1988
ANNUAL REPORT

CAP GEMINI SOGETI
EXPERTISE IN INFORMATION TECHNOLOGY

1988 ANNUAL REPORT OF CAP GEMINI SOGETI

1988 Results of Cap Gemini Sogeti:
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CAP GEMINI SOGETI
EXPERTISE IN INFORMATION TECHNOLOGY

Corporation with capital of FRF 91,409,260 - RCS: Grenoble B 330 703 844
Corporate Headquarters: 6, Boulevard Jean Pain - 38005 GRENOBLE (FRANCE)

LETTER FROM THE EXECUTIVE CHAIRMAN

CAP GEMINI SOGETI's performance in 1988 was a worthy successor to its performances in previous years. Revenue was up 39% from 1987, and a 44% increase in net profit resulted in a profit margin of 6.9%, which once again beat the record set a year ago.

But the Group's most outstanding accomplishment during the period under review cannot be summarized in numbers. The real success story of the year – and the one which occupied most of our time and energy – was the merger of CAP SOGETI and SESA. On January 1, 1989 the new CAP SESA Group was launched in France, with its 17 operational subsidiaries bringing together 5,000 people out of CAP GEMINI SOGETI's total workforce of 12,000(*).

The merger process also involved two of the three countries in which SESA subsidiaries already existed (Germany, Belgium and Italy). This event provided the occasion for some serious thought about CAP GEMINI SOGETI's strategy, its business, its line/staff structure, its employees and what motivates them and the system of values which drives the Group's actions. If the merger is a success – and the first few months of 1989 indicate that this is the case – it is mainly because it became clear very early on that this system of values was fully shared by the two organizations.

(*) *In this regard, see the editorial by Jacques Arnould and Alain Lemaire on page 51.*

Both these entities, as well as the Group as a whole, believe very strongly in what may be referred to as the "10 commandments of CAP GEMINI SOGETI." Unfortunately, I haven't the talent to set them down in a series of eight- or twelve-meter verses. But here they are nevertheless:

1. **Growth.** How would it be possible not to make strong growth an imperative when our market is itself doubling in volume every four years ? Because the "natural" rate of growth in our business is so high, and because we have to maintain a very fast pace just to protect our market share, the real achievement begins only when this natural growth rate has been surpassed. And if we want to increase our market share, we have to step up the pace even more. That is CAP GEMINI SOGETI's ambition, and it has thus become one of the leaders in its profession, a role that it means to maintain. As one of our American managers amusingly reminded us: The best way not to eat the dust of others is to stay at the head of the pack !

2. **Profitability.** This is the universal standard of good management, an overall and objective instrument for measuring the performance of each operational unit. It provides the force necessary to motivate our people and around which to channel our efforts toward continual improvement. Profitability is also the best guarantee of decision-making freedom and freedom of action because it ensures that growth is self-financed. Indeed, we have to recognize that the "liberating" role of profit (which is hardly any longer contested in the face of actual proof – even in France with its outdated models) has very special repercussions for a Group in which the majority of its capital has always been in the hands of its own managers.

3. Independence is a necessary condition of the consulting business and one of the Group's basic values; some might even call it an obsession. By this we mean independence from any political power, in order not to have to submit to "shifts" in power. It also means independence from any financial power (otherwise how could we refuse to consolidate our strategy and actions with those establishments holding the reigns of power?). Likewise it means independence from any industrial power, especially the computer manufacturers (otherwise how could we avoid giving preferential treatment to their products as opposed to those of their competitors?). No doubt this desire for independence is not without its perils. However, it constitutes one of CAP GEMINI SOGETI's most original features, setting it apart from many of its competitors who are tied in varying degrees to some outside power which stiffles or supersedes their own.

4. Loyalty. Growth, profitability, even independence, are not worth much unless they are achieved with total integrity. At the risk of losing attractive markets, or of seeming hopelessly naive (or dangerously "anti-establishment"), we in this Group will not tolerate the use of disloyal methods to win contracts. For example, everyone knows that it is strictly forbidden to receive or agree to commissions. Furthermore, everyone knows that any failure to meet the obligations of an honest, freely-negotiated business deal would be severely penalized. And, finally, everyone understands that this rule is as unbending as it is because some evil demons cannot be exorcised simply by making the sign of the cross.

