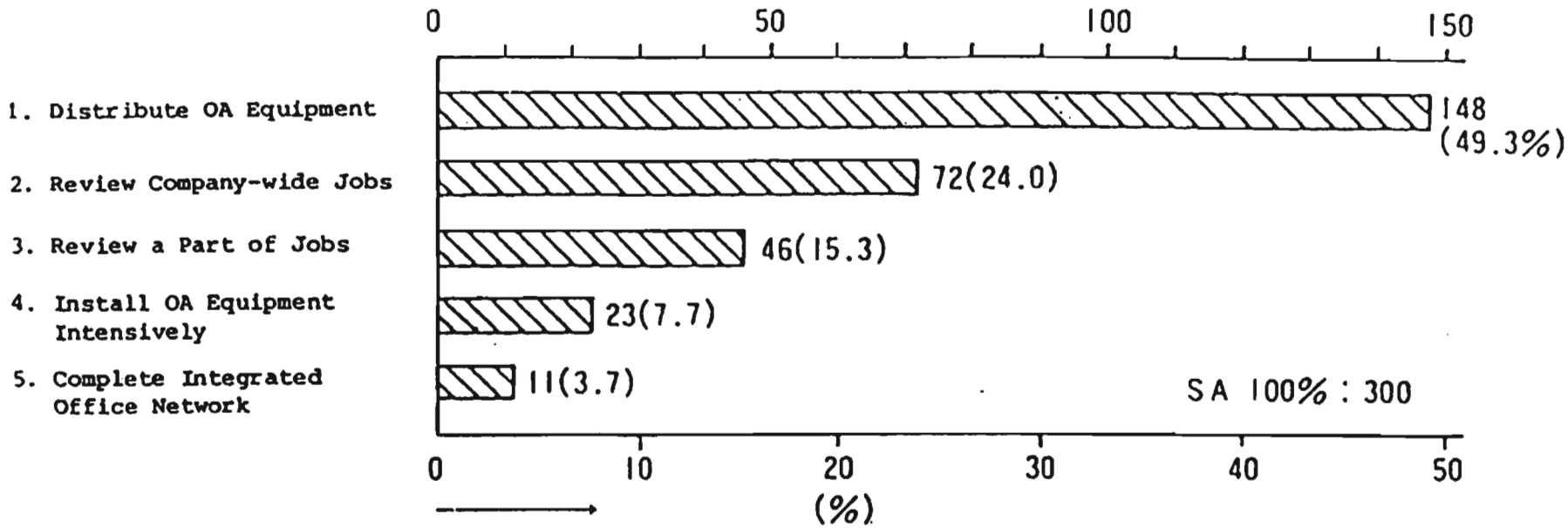


Figure 4: Standard Integration of OA System

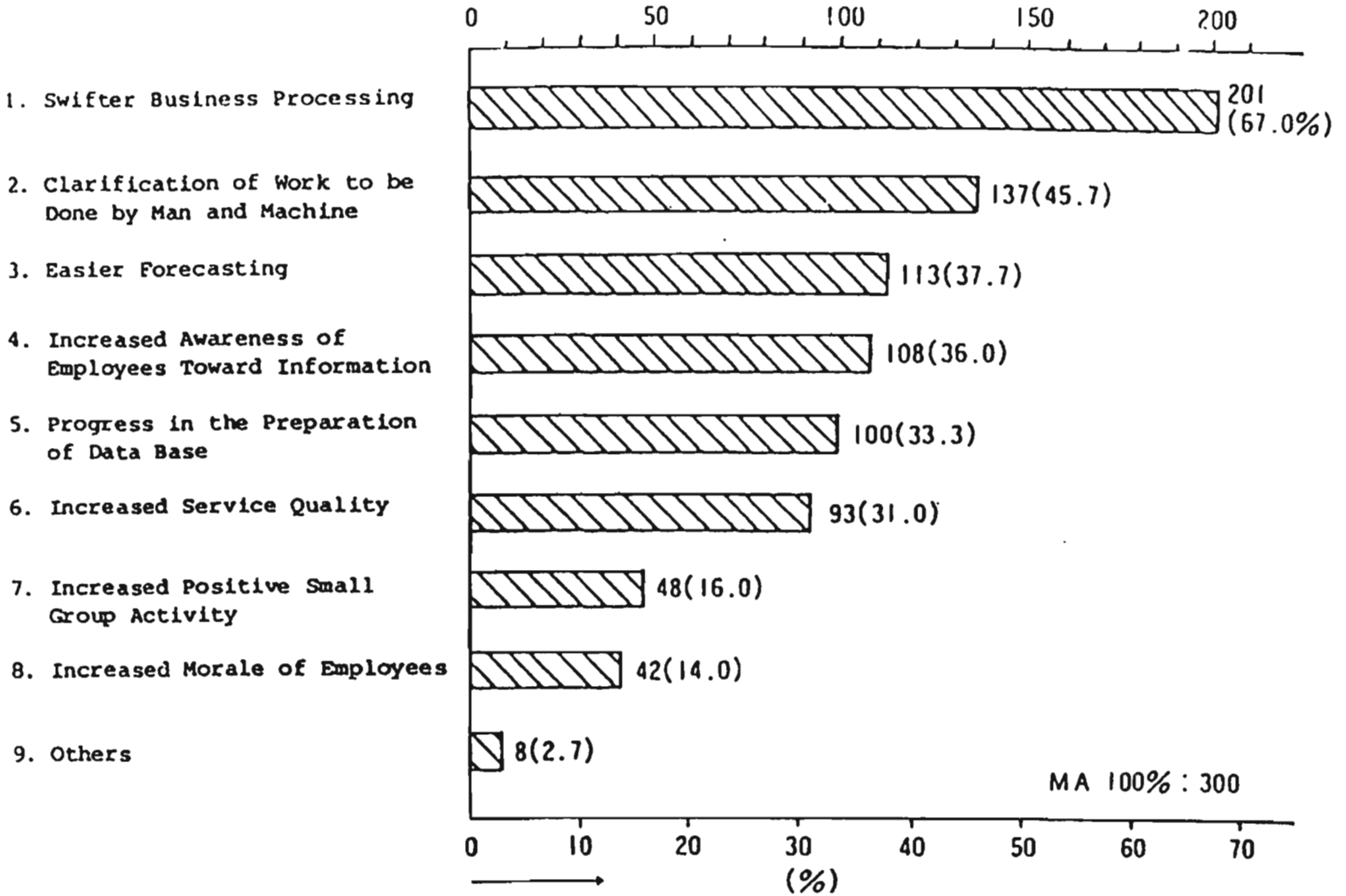


Figure 5: Effects of OA System

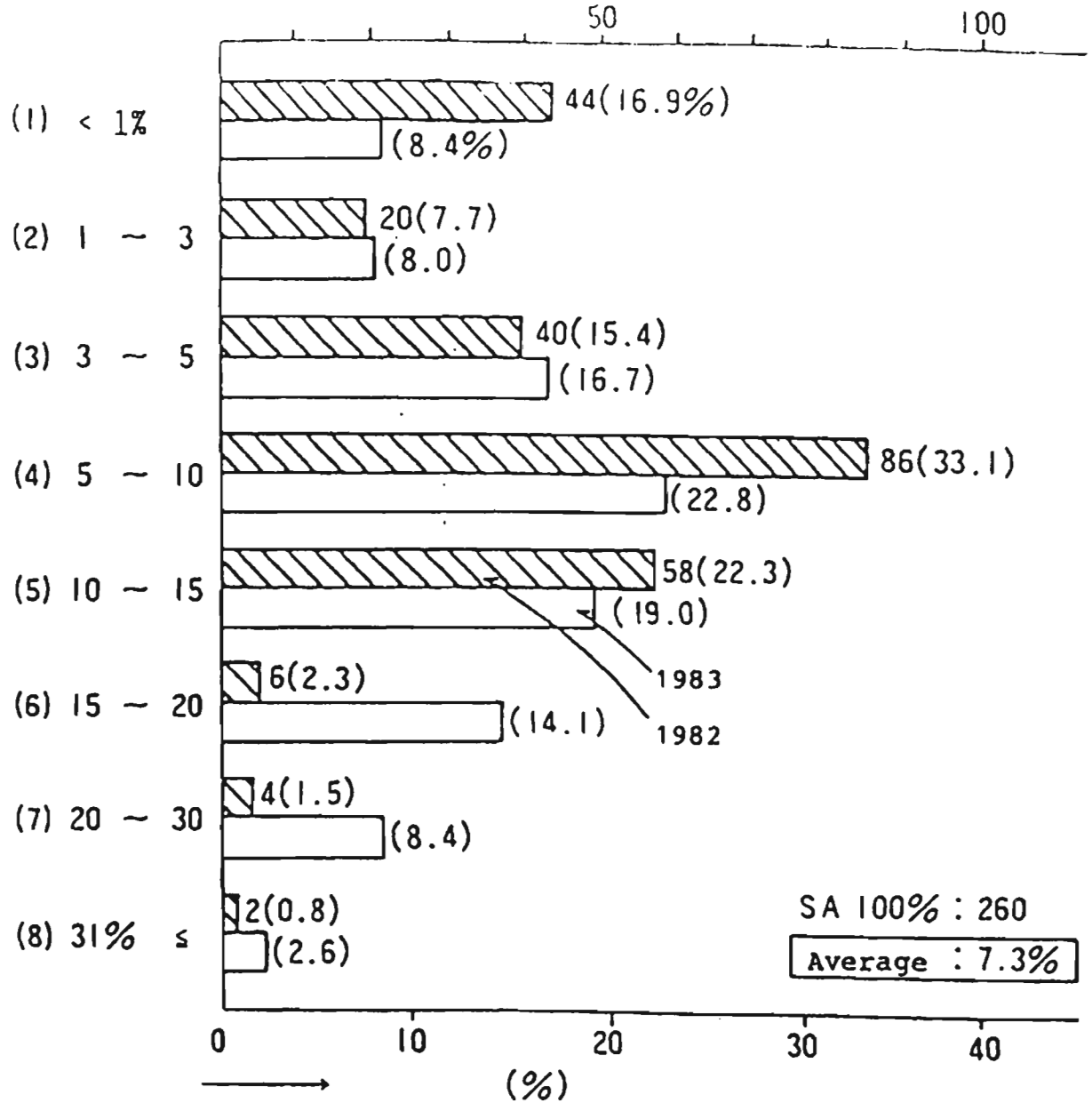


Figure 6: Cost Reduction Effects

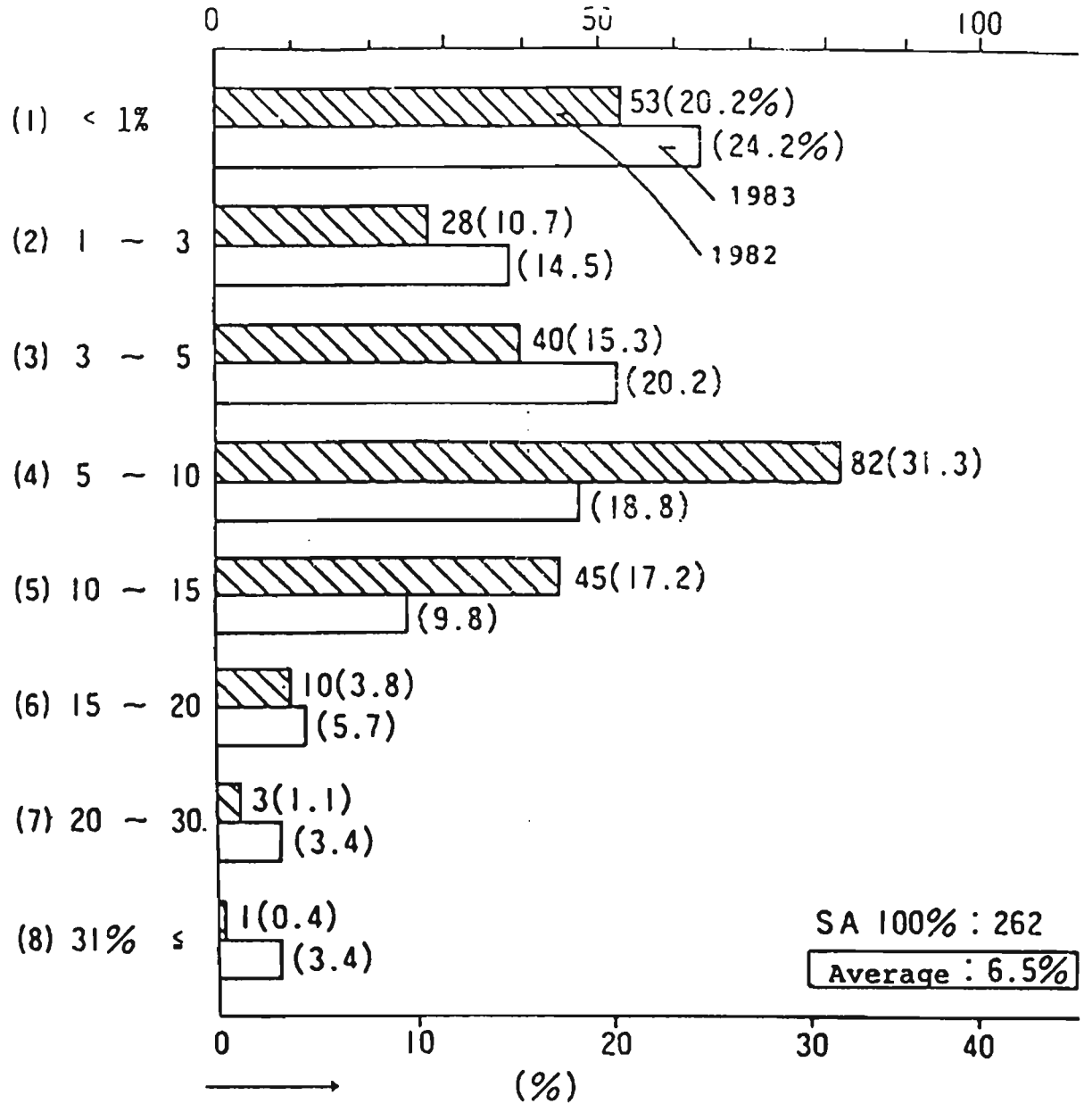


Figure 7: Manpower Reduction Effects

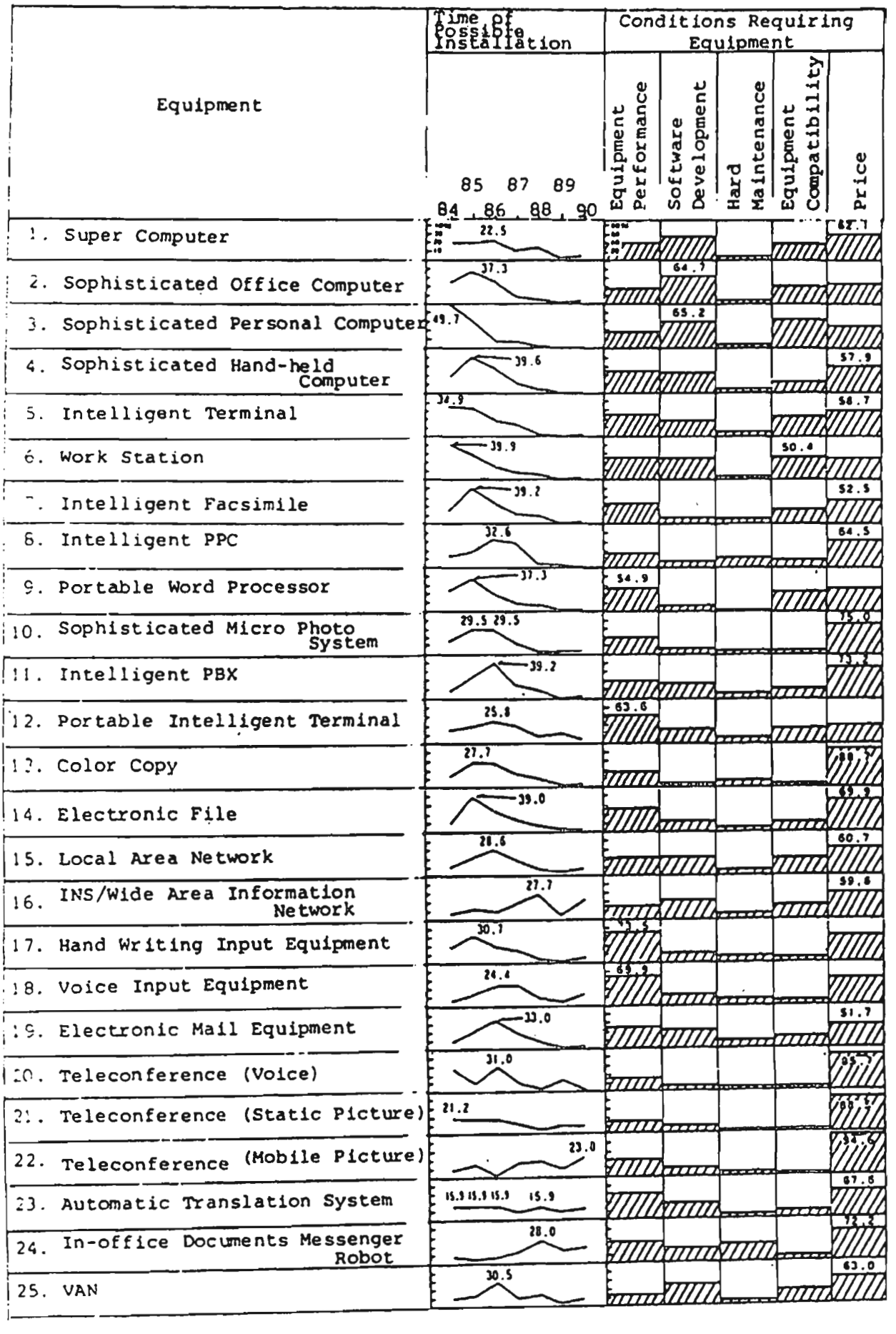


Figure 12: Forecast of Possible Installation of OA Equipment

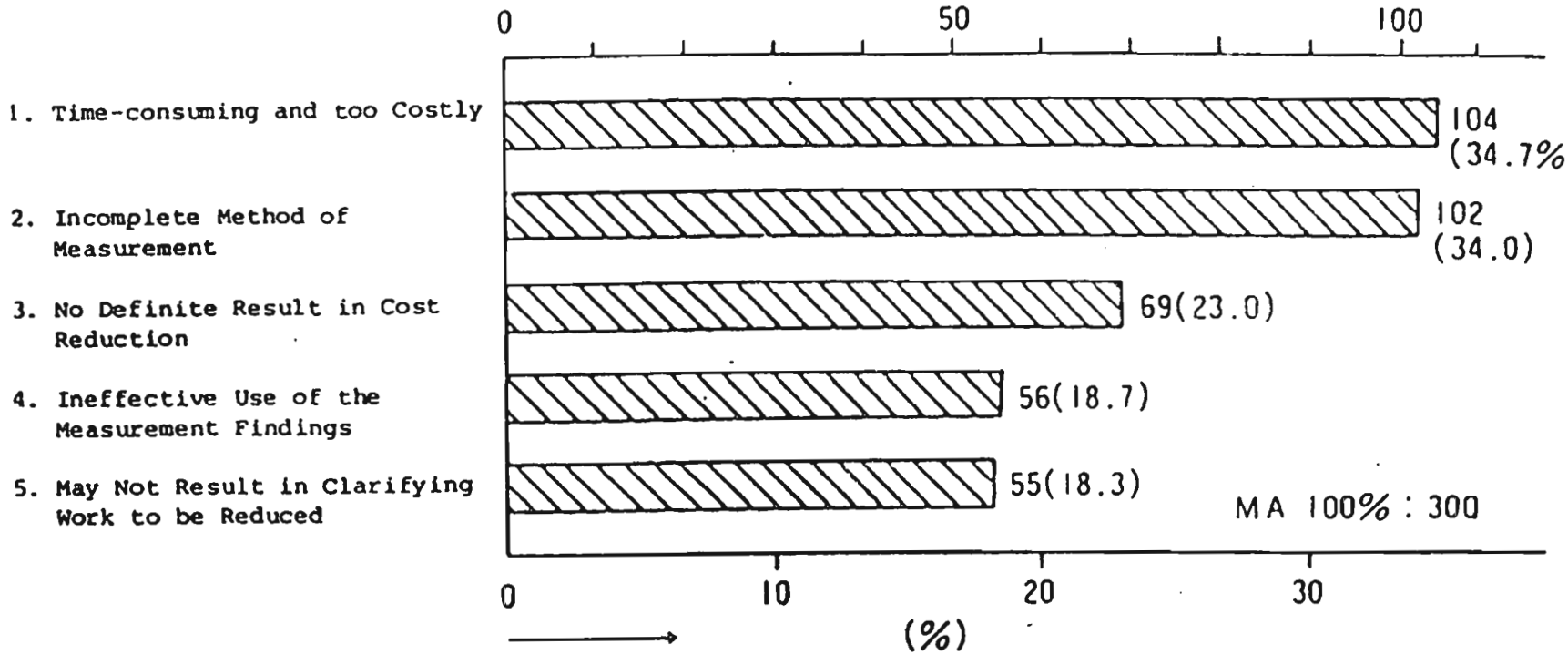


Figure 13: Problems in Measurement of Work Volume

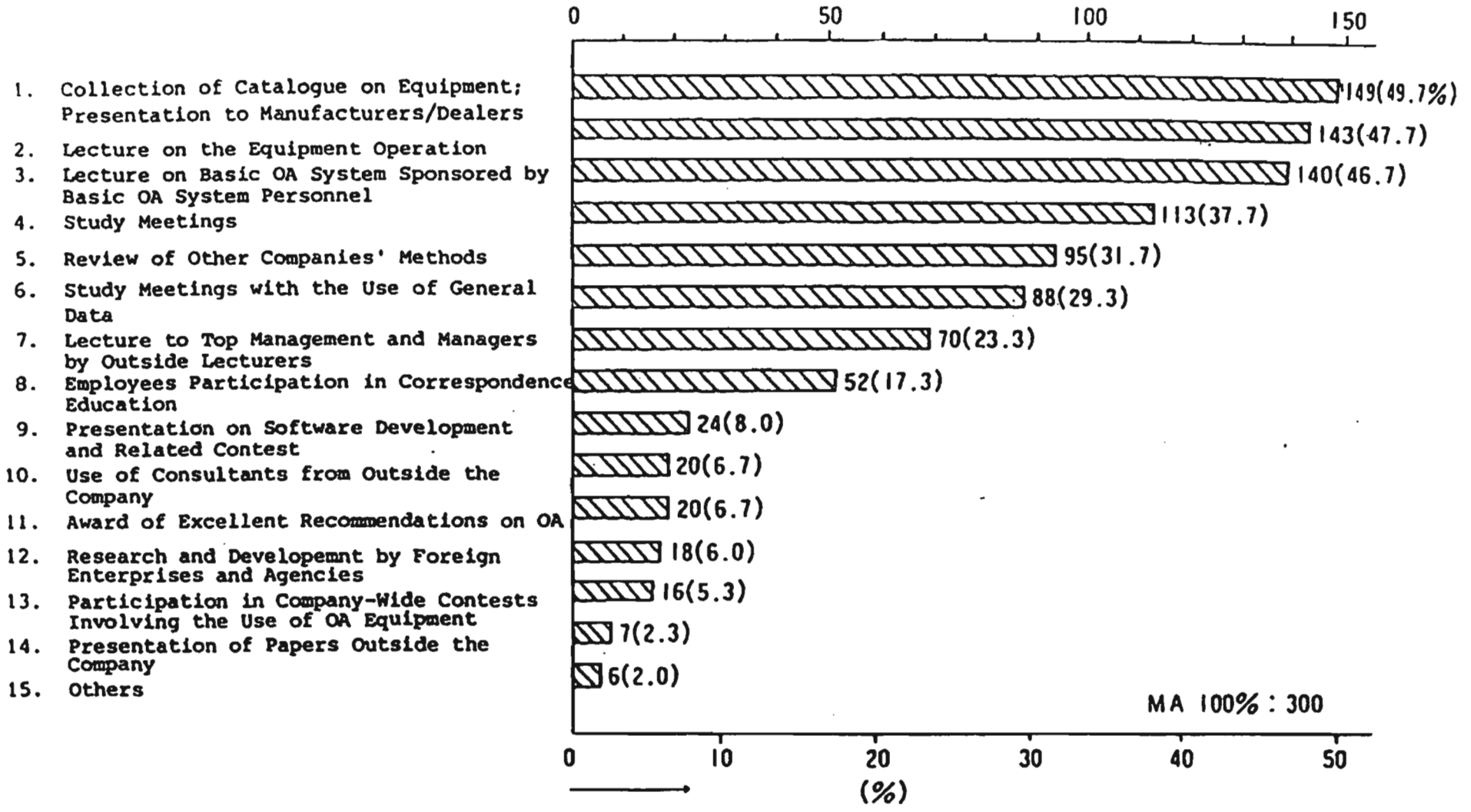


Figure 14: Method of OA Education

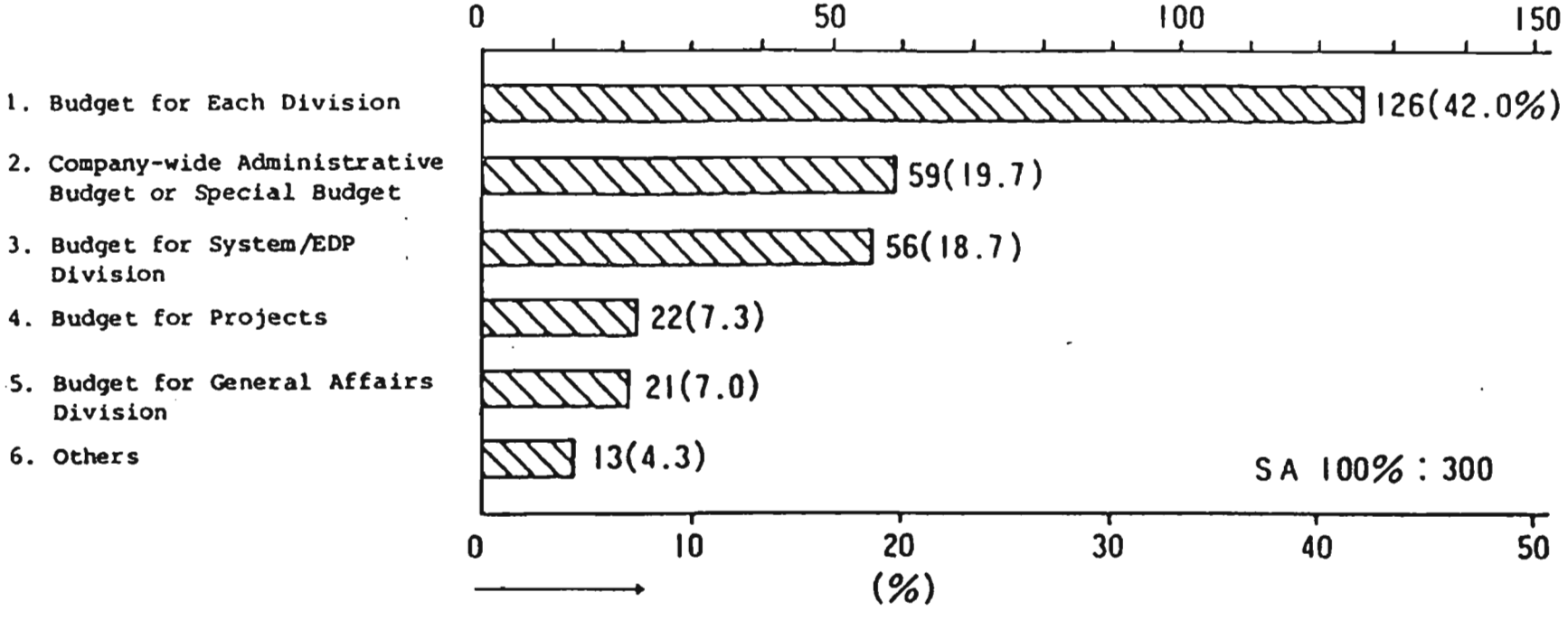


Figure 15: OA System Budget

SUMMARIES

TELEFAX G-4: The fundamental difference between the G-4 and other facsimiles is that it is digital and hence, it can access digital networks, transmission time is shorter, it can be linked with other digital terminals, and a "mixed mode" relationship with the teletex becomes possible. Currently, at the CCITT, international standards are being discussed, a tentative version of which will be released this fall(1984), and thereafter, the first of the G-4's are expected to enter the market. However, under the tentative standards to be released this fall, compatibility with the G-3 machine will not be established, and therefore, in Japan, where diffusion of the G-3 machine is extremely high, the demand for G-4's is expected to be severely limited. The G-3 will predominate until compatibility with the G-3 is established--three-to-four more years.

MACHINE TRANSLATIONS: Although machine translations technology is still crude--on a syntax analysis level, the first of such systems will enter the Japanese marketplace this year. R & D in this area is very intensive but there is a need to conduct analysis on a semantic and even a contextual level. This requires the inclusion of elements of artificial intelligence--being studied by the Institute for New Generation Computer Technology, where research on machine translation applications are expected to begin in 1985.

VOICE: Voice-related products have been on the market since the late 1970's, however, this market is still in a pioneering stage. On the manufacturer side, technological capacity falls short of the unlimited vocabulary level, i.e., number of recognizable/synthesizable words are limited (to approximately 200 words voice recognition and 100 - 200 words voice synthesis). On the user side, interest is high but there is a lack of applications know-how. In order to attain technology on the unlimited vocabulary level, as in the case of machine translations, elements of artificial intelligence become necessary.

CAPTAIN: The CAPTAIN System is the Japanese version of videotex. This system is to be commercialized in November 1984 and is expected to become the first financially self supportive system to be implemented on a national scale (break-even is expected to be attained within one year after inception). Services will include (1) information search & retrieval, (2) order entry, (3) closed user group. Distinctive features are (1) closed user group, (2) melody function, (3) the fact that protocols of various other videotex systems (TELIDON, PRESTEL, etc.) have been incorporated. One major inconvenience, however, is that financial services such as banking services have not been legalized.

CASES: In 1982, SCANTECH provided TELDOK with a report

containing 25 case studies of office automation applications in Japan. Of these, 8 companies were selected and updates of these 8 are provided in part V of this report. The 8 cases were those of: (1) Nisshin Steel, (2) Nippon Seiko, (3) Tokyo Sagawa Express, (4) Kawasaki Steel, (5) Kawasaki Heavy Industries, (6) Misawa Home/MRD, (7) Mitsui & Co., and (8) Nippon Credit Bank. In approaching this update four topics were sought: (1) original needs/intentions/expectations, (2) actual implementation (at the time of previous report), (3) results, and (4) modifications and future office automation plans. As to the question of quantitative measurement of results, most of these companies interviewed had, at best, very little data. (see fig. 13, which explains problems encountered when measuring work volume).

PART I: TELEFAX G-4

INTRODUCTION

The topic of part I is "G-4 IN JAPAN", with additional background information as to facsimiles in general and infrastructure in Japan provided in the latter two sections. Minute details as to the proceedings of the CCITT conference are not provided for the Swedish delegation should have first-hand knowledge and their reports should be available in Sweden.

Before beginning this report, the following point should be kept in mind. The Japanese writing system is made up of two KANA (alphabet-like systems consisting of 41 "letters") systems, plus many thousands of Japanese (originally Chinese) ideographic characters--far more complicated than Western alphabet systems. Thus, programs for word processors and the like become highly sophisticated, operation of these terminals become equally complicated and far more time-consuming to use than Western equivalents. Therefore, facsimiles which operate on a bit/image basis and can therefore transmit graphic, type-written, and hand-written texts are easier to operate, less expensive (cost/performance), and quicker. For these reasons, facsimiles are more popular than many of the other bit/character systems available in Japan.

SECTION ONE: G-4 FACSIMILE

1.1 NEED FOR STANDARDIZATION

The first facsimiles of the 1960's were noncompatible, that is, various firms produced facsimiles of various specifications and very often, communication between the facsimile terminals of two different producers was not possible. This situation greatly inhibited the potential of the facsimile as a means of communication and thus created a demand for standardization, not just on a domestic level but on an international level. The CCITT (below) is where such international standards are made. Groups 1, 2, 3, and 4, are international standard classifications set by the CCITT, each group having different specifications.

1.2 CCITT

The INTERNATIONAL TELEGRAPH & TELEPHONE CONSULTATIVE COMMITTEE (CCITT) under the INTERNATIONAL TELECOMMUNICATION UNION--an organ of the UNITED NATIONS, is where international standards for various types of telecommunications equipment including facsimiles are made. Its attendants are comprised of delegates from various nations and here, proposals, debates, compromises, and finally, international agreements are made. The CCITT operates on a four year per session basis, the current session ending in 1984.

1.3 HOW CCITT PROPOSALS FOR FACSIMILES ARE MADE IN JAPAN

A. Topics for further study are agreed upon at the previous CCITT meeting.

B. The Japanese CCITT delegates present the above "topics" to the DENKI TSUSHIN SHINGIKAI ("Telecommunications Commission"). This commission is comprised of persons from the MINISTRY OF POSTS & TELECOMMUNICATIONS (MPT), KDD (international telephone authority), NTT (national telephone authority), universities, major manufacturers, and users. Here, thorough discussion proceeds and ...