5. Quality. A company's responsibility to the various "associates" who take part in its activities (clients, employees, shareholders) is assured through fair mediation of their claims, no matter how much at odds they may be. There is one claim, after all, which is common to all of them: the desire to see the company turn out quality work. For a service company, however, the quality of the service provided is non-negotiable; it is an obligation. And for a DP service company it is even a question of legitimacy, because its role is mainly to transfer technology from all its professionals to each of its clients. But this kind of technological transfer can only be accomplished through a genuine concern for quality, discipline and durability, which are the trademarks of the best of these companies.

6. Advanced technology. At the same time that CAP GEMINI SOGETI has committed itself to only one business, at the same time that it resists giving in to current trends and to calls to invest in profitless activities or products, it has nevertheless always been able to demonstrate a strong propensity for innovation. Each year the Group invests a large percentage of its revenue in research. It is constantly alert to adapting its methods, organization and employee profile to the evolution both of customer needs and the most modern technology. Here, too, the landscape is changing very quickly. Adapting to these changes does not mean simply acting the chameleon and changing color at every opportunity. What is called for is a very broad, ongoing effort in research, innovation, technological distribution and training, a requirement in professional services more than in almost any other type of business.

7. Internationalization. Many companies on the "Old Continent" are finding out today that a new Europe is on the horizon for tomorrow — i.e., January 1, 1993. And they are discoving that they will have to make certain adaptations in order to meet it head on. Many other companies, however, long ago accepted the challenge that national boundaries would soon be far less important than they are now, and that henceforth their markets would cover the whole planet. CAP GEMINI SOGETI has been one such company since 1968, and the internationalization of its business activities has been both a primary objective and an outstanding virtue. One example from among a number: The time is not far off when the Group will not allow anyone to be hired — whether a technical professional, a manager or a secretary — who does not speak English fluently, since in this business the question of *which* language we have to adopt does not even arise.

8. Decentralization. A DP service company is, first and foremost, a company of people, and it cannot progress unless it places maximum trust in its people. The principle of decentralization is nothing more than the desire to place the company managers in a position as closely as possible resembling that of a single boss running his or her own small personal business. This means being responsible for a profit center, making use of largely autonomous methods and managing and developing them to the best of their abilities within the framework of the Group's general principles and objectives. Giving people this kind of real responsibility — supported by the necessary counterbalance of strict internal control — is one of the things that most surprises newcomers to the Group, who are equally quick to recognize that it is one of the things which most successfully meets their expectations.

9. Solidarity. It is not enough for a company to promote individuals. It must also inspire real cohesion and an active spirit of solidarity among them. And this is not so easily accomplished in a Group like CAP GEMINI SOGETI, with its forces spread out in 14 countries, in which 11 languages are spoken, in which so many different cultures and legal systems have to be respected and in which companies that were often fierce competitors in the past are now working together under one banner. The spirit of competition is applauded in the Group, and this is quite natural in such a young and vigorous profession. However, reconciling this natural sense of competitiveness with the spirit of solidarity that we want to achieve is not always easy. It is probably one of CAP GEMINI SOGETI's major successes that it has been able to accomplish this tricky balancing act. And this has mainly been the result of its focus on communications, communal effort and teamwork.

10. Fun. For an American, "to have fun" is one of the determining factors in his or her attachment to a company and the work to be done. We must all be a little bit American in the Group since we place the pleasure of work among our most highly-prized values. This pleasure is the result of all the previous "commandments," above all the sense of belonging to an independent, profitable, well-run company, one which is free to decide to do only what it knows it can do well...what it "enjoys" doing. This enjoyment would not be complete if it were not accompanied by a sense of humor and balance, which makes it possible to put performances (even the most spectacular of them) in their proper perspective, and to remain calm and unthreatened even when things are not going as well as we would like.

There are very few companies these days that do not have some kind of plan, or charter or system of values similar to this one. And upon consideration, CAP GEMINI SOGETI's is not so very different from the others. Thus there is nothing very original in what I have just described.

One detail, however: This system of values is twenty years old, and has not only survived seven or eight successive mergers, but has made them easier to achieve and, in return, has been enriched and fortified by them. It is a system of values which, in all this time, has lost nothing of the ability to inspire and unify people that it had when it was first drafted.

It's good to know that it's a system of values built to last.

Grenoble, March 19, 1989
Serge KAMPF

EXPERTISE IN INFORMATION TECHNOLOGY

The word "expertise" is a relative newcomer to English dictionaries. It was adopted from the French language but, oddly enough, its original meaning, "the quality of a person who is expert, proficient," has been virtually forgotten. Still, the distinguished members of that hallowed institution, the *Académie Française*, official overseers of the French language – perhaps with themselves in mind – are in no doubt about who is an expert: one who "by experience and practice has acquired high proficiency." An expert, therefore, is adept as well as knowledgeable.

Applying the word expertise to information technology (or IT, its now-familiar abbreviation) provides an occasion to restore it to its original and logical meaning. Expertise is the sum of the professional qualities held by a group of people in the exercise of their vocation. It is made up of knowledge, experience and know-how. Information technology is both an exact science and a well-defined discipline. Computers will not run unless the software fed into them is itself flawless. Human applications, in contrast, are necessarily imprecise, diverse and fluid. This is the crux of the problem: how do we establish a strong and lasting bond between these two worlds ? This difficulty is overcome by the experience and know-how of IT professionals, "experts in information technology." This **IT expertise** has clearly emerged as the most essential link in the process which bestows practical usefulness on the information technologies. The added value that it contributes to the products of data processing and telecommunications, to their applications and to the information technology industry as a whole is steadily increasing.

However, since brainpower is obviously not the exclusive endowment of either information technology or the IT professional, one may legitimately ask why expertise plays such a predominant role in this field. Why is the DP services business ten times larger now than management consulting, when the two activities were roughly the same size in 1970 ? Or take the telecommunications industry: Although it has a sales volume at least matching that of the DP industry, and although it employs technologies just as advanced as those of the computer field, why hasn't it fostered the growth of a strong professional services sector ? And why is it that our colleges and universities are now offering far more courses in computer science than in mechanical, chemical, aeronautical or civil engineering ? Of all the possible answers to these questions, the following seem to be the most telling: IT expertise provides a simultaneous response to three basic needs: mastery over complexity, dissemination of new technologies and the development of information systems. And these, in fact, will be the subjects of the first three sections of this report.

1) **Mastery of the complexity** of information technology raises some unusual problems. On the one hand, this capability is an outright requirement of end users, whereas in most other sectors (the auto industry, television, pharmaceuticals, etc.) its utility derives exclusively from the manufacturers. On the other hand, such skill is very difficult to achieve, as complexity arises from the combination of three factors: rapidly-evolving technology, stringent demand (for user-friendliness, security, availability, etc.), and an environment which imposes its own rigorous constraints (the weight of the installed DP base, the interdependency of networks, and so on).

2) **The dissemination of new technologies** parallels the development of the most advanced of these technologies. If users are to benefit from the resulting innovations, two conditions have to be fulfilled: well-adapted software and implementation techniques must be available, and teams of qualified professionals trained in these new techniques must be on hand to carry them out.

3) **The development of information systems** must meet users' strategic objectives, master a variety of complex problems as well as incorporate the most pertinent new advances. Only genuine expertise can cope with the full range of tasks associated with the planning, design and implementation of systems.

Pursuing the theme of IT expertise, this report goes on to examine the distinctions between:

4) **Individual expertise**, on the one hand, which is the basic substance of professionals who enjoy their work, who can listen and communicate, who devote a great deal of their time to learning new skills, who are equally at home with abstractions and concrete reality, who are imaginative as well as disciplined. These are professionals with knowledge and experience covering both computer science techniques and application sectors.

5) On the other hand there is **collective expertise** which forms the basis of quality assurance, methods development, training, maintenance, transfer of know-how, team mobilization and organization so crucial to the success of any important or urgent project. This kind of expertise flourishes in the large DP service companies.

MASTERING COMPLEXITY

Data processing has already made massive inroads into the corporate and government markets. Central computers can be counted by the tens of thousands, and microcomputers by the tens of millions. In spite of this – and here we are talking about an unusual, if not unique, situation – technological evolution is still moving at an astounding speed. Component density, central processing unit speed, storage capacity and system power are all growing steadily under conditions of increasing cost effectiveness. And the numbers of new users, applications and requirements are also showing exponential growth.

All of this translates into a dizzying increase in the complexity of the tasks facing, in particular, the people who implement information systems and make them work. Their professional expertise must advance apace if they are to master this complexity, regardless of its source: technology, user demand or the environment.