C. The Japanese proposal is ready for presentation to the CCITT.

1.4 GROUPS 1 - 4

As stated above, groups 1 through 4 are CCITT's standard classifications for various levels of specifications. The international standards for groups 1 through 3 have already

been determined and today, standards for the G-4 are being discussed. The G-1 terminal is capable of transmitting an A4 page in 6 minutes and is analogue. The G-2 terminal is also analogue but requires only 3 minutes for A4 transmission. The G-3 terminal scans and prints digitally but transmits analogue (a modem is built-in) and requires less than 1 minute. The G-4 will be digital and transmission speed will be shortened to 6 seconds (at 48kbps). The protocols, resolutions, and coding methods vary for each one of these groups but many of the more recent facsimile terminals on the market are compatible (G-4 terminals are not on the market yet) with terminals belonging to differing groups. It should be noted here that the speed classifications for each of the groups are very rough estimates. Some "high-end" G-3 class terminals on the market today are capable of transmitting an A4 page in 10 seconds.

1.5 G-4 ISSUES

The G-4 standards are presently being discussed at the CCITT and these discussions will be carried on to the next session (ending '88). The general issues in need of discussion are as follows:

A. Coding Method

B. Resolution

C. Protocol

1.6 JAPAN'S FUNDAMENTAL STANCE REGARDING THE G-4

Proposals submitted by Japan and Europe regarding the G-4 clash at a fundamental level. The Japanese view the G-4 as essentially an extension of the G-3 and their primary objective is to secure compatibility between the G-4 and the already widespread G-3. Europe, on the other hand, is primarily interested in establishing compatibility and furthermore, integration (that is, being capable of sending both graphic and character information on one page by coordinated use of the two terminals, the teletex sending character symbols and the G-4 sending graphic bit/image symbols--referred to as mixed mode) between the G-4 and the teletex. To understand these fundamental differences, the following two points should be taken into consideration:

A. FACSIMILE: Nearly half of the facsimile terminals in use worldwide today are located in Japan and approximately half of these are of the G-3 type. The facsimile is by far the most prominent means of domestic "written" telecommunications in Japan. On the other hand, in all of Europe, the number of units in use is approximately one-forth that of Japan and other forms of telecommunications predominate. However,

sales of facsimile terminals is growing rapidly in Europe today.

B. TELETEX: The teletex is essentially a European product. It is estimated that 5000 teletex units are in use today, of which 4500 are employed in FRG and the remaining 500 are located in other European nations. As mentioned in the introduction, when compared to alphabet-based systems, the Japanese writing system is far more complicated and as a result, Japanese word processor type systems are relatively difficult to operate and far more time consuming to utilize than are Western systems. Despite this fact, Japanese/English language teletexes have been available on the market since April 1984--this month. Forecasts as to how well teletexes will sell are very difficult to make. On one hand word processors are becoming popular in Japan, facilitating the transition to teletexes, but on the other hand, the diffusion of teletexes worldwide is extremely low and none are being utilized in the USA, greatly inhibiting the telecommunication potential of the teletex. At any rate, the immediate prospects for the teletex in Japan are not very bright and diffusion is expected to take some time. On the other hand, Japan recognizes the latent potential in the mixed mode system and regards its standardization as a very important step into the future.

Taking the above two points into consideration, the differences between the stances of Japan and Europe become natural and unavoidable (the United States shared the same stance as Japan). Hence, the CCITT study group sought a "middle of the road" arrangement. Here, some problems arise. The resolution standards of the G-3 and the teletex do not match. The resolutions of facsimile units are as follows: Standard Mode - 100 pels per inch (ppi), Fine Mode - 200 ppi, Superfine Mode - 300 and 400 ppi. G-3 facsimiles are operable at 200 ppi with some having 300 ppi for special applications. On the other hand, resolutions of 180, 240, 300, etc., (multiples of 60) ppi are more suitable for teletexes. As a compromise, three classes within the G-4 will be constructed:

	CLASS 1	CLASS 2	CLASS 3
RESOLUTION (standard)	200ppi	200ppi 300ppi	200ppi 300ppi
RESOLUTION (optional)	240, 300, 400ppi	240ppi 400ppi	240ppi 400ppi
TELEX COMPATIBILITY	NONE	RECEPTION ONLY	RECEIVE/SEND CHARACTER INFO
MIXED MODE	NONE	RECEPTION ONLY	YES

When the above standards are finally set (in next session ending 1988), all three classes will be G-3 compatible, class 2 will capable of receiving mixed mode (character + graphic information) transmissions, and class 3 will be capable of both sending (in conjunction with teletex terminal) and receiving mixed mode information. In addition, differences in protocol between the standard facsimile terminal and the teletex must also be resolved. The protocol will be set according teletex standards.

1.7 CHARACTERISTICS OF THE G-4

A. PDN ACCESS: Digital Public Data Networks having superior transmission capacity in terms of speed and quality, and to which are linked other digital terminals such as teletexes and computers will be accessible in addition to telephone networks.

B. DIGITAL

C. HIGH SPEED: Transmission speed will be enhanced greatly. At 48kbps--the maximum transmission speed of the Japanese PDN called DDX, an A4 page can be transmitted in 6 seconds.

D. HIGH RESOLUTION: G-4 classes 2 and 3 will offer 300 ppi as standard and all three classes will offer 400 ppi as an option--superfine mode.

E. COMPATIBILITY WITH OTHER DIGITAL TERMINALS

F. MIXED MODE

G. ADOPTION OF "ESSENTIALLY ERROR FREE" FUNCTION: Automatic correction of errors, said to improve bit/error ratio by three to six digits as compared to conventional facsimiles.

H. ADOPTION OF HALF TONING (GREY SCALE)

1.8 PROBLEM AREAS

A. PROTOCOL: Protocol will be based on teletex protocol. Facsimile terminals will have to be sophisticated and therefore, cost will rise.

B. RESOLUTION: As illustrated in the table above, the resolutions of the conventional facsimile and the teletex do not match and therefore, gradation is necessary, again tending to boost the cost of facsimile terminals.

C. PDN AVAILABILITY: Accessibility to PDN's worldwide is in need of much improvement. On the other hand, even if accessibility is high, their is a subscription problem, each user must apply and make new investments (if not previously subscribed) in order to gain access to this network.

D. PDN COST: Generally speaking, telecommunications via PDN can prove expensive if transmission volume is not sufficiently high. In contrast to telephone networks, to which practically every company/individual is a subscriber, for many, subscription to the PDN means additional investment.

E. TELEPHONE NETWORK: Although telephone networks have their limitations as to maximum transmission speed (bps) and quality, availability and subscription is extremely high. All previous facsimile terminals have had access to telephone networks and the G-4 is also scheduled to have access, however, this access will not be possible until the end of the next CCITT session in 1988--a major drawback for the near future.

F. G-3 COMPATIBILITY: One of the objectives of the CCITT is to secure G-4 compatibility with the G-3, however, this will not be possible until after the next session--another major drawback. (compatibility with the G-2 & G-1 will not be possible).

G. MIXED MODE: The ability to operate on a mixed mode basis is the most distinguishing and promising characteristic of the G-4 and this too, will not be possible in the near future.

H. COST OF G-4 TERMINAL: The cheapest facsimile on the Japanese market sells for less than ¥200,000. A "low-end" G-3 sells for ¥800,000 and a "high-end" G-3 sells for ¥2,500,000 - ¥3,000,000. Taking into account the sophistication of the G-4, it will definitely sell for more than ¥3,000,000, making it unaffordable for many.

I. TELETEX DIFFUSION: Teletex diffusion is a major area of concern for the future, when mixed mode becomes possible.

1.9 G-4 OUTLOOK FOR THE NEXT 3 - 4 YEARS

The current CCITT session ends this year--1984. Much discussion as to the G-4 standards will be carried over into the next session, however, a limited and tentative version of class 1 G-4 standards will be released this autumn. According to this standard, G-4's will not be compatible with G-3's, i.e., G-4's will only be capable of communicating with other G-4's. Mixed mode and telephone network access will not be possible.

In Japan, the next three to four years are expected to remain an era for G-3's. In addition to the restrictions and problems mentioned above, a comparison between G-3's and G-4's support this conclusion:

A. SPEED: G-4 transmission time for A4 is roughly 6 seconds. A standard G-3 takes 1 minute, however, high-end G-3's are as fast as 9 - 10 seconds, thus the difference in transmission speed is not as great as may appear upon first glance. Furthermore, in addition to transmission time, "handshaking" time should be taken into consideration. Handshaking time refers to the time spent by the operator in preparation for transmission such as inserting the documents and pushing the appropriate buttons. In this respect, G-4's are expected to be slower than G-3's due to the sophistication of the G-4 terminal.

B. PRICE: A low-end G-3 can be purchased for ¥800,000 and a high-end for ¥3,000,000. A low-end G-4 is anticipated to sell for over ¥3,000,000--very expensive.

C. NETWORK ACCESS: The G-3 has access to telephone networks while G-4's do not.

D. "ESSENTIALLY ERROR FREE": A similar function known as Automatic Repeat Request (ARQ) is already available on many high-end G-3's.

E. RESOLUTION: 400 x 400 can also be attained with G-3's.

The CCITT will release the tentative class 1 G-4 standards this autumn and the first of the G-4 terminals are expected to be on the market by the end of this year, however, short term prospectives appear unfavorable for G-4 performance, at this stage, is not much better if not worse than that of the G-3 while cost is expected to be higher.

1.10 LONG-TERM PROSPECTIVES

When questioned about the long-term prospectives of the G-4, Japanese administrators and manufacturers were less certain but seemed to agree that the G-4 has very interesting potential. Some key points to the opening of the G-4 era, in addition to completing standardization at the CCITT in the next session, were mentioned as:

A. PDN AVAILABILITY: The ISDN movement worldwide must progress further, this is expected to take five or six years.

B. COST OF G-4 TERMINAL: At over ¥3,000,000 for the G-4 terminal alone, rapid and widespread diffusion cannot be expected. There is a strong need to lower cost.

C. TELETEX DIFFUSION: At present, diffusion is low and and growth has been limited. This situation should be improved.

1.11 EXPERIMENTS WITH THE G-4

At the Information Network System (INS) model system experiments to be conducted in the Musashino/Mitaka district in Tokyo this fall over a period of roughly 2.5 years (see materials enclosed in appendix 1), various experiments with the G-4 facsimile will be conducted along with that of many other systems. Some facsimile models which are expected to be tested in this experiment are as follows:

	DF-1	DF-2A	DF-2B	DF-3
Channel Speed (kbps)	16	64	16	64
Transmission Speed (kbps)	16	16 or 64	16	64
Paper Size	A5	A4	A4	B4
Scanning System	Flat-bed on Image Sensor			
Recording System	Thermal-head Printing System			Electro-static
Resolution: Horiz. (dots/mm)	8			16
Resolution: Vert. (lines/mm)	3.85, 7.7, (5.78)	3.85, 7.7		3.85, 7.7, 15.4
Coding Scheme	MH/MR CCITT T.4, Extended MR			
Protocol	G-4 CCITT S.62, S.70 Based			

	Ultra High-speed Fax	Color Fax
Transmission Speed	768kbps	1,544Mbps, 64kbps
Paper Size	B4	A4
Scanning System	CCD	Contact-type + 3-color Solid-state Optical Switching
Recording System	Electrophotograph	Ink-jet/ Thermal Print
Resolution: H.	16 pels/mm (4096 pels/line)	8 pels/mm (1728 pels/line)
Resolution: V. (lines/mm)	16	7.7
Tone	16 levels	16 levels (each of YMC)

1.12 SOME IDEAS AS TO NEW FAX APPLICATIONS IN INS ERA

A. TELECONFERENCE: Telephone, still & motion image transmission, electronic blackboard, facsimile, etc., are potential components of such a system. Various combinations of the above components are expected to be integrated according to needs and facsimiles should be utilized for making hard copies.

B. FACSIMILE NEWSPAPER: A large facsimile terminal is necessary on the receiving end for wide-subscription daily newspapers. At the model system, experiments with smaller newspapers, such as, digests, newsletters, highlights, advertisements, etc., are planned.

C. "INFORMATION": Access to information such as, bargains, new products, events (concerts, movies, etc.), foreign exchange, TV & radio guide, economy, stock/investment, medical, hobby, technology, tourism, etc., etc. Unlike telephone information, these can be kept on record for later reference. Some will be on free access basis, others on membership basis, at intervals, or on demand.

D. CENTER/END TRANSMISSION: Connection of facsimile with the computer along with other data processing equipment.

E. PUBLIC FACSIMILE: As with public telephones today, facsimiles should also become accessible outside of the office, on the street. This arrangement exists today in a very limited form (accessable to public at local post offices).

F. COMPATIBILITY WITH OTHER TERMINALS:

G. FACSIMILE SHIPPING: Exchange of catalogues, price, delivery time, address, order, etc.

H. FACSIMILE BROADCASTING:

SECTION TWO: INFRASTRUCTURE

In order for a facsimile to function, a network must exist. The capacity of a facsimile is determined by both the capacity of the terminal itself and of the network(s) utilized. In order to provide a balanced view of facsimiles in Japan, a brief summary of those aspects of the Japanese infrastructure pertaining to facsmiles will be introduced in this section.

2.1 DOMESTIC

The NIPPON TELEGRAPH & TELEPHONE PUBLIC CORPORATION (NTT) is the domestic network authority. In Japan, basically five networks are accessible by facsimile: (A) telephone network, (B) facsimile network, (C) "Digital Data Exchange" (DDX)--Circuit Switched, (D) DDX--Packet Switched, and (E) private networks. A brief description as to the significance of each is as follows:

A. TELEPHONE NETWORK: It is estimated that over 90% of all domestic facsimile transmission is conducted via this network. The primary reason is wide availability and subscription. Practically every office and household nationwide has a telephone and the vast majority of the facsimiles in use today are linked to this network.

B. FACSIMILE NETWORK: This network is relatively new and an estimated 5% of domestic facsimile transmission utilizes this network today. Many facsimile services are included in this network system, however, utilization is still low because of small subscription volume and because only facsimiles that match the specifications of NTT can access this network. The MINIFAX-I and most of the more recent models on the market meet these NTT specs. The various services available when utilizing this network (outlined below) can be used as a substitute for functions built into each individual terminal, which means more functions can be satisfied with low-priced terminals. Another important characteristic is that this network is semi-digital, that is access is through the ordinary telephone network, where the the signals are digitized, transmitted, reconverted, and delivered--a step in the direction of INS. Although the utilization rate is low at present, this network is thought to have a promising future.

C. DDX--CS: As of 1982, only 27 facsimile terminals were linked to this network. This network is mainly utilized for data transmission and is regarded to be too expensive for facsimiles at present. Another problem is that coverage and subscription volume is low. However, for the digital G-4 with mixed mode capacity, this will be an important network.

D. DDX--PS: This network is theoretically accessible by facsimile, but packet switched networks are generally regarded as unsuitable for facsimile use. The number of facsimiles utilizing this network today is believed to be zero.

E. PRIVATE NETWORKS: This category includes those lines borrowed from NTT and those which are "truly" private. Many facsimiles are known to be connected to these lines, however, the proportion as compared to total domestic facsimile transmission is very small.

More details regarding the three most important networks are as follows:

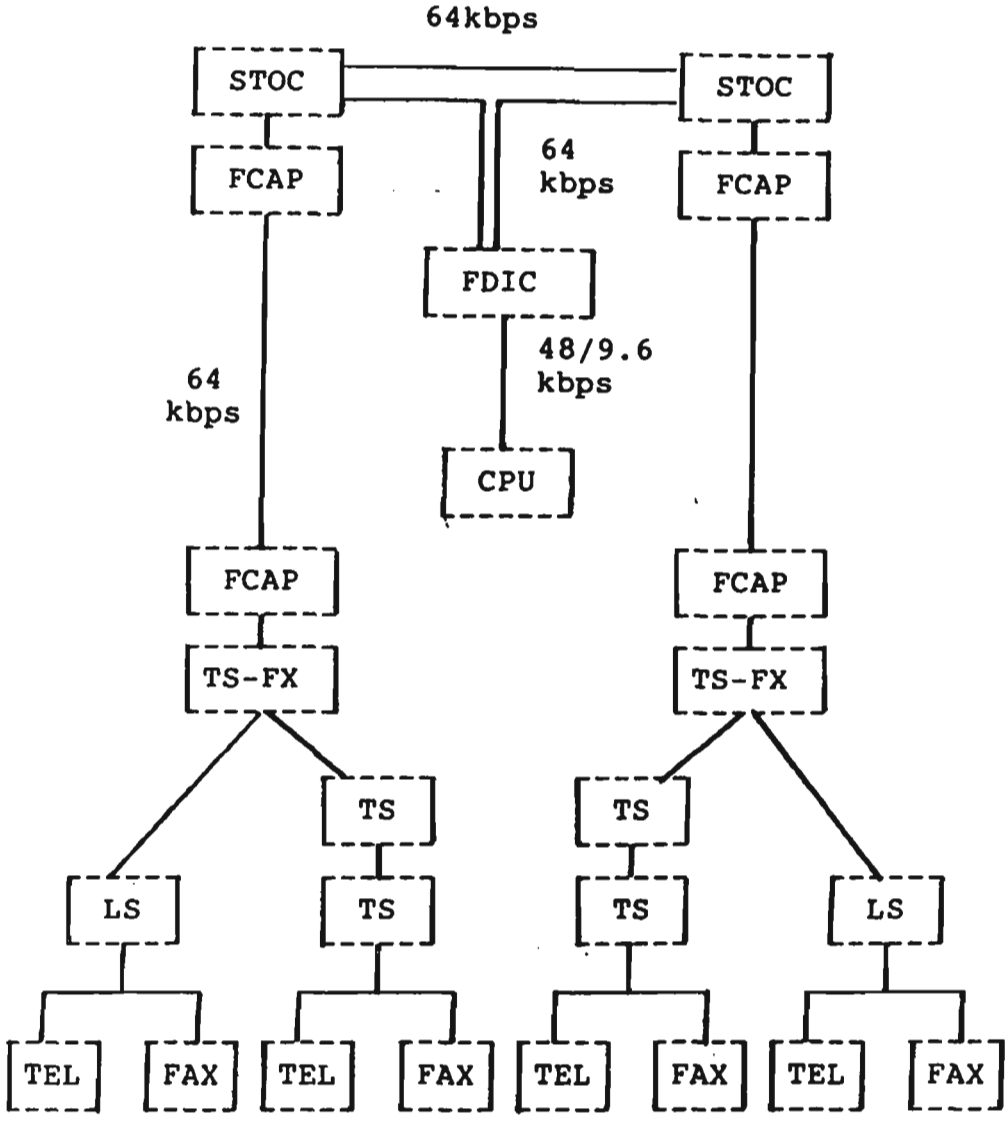
A. TELEPHONE NETWORK:

WHEN:	Liberalized 1971.
AVAILABILITY:	Throughout Japan.
SUBSCRIPTION:	Extremely high for telephone, relatively high for facsimile.
COST:	See NTT pamphlet in appendix 2, (Note: these rates have been revised in 1983).
SPEED:	2400, 4800, 9600 bps, 2400 is most commonly used, 9600 has bad transmission quality.

B. FACSIMILE NETWORK:

WHEN:	September 1981.
AVAILABILITY:	1981--Tokyo & Osaka area. End of '84--all cities having population over 100,000. Future--will continue extending.
SUBSCRIPTION:	Low at present.
COST:	Initial fee--¥300 Transmission fee per page--(-100km=¥40 for standard mode, ¥55 for fine mode) (-500km= ¥50/SM, ¥70/FM) (+500km=¥60/FM, ¥85/FM), for short distances, telephone network is cheaper.
SPEED:	Access--same as telephone network, but converted to digital and transmitted via 64kbps network (see network configuration below). Actual transmission time is not very fast for the message must pass through a multi-layer of stations.

CONFIGURATION:



*KEY: FDIC=Fax Signal Conversion & Interface Control Equip.
STOC=Fax Storage & Conversion Equip.
FCAP=Fax Signal Conversion & Procedure Contral Equip.
TS-FX=Tall Switch equip. with Fax Service Control Facility.

RESTRICTION: Only A5 at present, A4 transmission will be permitted beginning this summer (MINIFAX II), B4 transmission is being considered for 1986.

SERVICES (TODAY):

a. Automatic Reception.
b. Automatic recording of date, time and sender's telephone number.
c. Redial--if line is busy, will automatically redial 5 times in the next 30 minutes.
d. Busy Message--if even after redial, line is busy, sender will be notified.

e. Dial Memory--can memorize up to 40 numbers.
f. Dial Memory Check--when numbers in memory need be confirmed, the network will supply a full list upon request.
g. Sequential Broadcasting--if the same message need be sent to more than one location, the message along with all of the desired destinations need only be transmitted once.

SERVICES (FUTURE, to begin summer of '84):

a. A4 Service--with the coming of the MINIFAX II, A4, in addition to A5 will be transmittible.
b. Center/End Transmission--through the FDIC (see configuration above), make facsimile/computer, computer/facsimile transmission possible.
c. Confidential Transmission--receiver is informed of arrival of confidential message, in order to retrieve this message, receiver must punch in the appropriate code number.
d. Facsimile Box--upon request of subscriber, facsimile box will receive all messages on behalf of subscriber and store in memory, the subscriber can retrieve the messages at his convenience.
e. Closed circuit--line is reserved for transmission amongst a group of consenting subscribers.

C. DDX--CS.

WHEN: December 1979.

AVAILABILITY: 1984--all cities with population over 200,000. Expansion will continue in the future.

SUBSCRIPTION: Still limited to users with big transmission volumes.

COST: See appendix 2.

SPEED: 200bps - 48kbps (see appendix 2).

The above three networks are considered most important for the near future. Utilization of telephone networks are expected to continue rising and utilization of the facsimile network is expected rise even more quickly. The DDX-CS is expected to play an important role when the G-4 facsimile arrives.

2.2 INTERNATIONAL

KOKUSAI DENSHIN DENWA CO., LTD., (KDD) is the authority in charge of the international networks. Basically 4 networks are accessible by facsimile: (A) telephone network, (B) VENUS-P, (C) DATEL, and (D) private lines.

A. TELEPHONE NETWORK: As was the case with domestic facsimile transmission, the bulk of international transmission is believed to utilize this network. According to a recent KDD study, 60 - 80% of total I.S.D. calls from Japan to Europe and the United States, were facsimile transmissions.

B. VENUS-P: It is believed that facsimile transmission via these cables are minimal if not zero for packet switched systems are not suitable for facsimile transmission.

D. DATEL: This network resembles the telephone network only coverage is much lower and concentrated in the far east where facsimile units are still few. Utilization is near zero.

E. PRIVATE LINES: It is believed that a significant but relatively small amount of facsimile transmission is conducted over these lines.

None of these networks are ideal for G-4 transmission as they are today, however, as a possible network of the future, the VENUS-C (Circuit Switched) is now being considered.

SECTION THREE: GENERAL FACSIMILE RELATED TRENDS IN JAPAN

3.1 JAPAN INC.: INDUSTRIAL POLICY

The term "Japan Inc." is often used abroad to describe the relationship between government and industry in Japan. In some key industry/product cases, such as computers, the Japanese government has played an active role in supporting development, in the form of guidance, initiative, and assistance. In the case of the telecommunications industry, under the authority of the Ministry of Posts and Telecommunications (MPT), no "such" industrial policy exists. In the field of telecommunications, generally speaking, the private sector is one step ahead of the government in terms of technology and therefore there is no need for government to provide initiative (although both NTT and KDD do conduct R&D). Thus, MPT promotes this industry by participating in standardization (coordination), and providing outlooks (guidance). The manufacturers of telecommunications equipment are in day-to-day contact with officials of MPT, NTT, and KDD and information flow is highly favorable, thus, as a result, advancements in both terminals and networks are relatively balanced in Japan.

3.2 THE PRODUCERS

There are 18 producers of facsimiles in Japan. Of these, the top five are Matsushita, Ricoh, NEC, Toshiba, and Hitachi with market shares (1981) of 27.3%, 16.6%, 10.3%, 8.5%, and 8.3% respectively (source: "Market Share in Japan: Industrial Data on 800 Products", Yano Research Institute). Catalogues (some were available only in Japanese) have been collected from each of these top five producers + NTT and they are included in appendix 3.

3.3 PRODUCTION/FORECAST

95% of the facsimiles produced worldwide today are made in Japan. Some recent sales statistics are as follows:

¥million, (quantity)

'78	'79	'80	'81	'82
44,874	66,922	84,659	120,335	144,214
(53,417)	(75,406)	(104,225)	(153,265)	(241,919)

(source: Communications Industries Association of Japan)

Forecasted sales are as follows:

¥million

'83	'84	'85	'86	'87
170,900	202,100	237,900	278,200	323,000

(source: Communications Industries Association of Japan)

Facsimiles are divided into three classes, high, medium, and low speeds. Sales of both high and low speed terminals has been and is expected to continue rising. On the other hand, sales of medium speed terminals is declining each year.

3.4 PRICE TREND

There are two price trends within the facsimile market. One is moving in the upward direction and the other is moving in the downward direction. On one hand there is a strong demand for high-end, high-speed, multifunctional facsimiles and these are continuously being improved and becoming increasingly expensive. On the other hand, there is also a strong demand for low-end, low-speed, easy operation, inexpensive facsimile terminals. These two trends are expected to continue in the future.

3.5 CONSUMER TREND

1	Large firms
2	Medium-sized firms
3	Small firms
4	Households

Diffusion began at level 1 and is now penetrating levels 2 & 3. Demand at level 1 today is for high-end G-3's. At level 2, demand is for low-end G-3's priced at around ¥800,000. At level 3, demand is for slower models priced at ¥400,000. Level 4 is yet to be penetrated and remains a big question mark.

3.6 COMPUTER/FAX: OA

A spokesman for Matsushita envisioned that before or around the turn of the century, total system integration of office automation equipments will be completed. Today, copiers, word processors, facsimiles, computers, etc., etc., are seperate units functioning independent of each other. In the

future, total integration tailored to fit office needs is anticipated. Recently, Japanese facsimile producers have been striving to establish and improve the link between the facsimile and the computer and primitive forms of computer/fax linkages exist today, such as, borrowing computer memory to conduct sequential broadcasting, utilizing the facsimile as an output terminal (replace plotter), or using the facsimile as an input terminal (using mark sheets). "Mixed mode" type arrangements between the computer and the facsimile in its pure form are not yet possible but are expected to come out soon. On the other hand, mixed mode type arrangements between computers and scanner/printers (which are technically becoming very similar to the facsimile) in which character, graphic, and photographic information can be combined, are available on the market today.

3.7 POSITION OF FACSIMILE IN WRITTEN TELECOMMUNICATIONS

A. INTERNATIONAL: For international written telecommunications, the options today are (1) telex, (2) facsimile, and (3) teletex. Of these, the telex is still the predominate means, however, facsimiles, though still proportionately small, have been increasing in importance. A recent KDD study estimates that some 60 - 80% of total ISD international calls bound for Europe and the USA are facsimile transmissions. Teletex transmissions are zero at present for they are still brand new in Japan and diffusion worldwide is still very low. It is expected that facsimiles and teletexes will gradually come to replace telexes in the future.

B. DOMESTIC: The options are (1) facsimile, (2) Japanese language telex, and (3) Japanese/English language teletex. It is estimated that current proportion is facsimile=80%, telex=20%, and teletex=0%. In the future, facsimiles are expected to grow very quickly, teletexes also quickly, and telexes will disappear.

3.8 CLOSING

As mentioned above, the trend in office automation is in the direction of integration of various hitherto independent equipments into one system. Digitalization is a key factor in attaining these ends. The G-4 is the first of the standard digital facsmiles (some G-3's are also digital), making the interlinkage/integration possibility more real. Mixed mode between facsimiles and teletexes is an important step in the direction of integration. However, mixed mode will not be available until 1988 and the cost of the G-4 terminal as it looks today will be very high. The needs of the market (cost -vs- performance -vs- needs) as well as technical capacity (network & terminal) must be taken

into consideration when viewing the transition from G-3 to G-4. In the immediate future, the G-4 is not expected to play a major role due to market and other conditions described above.

PART II: MACHINE TRANSLATION

INTRODUCTION

In recent years, R & D in the field of machine translation (MT) has intensified. Resulting systems are still far from satisfactory for much pre and/or post editing is required, but considering the immensity of the translation market, and the performance of some of the recent systems in terms of cost, time, and quality, the first of the MT systems are expected to be commercialized soon. In fact, one system of U.S. origin (Weidner Communications) and offered by Bravice International in Japan, is already on the market. Various Japanese systems are expected to follow suit--beginning with Fujitsu's ATLAS/I in August or September of this year--1984.

The first section of this report will give a brief overview of MT technology in Japan. Section 2 will introduce the primary organs of R & D for MT, along with outlines of some of the systems undergoing development right now. Section 3 will focus on Bravice International and their already commercialized system. In section 4, focus will be placed on the importance of MT services in Japan and part II will be concluded with a presentation of topics for the future.

SECTION ONE: OVERVIEW OF MT TECHNOLOGY IN JAPAN

1.1 MT: CLASSIFICATION & GENERAL APPROACH

There are three basic stages in the translation process, namely, (1) analysis, (2) transfer, and (3) generation. A large proportion of the task, perhaps 60 or even 70%, is said to be in the analysis stage and thus, most R & D has been concentrated here, especially at the syntactic and semantic levels.

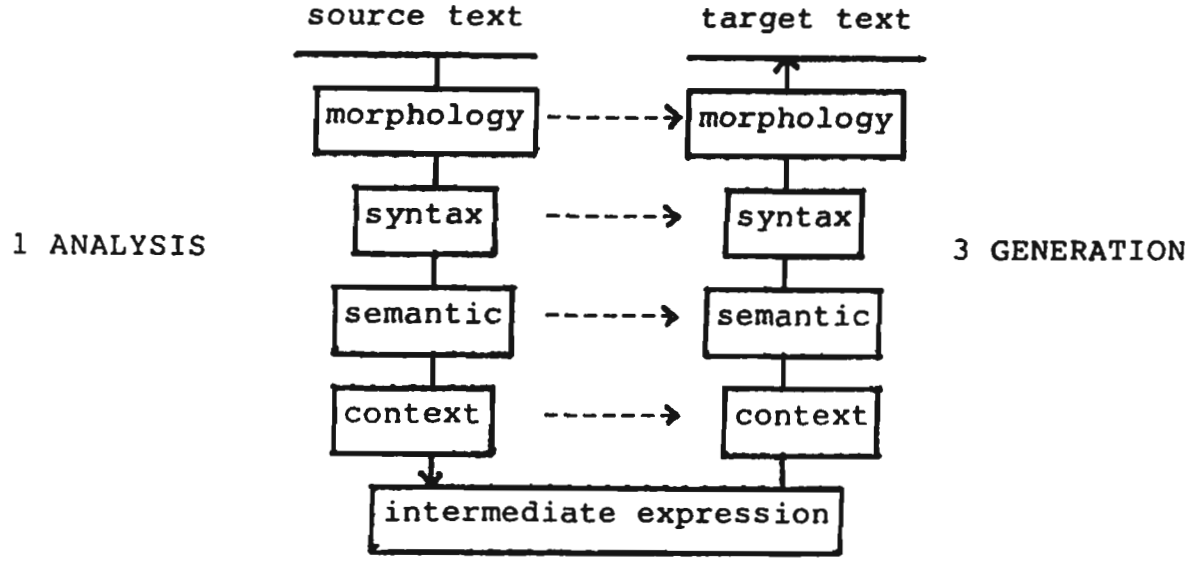


Figure 1.1: Outline of the MT Process.

Methods of approach in MT systems can be categorized into three general levels according to analytical depth:

(1) DIRECT TRANSFER METHOD--word-for-word translation with elementary levels of syntax analysis.

(2) TRANSFER METHOD--includes morphological, syntax, and usually, some semantic analysis.

(3) PIVOT METHOD--includes morphological, syntax, and in-depth semantic analysis.

The Transfer Method is most common in Japan. The Direct Transfer Method is too simplistic for two major reasons: (1) sentence structure of the Japanese language differs largely from that of Western languages and therefore, requirements as to syntax analysis when translating between two such diverse languages, are more severe, and (2) Japanese grammar is loosely defined as compared to that of Western languages and a certain degree of semantic analysis is a necessity for

correct interpretation of the interrelationships between words. On the other hand, the Pivot Method is a concept which is still far from concrete. In contrast to the Direct Transfer and Transfer Methods which deal with translations between only two languages, the Pivot Method proposes to extract a universal intermediate expression (Pivot Word) which can be a base for generation into any language. Many researchers presently have doubts as to whether this is even possible. For the above reasons, the Transfer Method is by far the most common method utilized in Japan. It should be kept in mind, however, that even within the Transfer Method, analytical depth varies widely from system to system.

1.2 MT: PRESENT POSITION OF R & D IN JAPAN

At present, it is not possible to identify any concrete trends in MT technology for this technology is still in a highly experimental phase. Different researchers are trying different approaches and opinions as to which methods are best vary widely.

MORPHOLOGICAL ANALYSIS/GENERATION: Technology at this level is relatively established, but exceptions, and there are many, continue to pose a problem.

SYNTAX ANALYSIS: This is an area in which much of R & D is concentrated and approaches are varied. However, case grammar is widely accepted as the most suitable method when working with Japanese. ATNG, DCG, and Extended Lingol are also common.

SEMANTIC & CONTEXTUAL ANALYSIS: Both, and especially the latter, are extremely difficult subject areas which will be major topics of future R & D. Although much research is currently being conducted on the semantic level, most of the systems (especially those to be commercialized soon) that will be introduced in this report include very little, if any semantic analysis.

GENERATION: This is an area which has been afforded very little R & D for it was hitherto considered easy. Recently, however, it is becoming increasingly clear that some of the problems posed here are extremely difficult.

PROGRAMMING LANGUAGE (PL): PL is an important factor which can determine the capacity of an MT system. Traditional PL's were meant to handle numbers and not languages, therefore, much is left to be desired here. More than half of the Japanese MT systems utilize Lisp or Prolog which are relatively suitable for handling languages. On the other hand, many of the systems of the private enterprizes use other PL's such as PL/I or C which have larger scale and quicker processing capacity. Yet, as Lisp and Prolog machines have been and are still being developed, processing

capacity for these two languages is on an upward trend. Further, as the Institute for New Generation Computer Technology has chosen Prolog as its main language for artificial intelligence, the odds are in the favor of Prolog as the PL for MT in the future.

SECTION TWO: THE PRIMARY ORGANS OF R & D IN JAPAN

Professor Nagao of Kyoto University was the first to begin R & D for MT in Japan. Shortly thereafter, ETL (MITI) and ECL (NTT) joined in, followed by Fujitsu and other private enterprizes. In addition, ICOT (fifth generation computer project) is expected to begin R & D next year.

The primary research organizations at the government, university, and private levels are introduced below.

2.1 GOVERNMENT

Both the Ministry of International Trade & Industry (MITI) and the Ministry of Posts & Telecommunications (MPT), especially the former, are heavily involved in R & D in the MT field.

2.1(a) MITI

MITI has two major projects underway. The first project is generally referred to as the "Science & Technology Agency MT Project" and the second is to be conducted by the Institute for New Generation Computer Technology--ICOT. These two projects came about for three major reasons: (1) MITI feels it has a responsibility to conduct R & D and to establish model systems, which can be a base for widespread diffusion, in selected fields; (2) MITI should have an accumulation of knowledge in advanced fields so that it can play a meaningful role in the event that international R & D cooperation occurs in the future; (3) The Agency of Industrial Science and Technology (AIST) under MITI has approximately 3000 researchers, and therefore, a great number of theses are submitted each year--in Japanese, MITI is attempting to develop an MT system for translation of these documents into English in order to improve accessibility to foreigners. In addition, there is a third project of smaller scale being conducted within the Electro Technical Laboratory (ETL) which is part of AIST, MITI.

A. SCIENCE & TECHNOLOGY AGENCY PROJECT:

This project began in 1982 and will be completed in 1985 with a budget totalling approximately ¥800 million. The concept behind this project is to develop the optimal system using the best hard and software AVAILABLE at the time this project was being planned--1981. The IBM 3081K and the Fujitsu M 380 were chosen. Participating organizations are the Japan Information Center of Science and Technology (JICST) under the Science & Technology Agency, ETL and the Tsukuba Information Center (RIPS) under AIST, and Kyoto University.

Under this system, analysis will be on a high-level syntactic

(semi semantic) basis and translations will be handled on a sentence-by-sentence (not contextual) basis. The system outline is as follows:

-TARGET LANGUAGE:	J-E, E-J.
-TARGET TEXT:	Abstracts from S & T theses.
-DICTIONARY CAPACITY:	Several tens of thousands of words.
-SYNTAX ANALYSIS:	Case grammar.
-TRANSFER:	Tree parser.
-PROGRAMMING LANGUAGE:	UTI-LISP

(see appendix 4 for further details regarding this project)

B. ICOT PROJECT:

This is a ten year project which began in 1982 and it is often referred to as the Fifth Generation Computer Project (MT system research is only one of many subprojects within). 40 - 50 researchers from ETL, ECL, Fujitsu, NEC, Toshiba, Hitachi, Mitsubishi Electric, Oki, Sharp, and Matsushita are directly involved in this project. Funding originates from the above mentioned eight private enterprizes and MITI. This project is divided into three phases, the intitial phase lasting three years, the intermediate, four years, and the final, three years.

With regards to MT R & D, the original concept was to develop the optimum MT system possible by 1990 with hard and software NOT YET AVAILABLE as of 1981. Thus, the Science & Technology Agency Project, whose goal is to develop the optimum MT system with tools ALREADY AVAILABLE in 1981, and the ICOT Project are sister projects.

FY 1984 is the final year of the initial phase in which efforts were concentrated on developing new tools. Although much of the research done in the initial phase, such as that regarding natural language understanding of simple Japanese sentences, is applicable to MT, direct R & D for MT will not begin until the intermediate phase beginning next year (April). Members are currently discussing possible methods of approach and implementation to MT development but no consensus has been arrived at yet for many diverse interests are involved. However, as the primary target of the ICOT Project is to develop an intelligent computer, approach to MT will undoubtedly be on an intelligent level--i.e., in addition to syntax analysis, semantic and even, contextual analysis is likely to be applied. What makes the ICOT even more interesting is that various types of technology, such as, voice technology (man-machine interface), as well as MT technology and many others will be integrated under this project.

C. ETL PROJECT:

Approximately 3 years ago, Professor H. Tanaka (now at Tokyo Institute of Technology) of ETL began research on using an "integrated", as opposed to a step-by-step approach to MT.

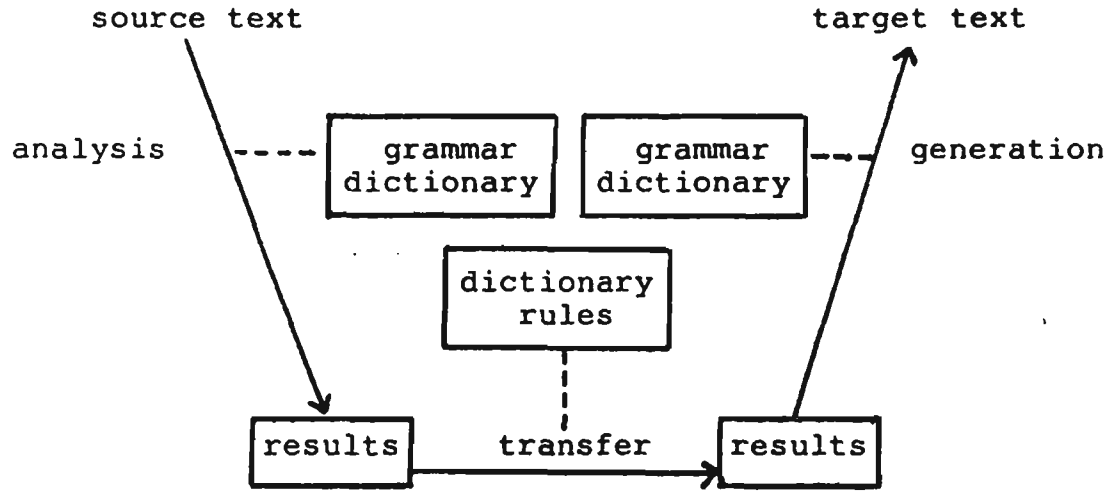


Figure 2.2: Step-by-step Transfer Method.

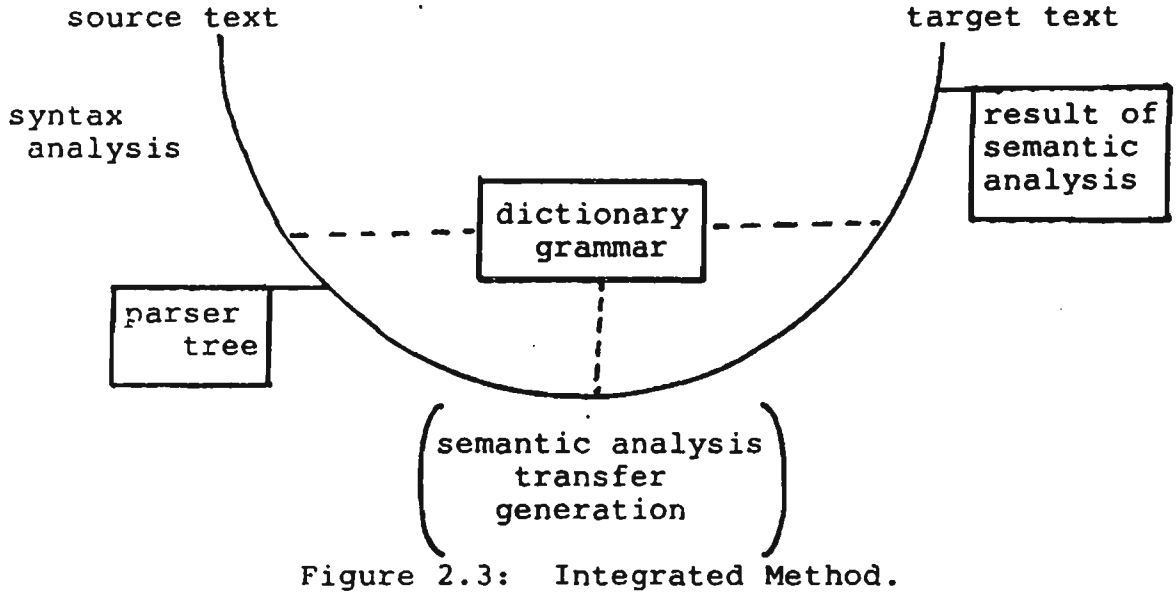


Figure 2.3: Integrated Method.

As figure 2.3 reveals, under the ordinary transfer method, diagnosis (dictionary & rule consultation) is required within each of the three steps. The Integrated Method is an attempt to eliminate such redundancy (fig. 2.3). During the process of extraction of semantic structure (after semantic analysis), transfer and generation, that is, selection of words and word-order in the target language is conducted. The system outline is as follows:

-TARGET LANGUAGE:	E-J.
-TARGET TEXT:	S & T theses.
-DICTIONARY CAPACITY:	About 200.
-SYNTAX ANALYSIS:	Extended Lingol.
-TRANSFER:	Integrated.
-PROGRAMMING LANGUAGE:	LISP

2.1(b) MPT

Two organizations under the Ministry of Posts & Telecommunications (MPT) are involved in MT. One is the Musashino Electrical Communication Laboratory (ECL) of Nippon Telegraph & Telephone Public Corporation (NTT), the domestic telephone authority. The other is the Kokusai Denshin Denwa Co., Ltd., (KDD) the international telephone authority.

A. ECL - Musashino:

At ECL R & D is centered around their MT system "LUTE" and the development of a screen editor "JMACS", in which both Japanese and English text can be displayed on the screen simultaneously. The outline of LUTE is as follows:

-TARGET LANGUAGE:	J-E, E-J.
-TARGET TEXT:	S & T commentaries.
-DICTIONARY CAPACITY:	150 - 200.
-SYNTAX ANALYSIS:	Case grammar + ATNG.
-TRANSFER:	Transfer of semantic structure.
-PROGRAMMING LANGUAGE:	MAC LISP.

B. KDD:

KDD is developing a system "KATE" whose system outline is as follows:

-TARGET LANGUAGE:	E-J.
-TARGET TEXT:	CCITT literature.
-SYNTAX ANALYSIS:	Extended Lingol + Prohibition Pattern.
-TRANSFER:	Pattern matching & production rule.
-PROGRAMMING LANGUAGE:	FRANZ LISP.

2.2 UNIVERSITIES

Many universities are involved in MT research. The three majors are listed below.

A. KYOTO UNIV.:

Professor Nagao:	J-E -- computer manuals. J-E -- titles for S&T theses. J-F -- S&T commentaries. E-J -- titles for S&T theses. (also S&T Agency Project).
Professor Doshita:	J-E -- computer manuals. E-J -- " " .

B. TOKYO INSTITUTE OF TECHNOLOGY:

Professor Tanaka: (formerly ETL)	E-J -- S&T theses.

C. KYUSHU UNIV.:

Professor Tamachi:	J-E -- weather forecasts. E-J -- " " .

2.3 THE PRIVATE SECTOR

Basically, those manufacturers heavily committed to R & D of MT systems are computer manufacturers, such as, Fujitsu, NEC, Toshiba, Hitachi, IBM Japan, Mitsubishi Electric, and Oki. Of these, Fujitsu was the first to become involved in MT and is thought to be relatively advanced. The systems of each of the manufacturers mentioned are introduced below.

A. FUJITSU:

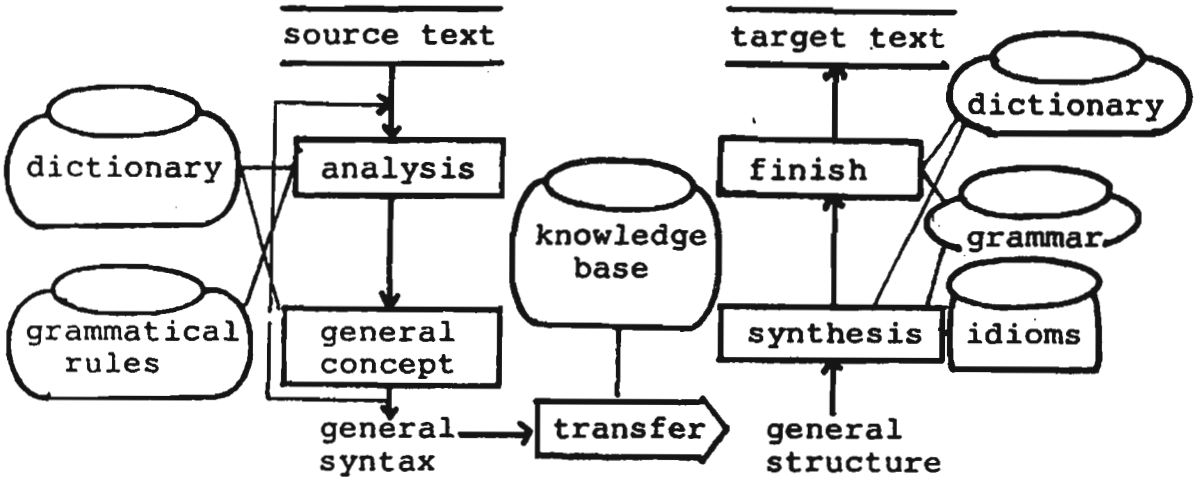
Fujitsu has two systems currently undergoing development: ATLAS/I, to be commercialized this year, and ATLAS/II. The system outline for the ATLAS/I is as follows:

-TARGET LANGUAGE:	J-E, E-J.
-TARGET TEXT:	Manuals, thesis abstracts.
-DICTIONARY CAPACITY:	Roughly 10,000.
-SYNTAX ANALYSIS:	Frame Knowledge Representation-0.
-TRANSFER:	FKR-0 based production system.
-PROGRAMMING LANGUAGE:	PL/I.

System outline for ATLAS/II:

-TARGET LANGUAGE:	J-E, E-J.
-TARGET TEXT:	Manuals.
-DICTIONARY CAPACITY:	40 - 50 thousand.
-SYNTAX ANALYSIS:	Grammatical rules for binomial coefficients.
-TRANSFER:	Syntax pattern & co-generative relationship.
-PROGRAMMING LANGUAGE:	System programming language.

System configuration of ATLAS/II:



B. NEC:

NEC also has two systems undergoing development: VENUS, which is near completion, and TRAP. The system outline for VENUS is as follows:

-TARGET LANGUAGE:	J-E.
-TARGET TEXT:	Manuals.
-DICTIONARY CAPACITY:	Several thousand.
-SYNTAX ANALYSIS:	Relational analysis based on indeterminate automaton.
-GENERATION:	Case structure.
-PROGRAMMING LANGUAGE:	SHAPE UP-PROLOG.

System outline of TRAP:

-TARGET LANGUAGE:	E-J.
-TARGET TEXT:	Manuals.
-DICTIONARY CAPACITY:	Roughly 1000.
-SYNTAX ANALYSIS:	DCG.
-TRANSFER:	Tree parser.
-PROGRAMMING LANGUAGE:	C-PROLOG.

C. **TOSHIBA:**

Toshiba's system is called TAURUS whose system outline is as follows:

-TARGET LANGUAGE:	E-J.
-TARGET TEXT:	Manuals, S&T documents.
-DICTIONARY CAPACITY:	Roughly 30,000.
-SYNTAX ANALYSIS:	ATNG.
-TRANSFER:	Relational network.
-PROGRAMMING LANGUAGE:	C.

D. **HITACHI:**

Hitachi is working on two systems: ATHENE (E-J) and NEAT (J-E). The ATHENE system outline is as follows:

-TARGET LANGUAGE:	E-J.
-TARGET TEXT:	High school English textbook, manuals.
-DICTIONARY CAPACITY:	Roughly 10,000.
-SYNTAX ANALYSIS:	Recognition of phrase & clause.
-TRANSFER:	Rearrangement of word order.
-PROGRAMMING LANGUAGE:	PL/I.

E. **IBM JAPAN:**

IBM is working on an English-to-Japanese system for translation of computer manuals and messages.

F. **MITSUBISHI ELECTRIC:**

Mitsubishi Electric is working on a Japanese-to-English system for translation of business correspondence.

G. **OKI:**

Oki is developing a Japanese-to-English system for translation of computer related materials.

SECTION THREE: THE CASE OF BRAVICE INTERNATIONAL

Weidner Communication Inc. of USA offers many MT systems involving languages such as English, Spanish, French, German, Portugese, and Arabic. In September of 1981, Weidner and Bravice International of Japan (which holds a large share of Weidner stock) began joint development for an MT system involving Japanese and English. Their original goal was to establish a system in which satisfactory results can be attained with the help of post editor who need not see the original text. The resulting systems are the BRAVICE PAK 11/73/80 and the BRAVICE PAK 11/73/40 which handle Japanese-to-English translations and were commercialized on June 1, 1984. Another system handling English-to Japanese translations is to be commercialized sometime next spring (1985). Some highlights of the above systems follow:

TARGET MARKET: Bravice claims that their MT systems can be utilized for a wide variety of translations such as, scientific documents, manuals, instructions, newspaper and magazine articles, etc., and they have set their target market as firms involved in international trade, research institutes, universities and government organizations.

SYSTEM & COST:

11/73/80	CPU basic memory 256KB serial 4-channel interface 80MB disk unit Q22 - BUS	1	
	256KB additional memory, cable	1	¥19,500
	NEC PC - 100, with CRT	2	thousand
	printer	1	
	OS=RSX-11M-PLUS (license)	1	
	RS-11M CP/M communication soft	1	
	J-E MT soft	1	
11/73/40	CPU basic memory 256KB serial 4-channel interface 40MB disk unit Q22 - BUS	1	
	256KB additional memory, cable	1	¥15,800
	NEC PC - 100, with CRT	1	thousand
	printer	1	
	OS=RSX-11M-PLUS (license)	1	
	RS-11M CP/M communication soft	1	
	J-E MT soft	1	
OPTION	magnetic tape unit with 2400 feet 800/1600B, 45/ips, 9 track		¥3,008 thousand
	controller	1	

The price for the J-E software alone is roughly ¥8 million.

ANALYSIS: Bravice claims they use an integrated syntax/semantic analysis approach.

DICTIONARY: The basic dictionary, which is included in the above system, contains 40,000 words, however, as different users have different vocabulary needs, the user is expected to input vocabulary words of their own choosing by themselves. Time required to prepare a complete dictionary is estimated to be three months.

EDIT NEEDS: Both pre- and post-edit are necessary.

SPEED: The 11/73/80 can handle 3000 words per hour excluding edit time. The 11/73/40 can handle 2000 words per hour.

TRAINING: Training is free of charge and requires the operator to take one week of lessons at Bravice International. Another three weeks of "hands-on" experience is required for the operator to become sufficiently skilled. However, as mentioned above, the building of a suitable dictionary can take three months.

SALES: As this is not only a new product for Bravice but for Japan as a whole, sales is slow. Bravice claims they have sold "several" of the 11/73/80 systems since commercialization in June and that many firms have shown interest in their product.

SECTION FOUR: POTENTIAL & TOPICS FOR THE FUTURE

4.1 SIZE OF TRANSLATION MARKET IN JAPAN

In 1982, the Japan Electronic Industry Development Association conducted a survey in an attempt to estimate the size and characteristics of the translation market existing in Japan. This study estimates that the translation market is worth ¥500 billion and is doubling every two years. Below are some breakdowns of the samples (questionnaires to firms) taken.

Figure 2.4. Volume of Translations by Language.

	PAGES	%
Japanese-English	725,420	62.07
English-Japanese	316,650	26.67
Japanese-Chinese	11,400	1.03
Chinese-Japanese	9,630	0.87
Japanese-Spanish	5,790	0.52
Spanish-Japanese	2,050	0.19
Japanese-French	16,730	1.51
French-Japanese	7,760	0.70
Russian-Japanese	5,790	0.52
Other	62,415	6.09
TOTAL	1,168,635	100.00

Figure 2.5. Translation Volume by Document.

	PAGES	%
Manual/catalogue/technical lit.	682,330	56
Contracts	107,722	9
Theses	127,600	10
Letters	152,193	13
Patents	69,150	6
Other	71,385	6

The size and therefore, importance of the translation market is significant and growing rapidly in parallel with the world economic integration process. Thus, the introduction of MT systems is desirable and would have important implications. Another factor evident in this study is that an overwhelming majority of the translations involve English and Japanese and that over half of these translations are that of manuals, catalogues, and technical literature. This is why practically all systems of private enterprizes in Japan are targetted toward translating manuals from Japanese to English and vice versa.

4.2 TOPICS FOR THE FUTURE

The final target of MT research is to develop a system in which man need not interfere. In order to reach this goal, simulation of manual translation becomes necessary. In manual translation, the translator focuses on translating the theme (contextual level) or meaning (semantic level), and tends to disregard syntax. The MT systems under development today take a syntactical approach. In order to raise MT technology to a contextual level, syntactic and semantic analysis technology must be established. This entails incorporating natural language processing technology as well as artificial intelligence technology in general. Thus, the short term topic for the future is to refine syntactical analysis and to further develop semantic analysis in order to pave the way for R & D for contextual analysis.

PART III: VOICE TECHNOLOGY

INTRODUCTION

Products of both the voice recognition (VR) and voice synthesis (VS) type have been on the Japanese market since the late 1970's, however, much was left to be desired both in terms of cost and performance. Recently, however, as the prices of these products are rapidly declining while performance quality is improving, more customers are showing interest. But, nevertheless, actual sales is still quite low and it can be said that the market is still in a pioneering stage. Problems in cost, performance, and particularly applications technology remain today.

Section 1 will present an overview of voice technology: goals and achievements thus far. Section 2 will introduce Japan's most active researchers of voice technology. Sections 3 & 4 will introduce some typical Japanese products and applications. Section 5: Conclusion.

SECTION ONE: OVERVIEW OF VOICE TECHNOLOGY

1.1 VOICE RECOGNITION TECHNOLOGY

Figure 3.1 below presents a classification of voice recognition (VR) technologies with varying levels of sophistication.

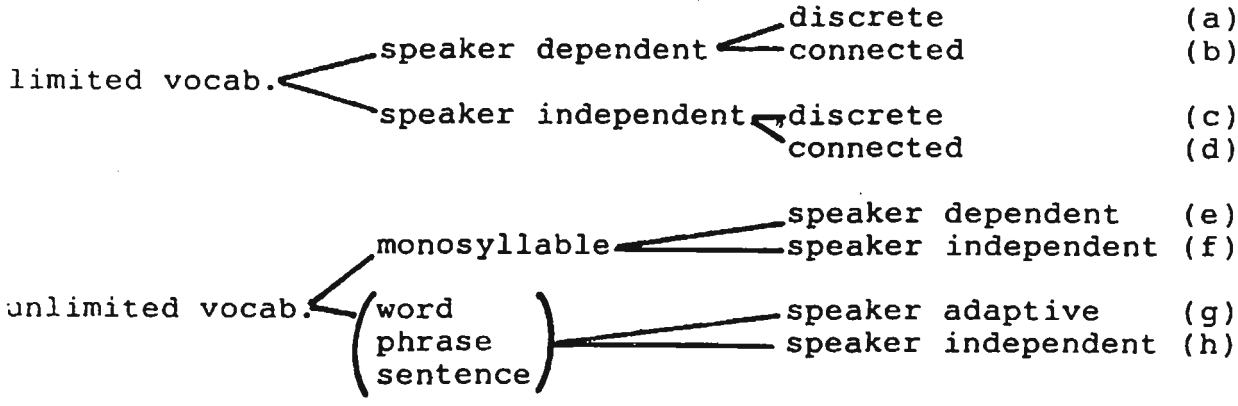


Figure 3.1. Classification of VR Technology.

The final target of VR research is to enable a machine to recognize and understand ordinary convesation regardless of speaker (h), and this target is far from being attained at present. For levels (a) through (d) above, recognition is conducted on a word basis and the number of words recognizable is limited. Tasks at these levels can generally be conquered by utilizing DP matching technology for discrete, (a) & (c), and two-level DP matching technology for connected, (b) & (d); thus, although much R & D is still being devoted to these levels, technology is relatively established and is reaching its limit at roughly 300 words, discrete, speaker dependent. On the "unlimited vocabulary" side, (e) through (h), the situation is quite different. Apart from (e), current levels of technology cannot accommodate. In order to achieve these levels, natural language understanding and processing technologies (syntax, semantic, context--artificial intelligence) become necessary. As to level (e), as there are a total of only 100 syllables (68 basic) in the Japanese language, VR is possible provided it is on a discrete and speaker dependent basis.

1.2 OVERVIEW OF VOICE SYNTHESIS TECHNOLOGY

Figure 3.2 below is a presentation of voice synthesis technology (VS) classified according to general approach.

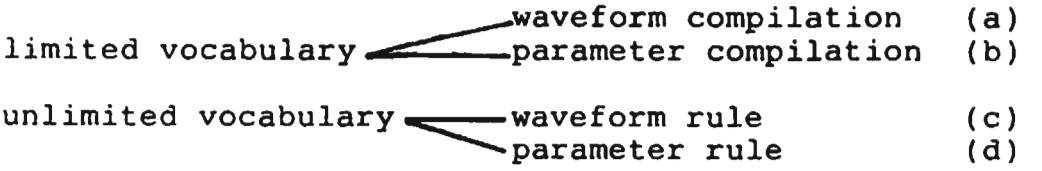


Figure 3.2. Classification of VS Technology.

Unlimited vocabulary text-to-speech systems, (c) & (d), are one of the primary targets of VS research and although much is still left to be desired, some systems are already available. With levels (a) & (b), synthesis data is stored on a word (or phrase) basis and technology is relatively established. Level (a), which involves technologies such as PCM, ADPCM, ADM, etc., is best in terms of intelligibility but also requires the most data. (b), on the other hand, utilizes compressed data using technologies such as LPC, PARCOR, FORMANT, LSP, etc., meaning memory requirement is smaller although intelligibility is reduced. Taking cost/performance into consideration, (b)-type products presently outnumber (a), however, as the cost of memory units are falling rapidly, (a) might become interesting in the future. In the case of rule synthesis, (c) & (d), methods such as, CV, CV-CVC, VCV, PARCOR-VCV, LSP-VCV, etc., are utilized and much of the current R & D is centered here though speech quality is still poor. In comparing (c) & (d), (c) has superior intelligibility but pitch control is more difficult.

SECTION TWO: VOICE TECHNOLOGY: R & D IN JAPAN

Japanese R & D pertaining to voice is very advanced. Some key dates (very rough estimates) related to Japanese voice technology are presented below, followed by highlights of the major research institutes at the government (2.1) and private (2.2) levels.

VOICE RECOGNITION:

'70	DP matching	NEC
'74	continuous word	NEC, ECL
'79	speaker independent	NEC, ECL, Fujitsu, Kyoto Univ.
'80	syllable	Hokkaido Univ., Fujitsu, NEC, ECL, Toshiba, Hitachi

VOICE SYNTHESIS:

'65	VCV	ECL
'69	PARCOR	ECL
'74	PARCOR-VCV	ECL
'75	Line-Spectrum	ECL
'79	LSP	ECL
'81	LSP-CV	ECL
'82	LSP-VCV	ECL

2.1 GOVERNMENT

Both the Ministry of International Trade & Industry (MITI) and the Ministry of Posts & Telecommunications (MPT) are heavily involved in voice research.

2.1(a) MITI

Two research institutes under the authority of MITI are especially worth mention: (A) Electro Technical Laboratory (ETL), and (B) Institute for New Generation Computer Technology (ICOT).

A. ETL:

ETL is the largest national research institute regarding electricity/electronics in Japan. They are noteworthy for

they have over 20 years of experience in dealing with voice technology and because they took leadership in the large-scale project "Pattern Information Processing System" (PIPS) in which voice technology was one of the sub-topics. PIPS was carried out from FY 1971 - 1980 and the total budget was ¥22 billion, of which roughly ¥450 million was allocated to voice research. The ETL approach to voice technology was voice analysis via vocal tract shape analysis. Today's voice topics are voice rule synthesis (improving naturalness), syllable recognition by spectral approach, voice data base, and antimetrical vocal tract shapes. The ETL researcher interviewed claims that they have achieved good results as to interspeaker variation and coarticulation with the antimetrical approach and that this approach appears very promising.

B. ICOT:

The ICOT (Fifth Generation Computer) Project is a ten year project which began in 1982. This group consists of 40 - 50 researchers from ETL, ECL, Fujitsu, NEC, Toshiba, Hitachi, Mitsubishi Electric, Oki, Sharp, and Matsushita and the project is divided into an initial (3 yrs), intermediate (4 yrs), and final (3 yrs) phase.

The central theme of this project is artificial intelligence with man-machine interface tools such as, voice technology, as a sub-topic. ICOT is scheduled to begin research on voice related applications in the intermediate phase (FY 1985 - 1988), however, specific topics and approach are yet to be determined. In any case, it can be anticipated that ICOT will serve as a merging ground for natural language processing technologies (syntax, semantic, context, etc.) and the more traditional approaches to voice.

2.1(b) MPT

The most active research institute under MPT is the Electrical Communication Laboratory (ECL), NTT. As can be seen from the chronological presentation of VR and VS technologies given at the beginning of this section, ECL has been very active in developing technologies ranging from VCV and PARCOR to LSP and LSP-VCV. Using these technologies, NTT is providing a variety of services primarily over the telephone network (see "applications" section 4).

2.2 PRIVATE

Various manufacturers such as, NEC, Matsushita, Fujitsu, Toshiba, Hitachi, Oki, Mitsubishi Electric, Sanyo, Sharp, etc., are involved in voice related R & D, with generally more emphasis on development than basic research. It is very difficult to compare the levels of technologies each of these

companies have for final products are similar, however, if forced to choose, NEC would be the ultimate choice for they were the first to become involved in voice.

A. NEC:

NEC became involved in voice R & D at a very early stage even before the government research institutes were well on their way. Thus, as NEC had no forerunner to learn from, they were forced to do some research at a very basic level. As has been mentioned above, NEC developed DP matching around 1970 and has since developed two-level DP matching, compressed DP matching, and more recently, clockwise DP matching.

SECTION THREE: INTRODUCTION OF SOME JAPANESE PRODUCTS

Currently, there are a great number of voice related products available on the market, however, the Japanese market is still in a pioneering stage and therefore, actual sales is still small. Although many clients are interested, they lack knowledge on how to use the technology, thus, the manufacturers must first persuade them of its advantages and then teach them how to use it (applications assistance). The products introduced below are primarily NEC products for time restrictions do not allow for wide coverage--manufacturers and products in Japan are too numerous. Catalogues for most of these products are included in appendix 5 along with other reference materials.

A. VR: LSI.

VR LSI's have been on the market since the latter part of 1981, however, it is only recently that actual sales has begun to expand. Prices are falling at an annual pace of 20 to 30% and, within one or two years, it is anticipated that the price of a 3-chip set such as the one described below, will fall below the ¥10,000 mark.

In 1982, NEC introduced an LSI chip set consisting of the MC4760, a speech waveform digitizer, the uPD7761, speech analysis/compressed DP matching processor, and the uPD7762, system control processor. Classification: limited vocabulary, speaker dependent, discrete. Can recognize 128 words with external 16Kb RAM, 512 words with 64Kb RAM. Response time is 0.5 seconds and accuracy is over 98%.

More recently, NEC introduced the uPD7764 which can operate under the following two classifications: (a) limited vocabulary, speaker dependent, discrete = 340 words, and (b) limited word, speaker dependent, connected = 40 words.

B. VR: BOARD.

Many VR boards are available on the market now. Prices range from ¥60,000 to ¥250,000 and number of recognizable words range from 60 to over 200. All of these products utilize DP matching based technology. NEC's PC-8012-03 is an optional voice input board for NEC's personal computers PC-8001 and PC-8800. Classification: limited vocabulary, speaker dependent, discrete, recognizes 60 words, uses compressed DP matching and costs approximately ¥60,000. Three of Sanyo Electric's representative systems are the SRB-64A, the SRB-S, and the MSR-10V. Classification of SRB-64A: limited vocabulary, speaker dependent, high speed discrete (almost connected), 64 words recognizable, costs ¥125,000. Classification of the SRB-S: limited vocabulary, speaker dependent, discrete, 46 words recognizable, costs ¥59,000. Classification of the MSR-10V: unlimited vocabulary

(monosyllable), speaker dependent, discrete, recognition of 68 monosyllables + 20 words--an option to Sanyo's MSX personal computer.

C. VR: TERMINAL.

Several voice input and voice input/output terminals of NEC and Fujitsu are introduced below.

NEC SR-100: A voice input terminal. Classification: limited vocabulary, speaker dependent, high speed discrete, expansion DP matching method, 120 words recognizable, 99% accuracy, costs ¥490,000.

NEC SR-200: Voice input terminal. Classification: both limited and unlimited vocabulary, speaker dependent, discrete, DP matching based method, 68 syllables and 50 words recognizable, 95% syllable and 99% word accuracy.

NEC DP-200: Voice input terminal. Classification: limited vocabulary, speaker dependent, both discrete and connected, two-level DP matching method, recognizes 100 or 450 (option) words discrete and 50 words connected (maximum of five connected words at a time), costs ¥4,900,000.

NEC DP-300: Voice input/output terminal consisting of VRU (recognition) and ARU (synthesis). VRU classification: limited word, speaker dependent, both high speed discrete and connected, recognizes maximum of 450 words discrete and 50 words connected. ARU classification: limited vocabulary, waveform compilation (ADPCM), maximum voice output duration is 175 seconds. This terminal is equipped with wireless system.

Fujitsu FACOM2371A: I/O terminal for Fujitsu computer. Input classification: limited vocabulary, speaker dependent, discrete, 256 words recognizable. Output classification: limited vocabulary, parameter compilation (PARCOR), maximum voice output duration is 300 seconds. Total system cost is ¥1,300,000.

NEC VWP-103N Model-2: Japanese language voice word processor--speech-to-text. Classification: unlimited vocabulary (syllable), speaker dependent, high speed discrete, DP matching based method, costs ¥2,346,000 including display, printer, and floppy. (NOTE: Japanese language word processors are relatively sophisticated for most syllables must be converted to the appropriate ideographic character of which there are many thousands to choose from).

NEC SR-1000 SERIES: Voice response systems primarily for telephone line use. NEC offers three models. SR-1101: limited vocabulary, speaker independent, discrete, four words recognizable, modified pattern matching method, 64 channels

available (extension is possible), costs ¥4,000,000. SR-1201: limited vocabulary, speaker independent, discrete, 16 words recognizable, classification function method, 64 channels, costs ¥5,000,000. SR-1301: limited vocabulary, speaker independent, discrete, 128 words recognizable, modified classification function method, 32 channels, costs ¥15,000,000. Demand for these types of systems is primarily in the banking sector. In the case of NEC, the SR-1201 is most popular for the SR-1301 is too expensive.

D. VS: LSI.

In the case of VS LSI, competition is fierce and better balanced. Below are highlights of some LSI's available on the Japanese market today. Generally speaking, the products of the more prominent manufacturers fall in one of two categories. Firms such as Hitachi, Mitsubishi Electric, Sanyo Electric, Matsushita Electronics, Toshiba, and Fujitsu favor parameter compilation technologies (primarily PARCOR). Oki clearly favors waveform compilation (ADPCM). NEC on the other hand, offers chips using formant, ADPCM, and phoneme particle methods. Sales of VS LSI's for 1983 is estimated to be somewhere between 1 - 2 million pieces. Prices range from ¥500 to ¥1000, one-half to one-third the price of the first VS LSI's.

HITACHI HD61885:

METHOD:	PARCOR.
DATA RATE (bps):	2.5/5.0/9.9.
FRAME SIZE (ms):	10/20.
BITS/FRAME:	50/99.
STANDARD FREQUENCY:	10 kHz.
VOCABULARY SIZE:	63.
DEVICE TECHNOLOGY:	CMOS.

MITSUBISHI ELECTRIC M50800:

METHOD:	PARCOR.
DATA RATE:	2.65 - 7.1.
FRAME SIZE:	7.5/10/15/20.
BITS/FRAME:	53 (including repeat bits).
STANDARD FREQUENCY:	8 - 10.
VOCABULARY SIZE:	64.
DEVICE TECHNOLOGY:	CMOS.

SANYO ELECTRIC VLM5030:

METHOD:	PARCOR.
DATA RATE:	2.4/4.8/9.6.
FRAME SIZE:	10/20.
BITS/FRAME:	48 (repeat included).
STANDARD FREQUENCY:	8.
VOCABULARY SIZE:	256.
DEVICE TECHNOLOGY:	nMOS.

MATSUSHITA ELECTRONICS MN6401:

METHOD:	PARCOR.
DATA RATE:	1.2 - 5.5.
FRAME SIZE:	10/20.
BITS/FRAME:	43 - 55 (repeat included).
STANDARD FREQUENCY:	10.
VOCABULARY SIZE:	63.
DEVICE TECHNOLOGY:	nMOS.

TOSHIBA T6803:

METHOD:	PARCOR.
DATA RATE:	2.5 - 9.6.
FRAME SIZE:	10/20.
BITS/FRAME:	50/56/98.
STANDARD FREQUENCY:	10.
VOCABULARY SIZE:	63.
DEVICE TECHNOLOGY:	CMOS.

NEC uPD7752:

METHOD:	FORMANT.
DATA RATE:	1.5 - 5.6.
FRAME SIZE:	10/20.
BITS/FRAME:	-
STANDARD FREQUENCY:	9.5 - 10.5.
VOCABULARY SIZE:	63.
DEVICE TECHNOLOGY:	CMOS.

OKI MSM6212:

METHOD:	ADPCM.
DATA RATE:	7 - 24.6.
NO. OF BITS ENCODED:	3.
STANDARD FREQUENCY:	5.5/8.2.
VOCABULARY SIZE:	124.
DEVICE TECHNOLOGY:	CMOS.

NEC uPD7751C

METHOD:	ADPCM.
DATA RATE:	14 - 24.
BITS ENCODED:	4.
STANDARD FREQUENCY:	4/5/6.
VOCABULARY SIZE:	8.
DEVICE TECHNOLOGY:	nMOS.

SHARP LR3681:

METHOD:	Phoneme Particle.
DATA RATE:	1.6 - 3.2.
BITS ENCODED:	-
VOCABULARY SIZE:	256.
DEVICE TECHNOLOGY:	CMOS.

NEC uPD1771:

METHOD:	Phoneme Particle.
DATA RATE:	-
BITS ENCODED:	0.2 - 0.4 bits/particle.
VOCABULARY SIZE:	-
DEVICE TECHNOLOGY:	nMOS.

E. **VS: OUTPUT TERMINAL.**

Again many manufacturers offer such systems. Catalogues for NEC AR-100 and Sanyo's SSP-2 are included in appendix 5.

SECTION FOUR: APPLICATIONS

4.1 THE PROS AND CONS OF VOICE TECHNOLOGY

ADVANTAGES OF VR/VS:
- -hand/eye freedom (gloved/oily hand, handicapped)
- -distance factor (telephone, wireless)
- -smoother interface (easier, more natural)
- -faster (especially for novice)
- -operator mobility (wireless)
- -handicapped persons

DISADVANTAGES OF VR/VS:
- -cost
- -no record
- -experience (very few have used in the past)
- -pronunciation (dialects, foreigner, age, sex)
- -currently not natural (limited vocab., discrete)
- -environmental conditions (noise, circuit condition)

4.2 POTENTIAL APPLICATION AREAS

WORKPLACE CONTROLS:
- -parcel/product sorting
- -robot/equipment control
- -automatic warehouse control
- -aircraft, ship, etc., controls
- -traffic control (airport, rail, etc.)

WORKPLACE INPUT:
- -test data (QC)
- -production data
- -inventory data
- -POS data
- -electricity/gas/water data

TELEPHONE--PUBLIC USE:
- -stock information
- -banking "
- -reservations
- -order entry

TELEPHONE--INTERNAL USE:
- -inventory info. etc., as aid to salesmen, etc.

PERSONAL & OFFICE COMPUTER:
- -programming
- -commands
- -data entry
- -language entry
- -games
- -interpretation

OFFICE APPLICATIONS:
-data entry
-language entry
-information retrieval

HOME APPLICATIONS:
-switch (lights, TV, etc.) controls
-responsive home appliances
-toys
-automobiles

HANDICAPPED:
-wheel chair controls
-speech-to-text
-text-to-speech

4.3 EXAMPLES OF ACTUAL APPLICATIONS

WORKPLACE CONTROL:
-voice control of ship main engine *
-parcel sorting **
-book sorting *
-QC at steel plant **
-floor guide in department store elevator

*denotes reference available in appendix 6 in English.
** " " in Japanese.

§TYPICAL CASE OF PRODUCTION & QUALITY CONTROL:
MAN : INPUT.
MACH : TEST RESULT?
MAN : FAIL.
MACH : DAMAGE TYPE?
MAN : CRACK.
MACH : DESTINATION?
MAN : A-12. . .

WORKPLACE INPUT:
-meat auction entry *
-inventory input/control

§TYPICAL CASE OF INVENTORY CONTROL:
MAN : INPUT.
MACH : PRODUCT NUMBER?
MAN : PA23.
MACH : PA23?
MAN : O.K.
MACH : INSTRUCT STORAGE POSITION.
MAN : V-12-a. . .

TELEPHONE APPLICATIONS:
-banking information *
-seat reservation system for railway

OFFICE APPLICATIONS:
- -fax, copier instructions
- -data/language input
- -word processor/personal computer--speech-to-text

HOME APPLICATIONS:
- -abacus instructor (Hitachi)
- -multiplication instructor (Matsushita, '80, ¥15,800)
- -calculator (Sharp, etc.)
- -pocket Japanese-to-English dictionary (Sharp)
- -talking toy block (Matsushita)
- -electronic "go" game (Matsushita, '81, ¥198,000)
- -microwave oven w/ alarm & instructions (Matsushita, '81, ¥169,800)
- -talking watch
- -automobile alarm (door, lights, seatbelt)
- -camera

SECTION FIVE: CONCLUSION

Although voice technology has come a long way, the final target is still distant. The final target of voice recognition technology is to enable a machine to recognize and understand ordinary conversation regardless of speaker, and that of voice synthesis technology is to enable a machine to respond to man in ordinary conversational language. These goals are still far from being attained and are primary topics of future R & D. The key element missing in voice technology today is natural language understanding and processing technology which is also being studied rigorously in other fields. As stated in section 2, ICOT is likely merging ground for various technologies hitherto diverse and thus, is likely to set the base for future voice technology.

PART IV: CAPTAIN

INTRODUCTION

After many years of extensive testing, the Japanese videotext text system, more often referred to here as the CAPTAIN (Character And Pattern Telephone Access Information Network) will begin commercialization beginning in November, 1984. Many factors make the CAPTAIN system a very interesting case study for the future. Although there are many other videotex systems in experimentation and limited regional or local operation that may be of a higher technical sophistication, the CAPTAIN system is probably the most technically sophisticated videotex system available on an national scale today, with its presentation level protocol syntax (PLPS) being proposed as an regional international standard to the CCITT.

Although there are several videotex systems already in commercial operation today, not many of the systems are financially successful to this date, regardless of its technical sophistication and feasibility. There are many factors behind this phenomena. The CAPTAIN system, however, is expected to be one of the first commercially successful and financially self-supportive videotex services made available on a nation scale. Much of this optimism is attributed to the enthusiasm of the Japanese consumer alone. However, some unique features and functions have been incorporated into the system making commercial success a little bit easier to achieve.

The following report will discuss and highlight some key features that make this system so interesting. Furtheremore, future prospects and potential as envisioned by the various parties concerned will be presented. Presentation of the system itself and its services have been made available courtesy of NTT and has been included in appendix 7-2, together with catalogs and pamphlets. For details concerning the actual presentation level protocol syntax, please refer to the actual manual presented to the CCITT that is also included in the appendix (7-4).

SECTION ONE: VIDEOTEX PROTOCOLS AND CAPTAIN

1.1 VIDEOTEX PROTOCOLS

Many videotex systems are presently operating in different parts of the world. Although all of the systems have been proven technically feasible, actual market penetration in terms of financial independence and self-reliancy is still a major problem. This can be seen in the failure of private commercial videotex services in such areas as Florida, and also in the general lack of public intrest with Prestel in England and Telidon in Toronto.

Most of the European videotex systems based on the CEPT protocol are operated and supported, at least in part, by their respective jurisidictive ministries, agencies, and offices, most frequently the respective post and telecommunications authorities of that country. Likewise, the Japanese CAPTAIN system will initially be supported by the Nippon Telegraph and Telephone Public Corp. (NTT), although the service is expected to be self-supporting from the initial start-off. One interesting factor is that the NTT will become a private industry from 1985, which will in turn completely turn the operation of the CAPTAIN system into a commercial endeavor. It is expected that CAPTAIN will achieve financial self-reliance from a relatively early stage.

There are many factors that contribute to this optimism. Much of the optimism is attributed to the enthusiasm of the Japanese public. For one, the Japanese are quick to jump to new media forms such as demonstrated by the TV, color TV, and the penetration of the home video player. Another major factor is the enormous orchestration that can be expected by the various hardware vendors and Information Providers (IP) to promote the system. There will be a very aggressive and joint effort from all parties concerned, not to mention the enormous efforts put into the project by the NTT in order to promote value added services and pave the way for INS in the future. The hardware vendors see the CAPTAIN as a follow up product to the home video system

which will be approaching market maturity in a few years. In this sense, they are extremely aggressive towards the promotion of the system.

Furthermore, several unique services and functions make the CAPTAIN system slighly more advantageous in achieving its financial self-reliance from a very early stage.

Many different estimates have been stated by various groups conerning the penetration of the CAPTAIN system. It is rather clear that each of the various estimates given by the different parties concerned reflect their minimum requirements to make this system profitable to their ends.

Among the various videotex systems in operation today on a national or regional level, three other major protocols exist, and have been presented to the CCITT for international standardization. They are:

NAPLPS	North American Presentation Level Protocol Syntax. Represented by the TELIDON service in Canada.
CEPT	Conference of European Posts & Telecommunications. Represented by the PRESTEL system in operation in England, West Germany and other European countries excluding France.
ANTIOPE	An original system proposed by France which is incorporated into their electronic telephone directory system.

Many other systems exist or are in consideration today, especially in the United States. The major networks and computer companies have developed their own protocols, and have not yet agreed to standardize the various systems into a unified national system. However, most of the major videotext systems in operation or consideration today in North America will be made compatible with the NAPLPS proposed by ATT. It would, therefore, be relatively correct to represent the North Americas with the NAPLPS at this present stage. (refer fig. 4-1)

FIG. 4-1 FEATURES OF MAJOR VIDEOTEX SYSTEMS IN OPERATION

	CAPTAIN PLPS	NAPLPS	CEPT PLPS
Display Method	Hybrid	Code	Code
Protocols	Alpha-photographic	Alpha-geometric	Alpha-mosaic
Character, symbol display functions	Alphanumerics, symbols, KANA, KANJI	Alphanumerics, symbols	Alphanumerics, symbols
Graphic functions			
- photographic	Possible	None	Possible for natural pictures only. (requires 64 kb transmission speed)
- geometric	Possible (NAPLPS equivalent)	Possible	Possible (CEPT original)
- mosaic	Possible (CEPT standard and original CAPTAIN mosaic)	Possible (limited CEPT standard mosaic functions)	CEPT mosaic
- DRCS*	Possible (CAPTAIN original)	Possible (NAPLPS original)	Possible (CEPT original)
Compelementary functions			
- meleody	Possible	Not possible	Not possible
- MPI**	Possible	Not possible	Not possible
Coloring	Block and dot based	Dot based	Block and dot based
Hard copy	Possible	Difficult	Possible
Character display	Standard: 15 x 8 (KANJI) (H x V) 31 x 16 (Alphanumerics) Maximum: 31 x 16 62 x 32	Standard: 40 x 20	Standard: 40 x 24
Data transmission	4800 bps from center 780 bps to center	1200 bps from center 75/150 bps to center	1200 bps from center 75 bps to center
Information input (frame composition)	Simplified (auto via camera, fax)	Auto input difficult	Auto input difficult

* DRCS: Dynamically Redefinable Character Set
** MPI : Moving Picture Instruction (achieves elementary picture movement)

FIG. 4-2 EXPERIMENTAL CAPTAIN SYSTEMS

	Phase I	Phase II'	Phase II''
Period	79-12-25 - 81-03-15	81-08-1 - 82-12	- 84-07-15
Area	Tokyo Metropolitan	as left	as left
Monitors [1]	1,000	2,000	as left
No. of IPs	199	221	320
Frames[2]	100,000	200,000	Fluctuating
Main Services	Information retrival	Information retrival Order entry* CUG**	
Information Input	From CAPTAIN Center - tablet input - facsimile	From CAPTAIN Center - as left plus camera, keyboard From External Computers Direct from IP input terminals - from user terminals with keyboard	
Terminal	Numeric input from user keypad	As left plus KANA input, hardcopy output	as left
Information Search	- Retrival from list of contents - Direct retrival from display frame via code	As left plus KANA and alphanumeric operation	as left

[1] Number of user terminals

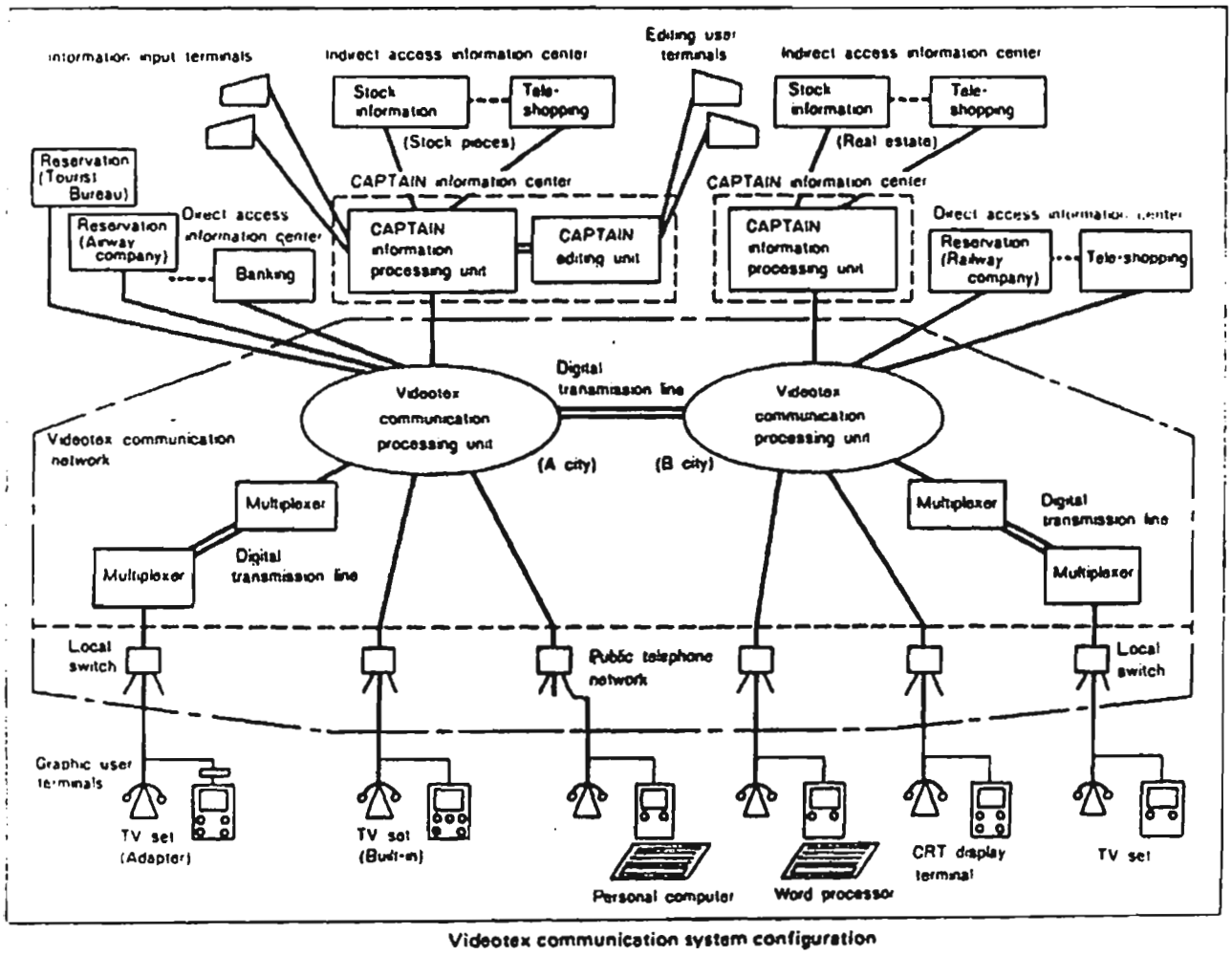
[2] Number of information frames made available to users

* Reservations and order entry from user terminals

**Closed User Group service

Table 1. Fields Expected to Be Provided from Information Centers

Field	Company	Service Provided	User	Purposes of Using/ Providing Service
1 Banks	•City Banks •Local Banks •Mutual Financing Banks •Credit Guilds •Credit Unions	Information on: •Balance •Money received •Automatic payments •Unregistered accounts •Remittance Calculation of various loans	•Business/ Home	•Convenience •To cultivate new depositors •Improve service
2 Seat Reservations	•Air Transportation •Railroad Transportation	•Seat Reservation •Vacancy Information •Timetable Information	•Business/ Home	•Convenience •Promptness •Increase sales
3 Accommodation Reservations	•Travel Agents •Hotel Association •Private Lodging Association	•Accommodation Reservations •Vacancy Information	•Home	•Convenience •Promptness •Increase sales
4 Stock Market	•Stock Information Associations	•Stock Information	•Business/ Home	•Promptness
5 Insurance	•Life Insurance •Non-life Insurance	Information on: •Insurance Business •Insurance Contracts •Claim for Premiums	•Business/ Home	•Convenience •Sales Improvement
6 Credit Cards	•Credit Companies •Department Stores	•Details of purchased Goods •Subscriptions for Cards and Loans •Balance Sheet of Credit Accounts	•Home	•Convenience •Sales Improvement
7 Exchange Rate	•Banks	•Exchange Rate Information	•Business	•Promptness
8 Mail-order	•Department Stores •Supermarkets •Publishers	•Home Shopping	•Home	•Sales Improvement •Sales Routes Expansion
9 Distribution	•Wholesalers, •Retail Stores •Chain Stores •Parent Companies and Subcontractors	•Store Management •Orders for Parts •Notice of Sales	•Business	•Sales Rationalization •Sales Routes Expansion
10 Real Estate	•Real Estate Dealers •Trust Banks	•Real Estate Information	•Business/ Home	•Promptness •Convenience
11 Education	•Publishers	•Entrance Exams Information •Guide to Schools of One's Choice •Education Information	•Business/ Home	•Consultation for Entrance Exams •Personal Education
12 Horse Racing	•Horse Racing Association	•Ticket Sales •Odds Information	•Home	•Convenience •Sales Improvement
13 Specialized Information	•Data Base Centers	•Retrieval of Judicial Precedents •Bibliographic Data Retrieval •Pharmaceutical Products Data Retrieval •Article Retrieval	•Business	•Convenience •Joint Usage
14 Calculation	•Calculation Center	•Calculation Service •Tele-Software	•Business/ Home	•Convenience •Leisure Provision



Videotex communication system configuration

Of the major national-level systems in operation today, the Japanese CAPTAIN is technically and practically most interesting due its protocol being a hybrid system, incorporating feature characteristics from both the NAPLPS and CEPT systems into its own protocol syntax.

1.2 EXPERIMENTAL CAPTAIN

Commercial CAPTAIN will come into full fledged operation within a limited geographical area beginning in November, 1984. Prior to this stage, there have have been 3 experimental stages in which the the system was studied in great detail for both ease of use and types of services to be provided.

As it can be seen in fig. 4-2, the initial phase of the experiment took place during December, 1979, to March 15, 1981, with 1,000 households and businesses, most frequently IPs themselves in the Tokyo metropolitan areas, acting as monitors and 199 Information Providers (IPs). During this phase, only information search and retrival services were provided.

Phase 2 began on August 1 of the same year and lasted until December, 1982. Although geographically limited to the same Tokyo metropolitan area, the number of monitors were increased to 2,000. The services provided were also expanded to include order entry, Closed User Group (CUG) services and the original information search and retrival. The number of IPs were also expanded to a total of 221.

Phase 3, or more correctly, an extention of Phase 2 began shortly after with the same number of monitors in the same geographic area and the same type of services but with an increased number of IPs. This final phase was terminated on July 15, 1984, with roughly 320 IPs.

As it can also be seen from fig. 4-2, the number of information frames provided has also steadily been increased. Furthermore, information input systems have also been modified and expanded, making it more easier for the information providers to input information and service data into the CAPTAIN system. (refer fig. 4-3)

SECTION TWO: COMMERCIAL CAPTAIN

The CAPTAIN system that will become commercialized in November will be slightly different from the experimental systems that have been in operation. First of all, the presentation level protocol syntax (PLPS) will be a hybrid system rather than the original dot pattern transmission only. With the new protocol, characters (Kanji: ideographic characters, Kana: phonetic alphabet consisting of 41 characters supplementing the Kanji) and alphanumerics will be transmitted in code and the various graphics will be transmitted in dot pattern form. Furthermore, the new CAPTAIN PLPS takes in several key features of other videotex protocols allowing it to form textual frames faster and have very high graphic capabilities. (refer appendix 7-2, 7-4 for complete description of the CAPTAIN PLPS).

Some interesting applications and features of the New CAPTAIN System:

One function unique to the CAPTAIN system is the possibility to synthesize melodies through the use of a tone generator or synthesizer. No other videotex system in the world today have the capacity to provide this service. There are many potential applications to this function, such as providing music to enhance presentations of the various vendors, and as elementary music instruction for children and adults alike with melodies provided along with the notes illustrated on the screen.

Furthermore, the new system can display a frame in about 1 second (originally 8 - 10 seconds), construct a frame 4 times denser than the test system depending on what type of user terminal is being used (high density display), can therefore display 4 frames at the same time on one screen, allowing much more information on one screen, or one frrame need only to be 1/4 of a complete intended display.

Also since a higher density picture can be achieved, more detailed graphic descriptions (product illustrations, drawings, illustrated process and methods instruction, etc.) has been made possible.

Another main feature and application is the Closed User Group Service (CUG). This allows an IP to create a type of local area network, limiting the access to certain information to a specified group of user terminals only. Since there are no networking costs (the CAPTAIN system becomes the network line) other than the cost of the user terminal and other hardware (printer, input terminal if desired, etc.), and the minimum charges of becomming an IP, it probably is the cheapest way to construct an information network of any scale today, local or not, since the price for using the network is ¥30 per 3 minutes, regardless of the location or area of the user (services initially limited to Tokyo, Osaka, Kyoto, Kobe and Nagoya areas). The cost for using the service is fixed, regardless of the distance inbetween. Therefore access from Nagoya to Tokyo is ¥30 per 3 minutes, and access within Tokyo is also ¥30 per 3 minutes, and a 4 minute access is ¥60 due to 3 minutes being minimum unit. Probable application procedure would be that the head office becomes an IP, and their branches will become the users. If the head office is already an IP to start with, then they can present services to the general public and at the same time construct a network for a minimal of cost.

Naturally the CUG service can be utilized as a subscriber system in which subscribers must belong to a certain group or must pay subscription fees independently of the CAPTAIN system to the IP.

SECTION THREE: INFORMATION PROVIDERS (IPs)

As of July 15, 1984 when the final phase of the experimental CAPTAIN system was terminated, there were roughly 320 IPs. Most of the IPs provided information and services pertinent to their field of activity. (refer appendix 7-2, for types of services provided). Although the CAPTAIN system is by definition, an information access system, IPs should not expect to recover cost for participating in the system through the sales of information alone. Rather, the system should be considered, at least during the initial phase, as a medium of enhancing corporate image or as a medium of sales - similar in form to that of catalog and mail order shopping. This is in part due to the fact that access to the system has been kept rather low (¥30 per 3 minutes. For more details refer to 1.3) to promote use and penetration of the system.

Since the CAPTAIN service is a public service just as with the telephone, anybody - corporate or private, has the right to become an IP, just as every person having the right to own a telephone and use the public telephone network. Therefore, as long as all application procedures are properly taken, IP status is guaranteed.

To become an information provider, the minimum cost turns out to be ¥632,000.- excluding the cost of input.

¥500,000	for yearly registration, consulting and advice for information input and methodology
¥ 11,000	for a 100 frame minimum rental monthly X 12 (¥1,100 per every extra 10 frame minimum rental)
¥632,000	Total

FIG. 4-3 VARIOUS INFORMATION INPUT METHODS AND SYSTEMS

1. Information Input Terminal (IT)
   Allows creation of the actual frame to be transmitted online to the CAPTAIN Information Center.

2. Editing Terminal (ET)
   Cannot create the actual frame to be presented on the CAPTAIN service, but allows creation and editing of text only via online coversation with the CAPTAIN Center frame editing device.

3. Information Input Center (INC)
   Allows connection of own computer direct withe the CAPTAIN Center computer. Actual CAPTAIN service to be performed by Center.

4. Indirect Informatin Center (IF)
   Allows communication with CAPTAIN Center to provide realtime online information to users via the Center.

5. Direct Information Center (DF)
   Allows realtime online information services directly hooking up to the CAPTAIN videotex network.

4-4. TYPES OF USER TERMINALS TO BE AVAILABLE FROM NOVEMBER

Rank	Type	Features	Notes
1 lowest	Pattern Terminal	Pattern display of characters and graphics same as in experiemental system)	
2 Standard	Hybrid terminal	High speed display characters and mosaics via code. Graphics via pattern (photographic) Standard display density H204 x V248 dot	
3	High density hybrid terminal	Double vertical density: H204 x V496 dot 4 times standard density: double density both vertical & horizontal H408 x V 496	Display not possible on standard TV sets
4	Comand terminal	Hybrid terminal (standard density) and geometirc graphic display function	
5 Highest	High density hybrid command terminal	High density hybrid terminal - 2 / 4 times standard density and geometric graphic display function	Display not possible on standard TV sets

SECTION FOUR: FUTURE

In many ways, CAPTAIN can be a very intersting medium for many foreign and overseas company to break into and penetrate the Japanese market. This is because as a medium, it is completely standardized in terms of cost and presentation, and also the potential exposure it holds is extremely large. If penetration maturity comparable to that of the color television can be expected, exposure, although limited unidirectionally (requested from the user only, since it cannot turn the TV set on automatically and begin advertising or solicit orders), is immense.

As it can be seen in fig. 4-3, there are various input methods and hardware relative to the input methods. However, if no input terminal is to be purchased by the potential IP, CAPTAIN K.K. will undertake the job for the IP. A frame basically consisting of text only will be input into the system for ¥700 per frame. For frames with graphics alone or graphic and text information, input per frame is a minimum of ¥2,500. Naturally, since the terms require a 100 frame minimum, the figure should be multiplied by 100. Reversely, if some wish to keep some or most of their frames empty, that is also possible. This is why the CAPTAIN system may turn out to be the cheapest information network for some companies with limited information or services to provide on the system.

4.1 PENETRATION

Many different figures have been tabulated by different parties involved concerning the penetration of the CAPTAIN system. Penetration also will also vary depending on how low hardware costs can be brought down by the hardware/terminal vendors.

The CAPTAIN R&D CENTER estimates 1 million users within the first 3 years of commercialization, and up to 3 million users within 3 to 5 years if the hardware prices can be brought down to the ¥100,000 level. Different levels of user terminals, and the above ap-

plies for standard models not including a new display, ie., using their own TV sets.

NTT estimates 10,000 - 20,000 users during the initial year, and an increase to about 100,000 users within the first 3 years. They expect to exceed the 1,000,000 (million) mark by the 5th year of operation, again, if the hardware prices can be brought down to the ¥100,000 level, which they estimate will happen within the initial year of commercialization. There are presently roughly 15 - 20 vendors. In the end, they expect to be able to have a penetration of about 20 - 30% in total, which they believe is possible if the hardware prices can be brought down to under the ¥50,000 level. According to their calculations, there would be no commercial merrit as a public service until the 100,000 users mark is exceeded. However, with 500 - 1,000 CUG user networks, the system can break even and recover costs of operation and start-up. Therefore, the initial phases should concentrate more on business applications rather than as a household or general public system. They believe immediate public response will be limited at first because of the limitations in types of services that will be made available. Presently, order entry cannot be accomplished 100% via the CAPTAIN due to the fact that direct banking and other financial services have not been approved by the Finance Ministry to be provided on the CAPTAIN system. There is still a lot of manual/telephone checking and confirmation to be performed: eg. "please send me this item, to be paid in to this account of the vendor from the specified bank". Complete home shopping cannot be achieved.

NTT hopes to be able to expand the service to a nationwide net within 3 years of commercialization. With TV penetration of roughly 40 million sets and a telephone subscriber penetration of over 40 million (both 1981), the potential is there.

SECTION FIVE: CAPTAIN AND INS

INS is the abbreviation for Information Network System. There is nothing new in this concept itself. In Japan, however, INS has come to mean something slightly different, or rather bigger. It is used here to refer to a comprehensive digital carrier network in which all aspects of new media forms presently proposed will be incorporated (refer appendix 1). Since CAPTAIN is basically an analog system, it has no place within the INS concept. Presently, however, a Digital CAPTAIN is now being experimented in much the same way as the analog CAPTAIN system has been tested in the INS model system in Musashino City, Tokyo.

All of the present services and functions of the analog CAPTAIN has been incorporated into the Digital CAPTAIN. However, since transmission capacity with a digital network is much greater than that of an analog system, new applications and functions such as voice, not only melody, and still picture transmission, etc., are being envisioned.

The CAPTAIN Research & Development Center together with the CAPTAIN Inc. is presently in the process of drawing up a comprehensive plan of action for the Digital CAPTAIN to be realized in the future. The CAPTAIN R&D Center acts as a coordinating organ between the local business operations and the authorities who implement industrial and telecommunication policies of the government. The CAPTAIN Inc. actually operates, promotes, and implements the system.

Although the two systems may appear to compete in the future, that is not expected to happen. This is basically because present CAPTAIN services and functions will be completely be incorporated into the digital system and be provided by the same "supplier". Consumers will gradually grade up their system according to their needs, and especially according to their carrier line that they will be subscribing to. The CAPTAIN system as it is now will never be discontinued as long as analog telephone lines are in use, and consumers with access to digital carrier lines will naturally and

automatically be introduced into the digital system. Therefore the systems will never have to compete in the same "market".

PART V: CASE UPDATE

CASE 1: NISSHIN STEEL CO., LTD.

FIELD: Manufacture, processing, and sales of steel.

ESTABLISHED: April, 1959.

'83 CAPITAL: ¥40.1 billion.

'83 SALES: ¥368.0 billion.

EMPLOYEES: 8,846.

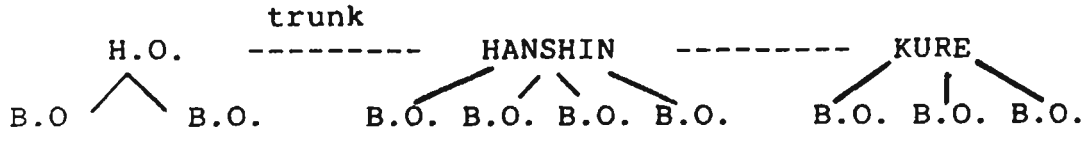
SYSTEM: NAIS-1--(1) data, (2) telephone, (3) fax.

NEEDS:

In 1979, Nisshin Steel took concern in its growing communications related expenses and conducted a traffic study to determine the amount of traffic volume per destination. The study revealed that 68% of all communication (telephone, facsimile, data) flow was internal. Thereafter, Nisshin began devising a plan to rationalize its communications network.

IMPLEMENTATION:

(1) Nisshin decided to utilize NTT's 24-channel "I-1" as a trunk-line connecting the head office (H.O.) in Tokyo with two of its plants in Hanshin and Kure, and further, 9 branch offices (B.O.) are connected to these three stations by public telephone lines. (2) Install three electronic switchboards (Oki OMNIPAX KE - 100) and one packet exchanger (Oki KE - 800). (3) Install 14 facsimiles (PANAFAX UF 520 III). The system's geographical configuration follows:



The above system was put into effect in 1981.

RESULTS:

The total cost of this system was very roughly, ¥250 million and Nisshin expected complete return on investment in 3.5 years. In fact, this was attained in less than 3 years. Nisshin estimates that communications costs have been reduced by approximately 20%.

FUTURE:

As illustrated above, this system was highly successful and Nisshin does not intend to make any major changes in the future. One minor change which has already been made is that the 14 UF 520 III's have been replaced by 17 UF 2100's. The UF 2100 is a 15-second machine with two transmission lines (one for internal and the other for external communications), other benefits are simplified operation, one-touch addressing, and automatic recording of all transmission. In addition, our previous report states that Nisshin was considering "establishing a company mail system and even a television conferencing system". Nisshin's stance is still unchanged--they are an interested observer of such systems.

CASE 2: NIPPON SEIKO K.K.

FIELD: Manufacture & sales of bearings (no. 1 in Japan).

ESTABLISHED: Nov. 1915.

'83 CAPITAL: ¥16.25 billion.

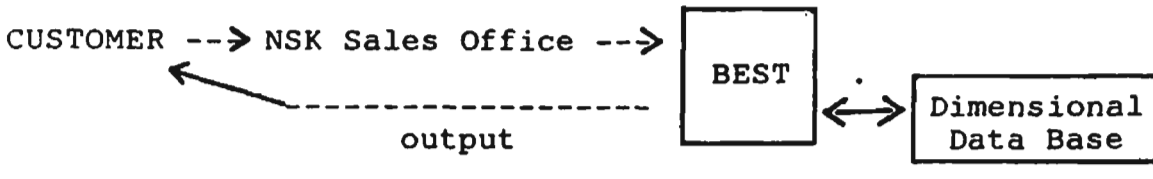
'83 SALES: ¥204.3 billion.

EMPLOYEES: 7,363.

SYSTEM: Computer-fax.

NEEDS:

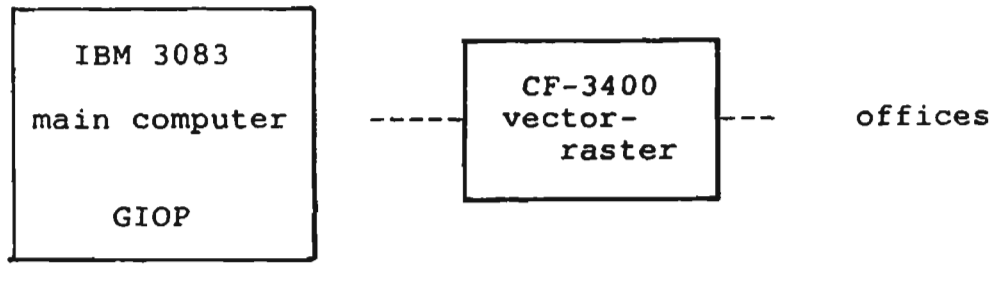
In order to understand NSK's situation, a brief explanation of "Bearing application Engineering SupporT"--"BEST" is necessary.



NSK's product information retrieval and guidance system outlined above works as follows. The customer in search of a suitable bearing provides the sales office with the desired specifications and application. This information is submitted to BEST, which selects the most suitable NSK product as per the customer's request. The results are then delivered to the customer in report form along with diagrams. This is where the need for a computer-fax system arose. In the past, the above process took three to five days for the reports were mailed. In 1981, NSK began making plans to make this system work on a real-time basis.

IMPLEMENTATION:

NSK had a choice of installing X-Y plotters or facsimile terminals at each of the offices and they chose the latter for two major reasons: (1) all offices already had facsimile terminals, and (2) facsimiles are multi-purpose and therefore, more useful.



Approximately 40 facsimile terminals spread out over 30 locations (head office, factory, laboratory, branch) throughout Japan are linked to the CF-3400. All facsimiles are of the G-3 type and both leased and public lines offered by NTT are utilized (international linkage is also possible). In addition to facsimiles which only handle A-4 and B-4 paper, NSK recently added three NSP-100's (developed jointly by NSK and Matsushita Graphic Communications System) which can print diagrams of the A-2 size. Although currently not in use, linkage with subsidiaries and affiliates overseas is also possible. (GIOP--Graphic Information On-line distribution system Program, is NSK's original software).

RESULTS:

The total investment at the time of installation was only that required to purchase the CF-3400, ¥15 million (other costs were not additional). The average utilization volume per month for the CF-3400 is 1500 times and that for each NSP-100 is 800 times. NSK has not been collecting data regarding productivity, savings, etc., they insist that this system's primary merit is speed and that, from this point of view, it has been very successful for delivery time has been reduced from over three days to several minutes. As a matter of fact, this system was so successful that NSK, in conjuction with IBM, is offering it for sale (see "comments" below).

FUTURE:

NSK is quite satisfied with this system and does not plan to make any major changes in the near future.

COMMENTS:

This system is now for sale and many firms have shown interest but no sales so far. The cost of the total system is ¥9,950,000 which includes the hardware ("N"CF-3400) at ¥8,550,000, the software (GIOP) at ¥950,000 and installation charge at ¥450,000. The NSP-100 is extra and each unit costs roughly ¥1,000,000. The software is a "Vendor Licensed Program" offered by IBM and the hardware and support is to be provided by NSK. In order to utilize the above system, the customer must have a sophisticated data base system resembling BEST, use an IBM 3080 or 4341, and have a G-3 fax network.

(a sample of a diagram delivered via fax is included in appendix 8, note the clarity).

CASE 3: TOKYO SAGAWA EXPRESS (TSE)

FIELD: Transportation.

ESTABLISHED: September 1974.

'81 SALES: ¥50 billion.

'81 EMPLOYEES: 1,500.

SYSTEM: Internal Process Buss/DATAPOINT.

NEEDS:

TSE is a young but remarkably successful company which has been expanding rapidly. From the beginning (1974), they were searching for a method to rationalize invoice processing whose volume was growing at an equally rapid pace.

IMPLEMENTATION:

TSE came to the conclusion that an OCR system was the solution and proceeded to develop their own OCR system "SGW 8100" and linked it to DATAPOINT's DP-6000 series (see previous report for system configuration). Functions of the entire system "Internal Process Buss" (IPB) in 1982 were (1) invoice processing (OCR + DP), (2) work hour/salary/personnel processing (DP), and (3) general accounting (DP).

RESULTS:

As of August 1984, results were mixed. As to the OCR invoice processing system, the core of this system, results were bad. The problem was primarily a hardware problem. The paper (invoice) feeder did not function satisfactorily. In addition, DP's capacity was too small. Thus, TSE is currently using NEC's ACOS 750 (host) and 5730 (OCR) independent of the IPB. On the other hand, DP was very successful in the handling of functions (2) and (3) above. In the past, these operations were done manually and this required a large clerical staff. After installation of the DATAPOINT system, the clerical accounting staff was reduced by 80% while education expenses were zero (done on free time basis with a knowledgable staff member as instructor). Thus, although this system failed in its major purpose, TSE is quite satisfied and is currently in the process of replacing the DP-6000 series with the DP-8800 series which has a larger capacity. Thus, today's IPB system does not include the OCR-invoice processor, but otherwise, the configuration is unchanged.

FUTURE:

TSE does not intend to make any basic changes in this system

in the future. As to the microfilm, voice and other systems mentioned in our previous report, these systems exist independently of the IPB system today.

CASE 4: KAWASAKI STEEL CORPORATION

FIELD: Steel, one of Japan's top 5 producers.

ESTABLISHED: August, 1950.

'83 CAPITAL: ¥134.8 billion.

'83 SALES: ¥1,092.3 billion.

EMPLOYEES: 29,268.

SYSTEM: Data Highway.

NEEDS: (see "comments" below).

IMPLEMENTATION:

Installation of optical fiber system in new office building.

RESULTS:

Very unsuccessful. Reason not stated.

COMMENTS:

Kawasaki Steel refused interview. They were not willing to discuss this particular system for it was unsuccessful. When inquired about original "needs", however, they did admit that needs were rather ambiguous.

CASE 5: KAWASKAI HEAVY INDUSTRIES, LTD.

FIELD: Integrated heavy machinery manufacturing

ESTABLISHMENT: October, 1896

'83 CAPITAL: ¥66.167 billion

'83 SALES: ¥702.683 billion

EMPLOYEES: 24,300

SYSTEM: Integrated word processing network

NEEDS:

KHI has 3 main divisions, 1) shipbuilding, 2) engines (mostly diesel engines for ships), and 3) plant engineering. The word processing network was especially constructed to meet the requirements of the plant engineering related departments.

A comprehensive manual for a single plant export may consist of several 1000 pages each. Changes and additions, exclusions are very frewquent. Moreover, many types of plant exports entails text that may be very similar of exactly the same in part, such as with specifications of certain key equipment. Formally, they had the recompose the text independently each time such a case arose, and subcontract typing and formating outside of the company. Furthermore, since contract documents and plant manuals tend to be handled directly by the relevant divisions with the department (North Africa dept., Middle East dept., etc.), there was much redundancy and inefficiency with the process.

IMPLEMENTATION:

KHI began considering the introduction of a word processing system that will systemize and rationalize this expensive, and above everything else, time consuming process. A tender was made and the WANG VS Word Processing system was decided upon. Although the primary objective of the system was word processing, there were several specific functions and applications that were unique to the needs of KHI, such as extensive search and retrival, storage memory, languages (English, French, German, and Spanish) capacity, graphics, and formating / editing. With the help of Wang system engineers, KHI developed their own software. A telex tape puncher was also included into the network.

RESULTS:

Total cost of the system and in-depth monthly charges and fees could not be obtained. However, they have stated that monthly savings are presently at the level of cost that they have been formerlly paying to typing subcontracters, which was stated in an earlier report to be around ¥140 million a year. Lease charges and fees at this point are in the range of ¥4 - 5 million a month.

One specific comment that they have stated is the lack of Japanese word processing ability. Much plant contracting is also carried out domestically - which the word processing system cannot support. They have added, however, that Japanese word processors and systems are by far cheaper than that for alphanumerics.

This system has been appraised as successful and easy to use by the implementing department and also by the actual users of the system. Since this is basically only a word processing system, learning to use the system is very easy, requiring only 2 days of education from the vendor. There are presently 7 work stations located within the word processing center (unchanged from as of implementation), and the number of distributed (within various divisions) workstations have been incresed to 13 from the original 8. Furthermore, the central processor unit for the network has been upgraded from the original VS80 to VS100. An OCR has also been added into the system configuration, furthering input ease of other documents that may arise from their suppliers to be included into the manuals and service reports for KHI.

FUTURE:

There are no immediate plans for discontinuing or modifying the system to a great extent. They are quite satisfied with the system. They do, however, plan to integrate direct and automatic telex tramission and reception functions into the system. Furthermore, an intelligent fax is also planned to be hooked into the network.

CASE 6: MRD CO., LTD. / MISAWA HOMES CO., LTD.

FIELD: Promotion of the MRD system and the sales of computer hardware and software for real estate development.

ESTABLISHMENT: November, 1979

'83 CAPITAL: ¥500 million (80% owned by Misawa Homes)

'83 SALES:

EMPLOYEES: 90

SYSTEM: Real estate trading with voice responce system.

NEEDS:

Misawa Homes is engaged in manufacture and sales of prefabricated homes. In most cases in Japan, new homes are sold together with the land on which the house is built. The old or former house of the customer must therefore be disposed of in some way. Furthermore, trade-ins are very frequent in Japan, and is a major sales and contract factor and tool. Misawa Homes must therefore find an effective and profitable way to dispose of the old or second-hand house in order to compensate for the high trade-in price (ie., discount). Such transactions are usually handled by regional real estate dealers. However, there is a limit to the number of real estate properties a single dealer can handle, and if geographic locations also come into play, the process can get rather time consumming and expensive.

Misawa Homes has therefore proposed ideas for an online real estate trading system to various associations involved in real estate development and trading. Due to the negatve response from the associations, they decided to implement this system by themselves, establishing a separate company exclusively for this purpose.

IMPLEMENTATION:

In order to make most of the system, they decided that the system should first be a membership, be self-supportive (independent company), use the telephone line, and be very easy to use.

The system requires members to have a push button telephone and a facsimile for the complete service. When a member wants to feed information concerning a piece of real estate for sale, he calls the MRD system (upgraded to UNIVAC OF

Series 8), a voice response system (Hitachi HITAC H-1100) will instruct the caller, step at a time, to punch in relevant information in coded form from the push phone. The members will already have gotten a standardized code list in which information such as age of the house, size, number of rooms, price, etc., will be categorized in number codes. Once finished, he has completed registering his piece of real estate onto the system host which will be made accessible to any other member looking for a house or apartment of that specification.

Much in the same way, a member looking for a piece of real estate may call the system center up, and input his requirements. His response, however, will be sent in printed form via facsimile. Once the information has passed hands, direct negotiations and contracting is performed between the real estate dealers themselves.

The system was put into full operation together with the establishment of the company in 1979.

RESULTS:

The MRD system has now 2,000 members and case a file of roughly 50,000 real estate pieces. There are roughly 5,000 transactions monthly. The system basically breaks even with a monthly membership fee of ¥30,000. The company uses this system for sales promotion of computer hardware and software developed for real estate applications. Therefore, the system can be used on an online basis with computers at this point. Financing real estate projects and ventures are also a major part of the company. The membership to the MRD system serves as customer pool for such services.

The company has now a target of 100 new monthly members.

FUTURE:

No significant improvements and modifications to the system are planned at this stage. They do, however, plan to continue aggressively promote their sales of hardware and software for real eatate companies (which utilizes basically the same protocol; and therefore requires no major modification to the system other than eliminating the voice response for those members who use keyboard input and CRT response display). They plan to maintain their 100 new members monthly target. They believe that once the 10,000 member mark has been surpassed, they will be able to achieve a snowball effect achieving up to 30,000 members within 2 years. This figure is significant because there are presently 120,000 real estate dealers in Japan, of which 50% is basically dormant. 30,000 members mean that they will hold a 50% market share of the 60,000 active real estate dealers.

CASE 7: MITSUI & CO., LTD.

FIELD: Trading company

ESTABLISHED: JULY, 1947

'83 CAPITAL: ¥49.272 million

'83 SALES: ¥13,960.422 billion

EMPLOYEES: 9,440

SYSTEM: ORION: Office Reformation by Information through On-line Network.

NEEDS:

Mitsui & Co. is a major force behind the Mitsui Group which is one of Japan's major industrial group. Due to such a nature, Mitsui beagn its computerization efforts rather early. However, each of their main departments and divisions owned their own office computers, and often were not linked in an network. In order to implement an integrated network, the ORION system was conceived. In the minds of the system developers, immediate cost recovery of the system was a key factor.

Mitsui found that immediate cost recovery could be obtained by focussing the system initially around the financial and accounting work areas. Over 100,000 accounting and other financial documents may arise in a single day towards the end of any given month. Processing them frequently took the financial divisions involved roughly 3 days. Futhermore, the various types of blank forms that had to printed were also immense.

IMPLEMENTATION:

A system by UNIVAC was decided to be introduced. Initially, all accounting and financial documents were typed on appropriate forms and then transferrred to the financial department to be feed into the computer via punch cards. There was the form costs and the punch card typing cost. An OCR system was introduced which read the typed information on the appropriate forms directly into the financial department's computer to be processed and corrected, then fed into the company's host computer. Error location and correction were very cumbersome and time consuming. (host: UNIVAC 1100, ORION Center: MEGAMINI, work/terminal controller: OP 7000, work station terminal: OT 7000).

RESULTS:

As of the present, the system has been highly successful, and further expansion of the system is being planned to included their branches and group companies. With the implementation of the complete ORION system allowing direct input of such information from independent terminals, such problems as error check and correction difficulties were overcome, and the types of blank forms that were initially needed was drastically reduced, along with the elimination of the punching job. Processing financial documentation time was reduced to a mere one day's job. Although direct quantitative results could be disclosed, they have stated that savings on printing costs, paper, and subcontracting card punching alone save roughly ¥8 - 10 million a month. Furthermore, many added office automation functions can now be achieved on the same terminal such as business graph composition, word processing, information retrival etc., which has not been accounted for directly within the ORION which is still by definition a finance and accounting tool.

Also, simple and user friendly operation allows almost any employee to use the system, although the input job most frequently is performed by female clerical personnel.

FUTURE:

Mitsui presently has 29 work station controllers, and 315 work stations. 24 work stations are located on 2 different floors (12 stations each) as a pool for divisions who have not yet been alloted a work station due to reasons of profitability and or size. The network is presently limited and contained to the head office building only. Mitsui presently plans doubling the number of work stations to include branches and group companies closely related to the head office along with increasing the number of work stations within the company in the future. Furthermore, they plan to slowly upgrade the individual work stations in order to achieve even greater stand alone capacities. (refer appendix 8, MITSUI ORION SYSTEM for configuration details)

CASE 8: NIPPON CREDIT BANK, LTD.

FIELD: Industrial Financing

ESTABLISHMENT: April, 1957

'83 CAPITAL: ¥78.5 billion

'83 SALES: ¥8,043.075 billion

EMPLOYEES: 1,916

SYSTEM: NOAS: Nissaigin Office Automation System

NEEDS:

Interestingly enough, Nippon Credit Bank's (NCB) first reaction the the question of needs was a simple "It was the times (era)", meaning that more than anything else, they felt that informization was the subject of the times. Naturally, they also had more tangible needs, such as increased sales support, rationalization and speed up of routine office work, etc., on an integrated basis. Furthermore, thay have expressed the great corporate image enhancement that came along with the introduction of the system.

IMPLEMENTATION:

NCB, due to the nature of their business, had been using stand alone personal computer in their various departments for a variety of local, on the spot needs. The NOAS system is basically a local area network of such independent personal computers. NCB chose to develop their system around NEC computers due to NEC's wide market penetration and available of software. As the host, they installed a NEC NEAC/MS50, and decided to use the PC8801 and 8001 series of personal computers as their terminal stations. Features of the system included electronic mail, graphic information transfer, and joint use and storage of personalized software developed by their employees.

They have networked all 17 of their domestic branches besides within their head office. They presently have 57 terminals over their respective branches, and 40 terminals are in use within their head office.

RESULTS:

The system was extremely successful in more ways then they had expected. Financial information such as exchanges rate fluctuations, sales, etc., were now made available on a company baisis in graphic form - which makes the information

much more tangible than in mere numerical form. Electronic mail services and software storage (library) was also made possible on a company-wide basis, furthering efficiency and eliminating redundency of routine work.

Naturally, all stand alone personal computer functions can be achieved, and therefore local/on the spot work automation was also achieved.

Furthermore, NCB hold workshops and regular training programs for those who wish to attend and further their computer skills.

Finally, the system proved to be so successful that NEC, the supplier of the hardware and also much of the sutom made software for the networking and the actual system functions have decided, with the permission of NCB, to market a NOAS type system from November of 1983.

FUTURE:

With increased workloads and new developments in many areas of their business line, they have started to feel the limitations of 8 bit machines. Their main concern with the future is gradually upgrading the system in order to shift to 16 bit personal computers. Furthermore, with a 16 bit machine, advanced and sophisticated business software can also be used.

TELDOK

On request, more information on TELDOK activities will happily be supplied by members of the TELDOK Editorial Board:

Bertil Thorngren, the Swedish Telecommunications Administration (televerket), +46 8 713 30 77

Göran Axelsson, the Swedish Commission for Informatics Policy (Datadelegationen), +46 8 763 23 72

Bengt-Arne Vedin, the Swedish Council for Planning and Coordination of Research (Forskningsrådsnämnden), +46 8 23 25 20

Birgitta Frejhagen, the Swedish Trade Union Confederation (LO), +46 8 22 55 80

Agneta Qwerin, SSI, +46 8 738 48 62

Nils-Göran Svensson, the Swedish Federation of Data Processing Users (Riksdata-förbundet), +46 8 52 07 20

Peter Magnusson, the Swedish Central Organization of Salaried Employees (TCO), +46 8 14 24 00

P G Holmlöv, the Swedish Telecommunications Administration (televerket), +46 8 713 41 31

Publications in English by TELDOK

TELDOK Report 6. The automated office. A description and some human factors design considerations. (With a summary and articles in Swedish.) November 1983.

TELDOK Report 11. New telecommunications technology – New organization? June 1984. (Also published in Swedish.)

TELDOK Reference Document B. Office automation in Europe. February 1983.

TELDOK Reference Document C. Office automation in Japan. February 1983.

TELDOK Reference Document D. Office automation and related technologies in Japan. February 1985.

TELDOK Reference Document E. Office automation in the US (partly in Swedish). February 1985.

Initiated by the Board of the Swedish Telecommunications Administration, the aims of TELDOK include:

- documenting, as early as possible, working applications of telecommunications systems, particularly for office use;
- publishing and distributing – when needed, also translating to Swedish – information on the use of telecommunications systems (particularly for office use), which might otherwise be difficult to obtain; and supplementing the information so as to increase its value to a Swedish audience and in a Swedish environment;
- study travel and conferences related to the documenting and distributing of information on working applications of telecommunicatons systems, particularly for office use.

The address is: TELDOK, c/o PG Holmlöv, Gdp, Room H33:21,
Swedish Telecommunications HQ, S-123 86 FARSTA, SWEDEN.

ISSN 0280-9583