TECHNOLOGICAL COMPLEXITY

There is no disputing that the "telecommunications dimension" is now a part of the realm in which DP professionals must navigate. Their ability to make workstations or computers communicate with one another is a foregone conclusion.

But unprecedented features have been added to the picture. We are not talking about mere technical enhancements, but actual new dimensions, and factors of complexity as well as of enrichment. We will mention four of them, taken from differing levels of scope and maturity:

1) The first is the universal spread of microcomputers. Their computing power, user-friendliness and connectivity are forging rapidly and continuously ahead. The main source of this advance lies in microprocessor power. The installation of "32-bit" machines (based on the Intel 80386 microprocessor, a chip containing 350,000 transistors) began in 1987, and estimates indicate that these devices will account for one-third of all microcomputer sales by 1991. These machines process 32 bits of information simultaneously, in contrast to the 16-bit capability of their predecessors, introduced in 1983. The fastest version currently available has a basic data cycle of 40 nanoseconds (a nanosecond is one-billionth of a second). These machines are capable of simultaneously processing multiple applications and, as a rule, have powerful graphic capabilities.

Demand for these machines is especially strong among engineers (for computer-assisted design applications and scientific computation in general), as well as among management professionals and, especially the financial services sector. We can reasonably anticipate that their power will aid in the creation of user-friendly office automation tools.

Even more important: these powerful microcomputers mark the true advent of distributed information processing. Within a given organization, they are interconnected — and connected to still other machines (such as servers, as shown in the illustration, opposite) — by means of local area networks. They can access departmental computers and central computer sites. And a company's various local networks can be linked to one another.

These are not new concepts, but we are only just beginning to witness their widespread implementation. As a result, hefty computing power and massive storage capacities will be made available to end users. Processing capability and actual data will be distributed among another order of magnitude of participants. From now on, the design of applications, the development and implementing of technical solutions will systematically have to incorporate these new dimensions.

2) The availability of high computing speeds and large memories has permitted the development of artificial intelligence and its range of applications, the most promising of which are expert systems. These systems simulate the thinking of specialists in specific areas of knowledge. Expert systems are already being used quite extensively in financial modeling and in systems diagnostics and configuration. Just a few years ago it was still believed that artificial intelligence products and services would be supplied only by specialized organizations. It is now clear that this problem-solving technique will ultimately have to be within the grasp of all information professionals.

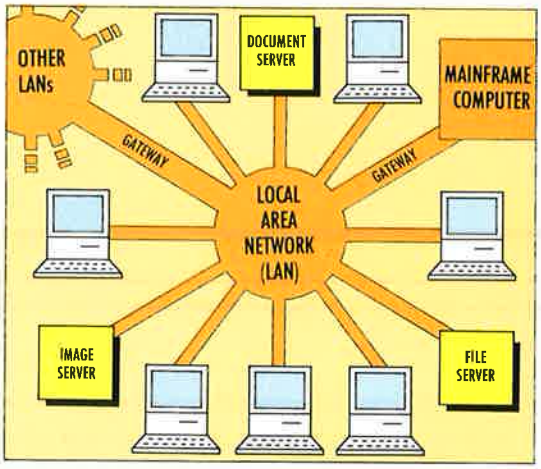
3) The new parallel computer architectures are already in operational use, but only in supercomputers (machines with computing speeds on the order of one billion operations per second), and only in limited scope (fewer than ten paralleled processors). Experimental machines have been assembled, such as the "connection machine," with 65,536 processors working simultaneously on a given task. This simultaneous operation of a parallel computer's many processors raises significant questions. How does one break down an application into a number of separate tasks suitable for independent execution? How should memory be organized? How should programs, data and results be best allocated to memory facilities?

4) Machine comprehension of natural language and pattern recognition are still in an embryonic stage. A few applications have been developed and major research operations have been undertaken (some of which will be mentioned in the following section). The stakes are high: expansion of robot technology, automatic translation, security, etc. But the problems raised are no less substantial. The understanding of a text presupposes a knowledge of its context, due to the many interpretations that can be placed on a single word. At the present stage of scientific understanding, artificial vision requires a more or less faithful copying of the human model. An image must be broken down into a very large number of elementary surfaces, each of which is scanned by a separate processor, with processing carried out by a parallel machine.

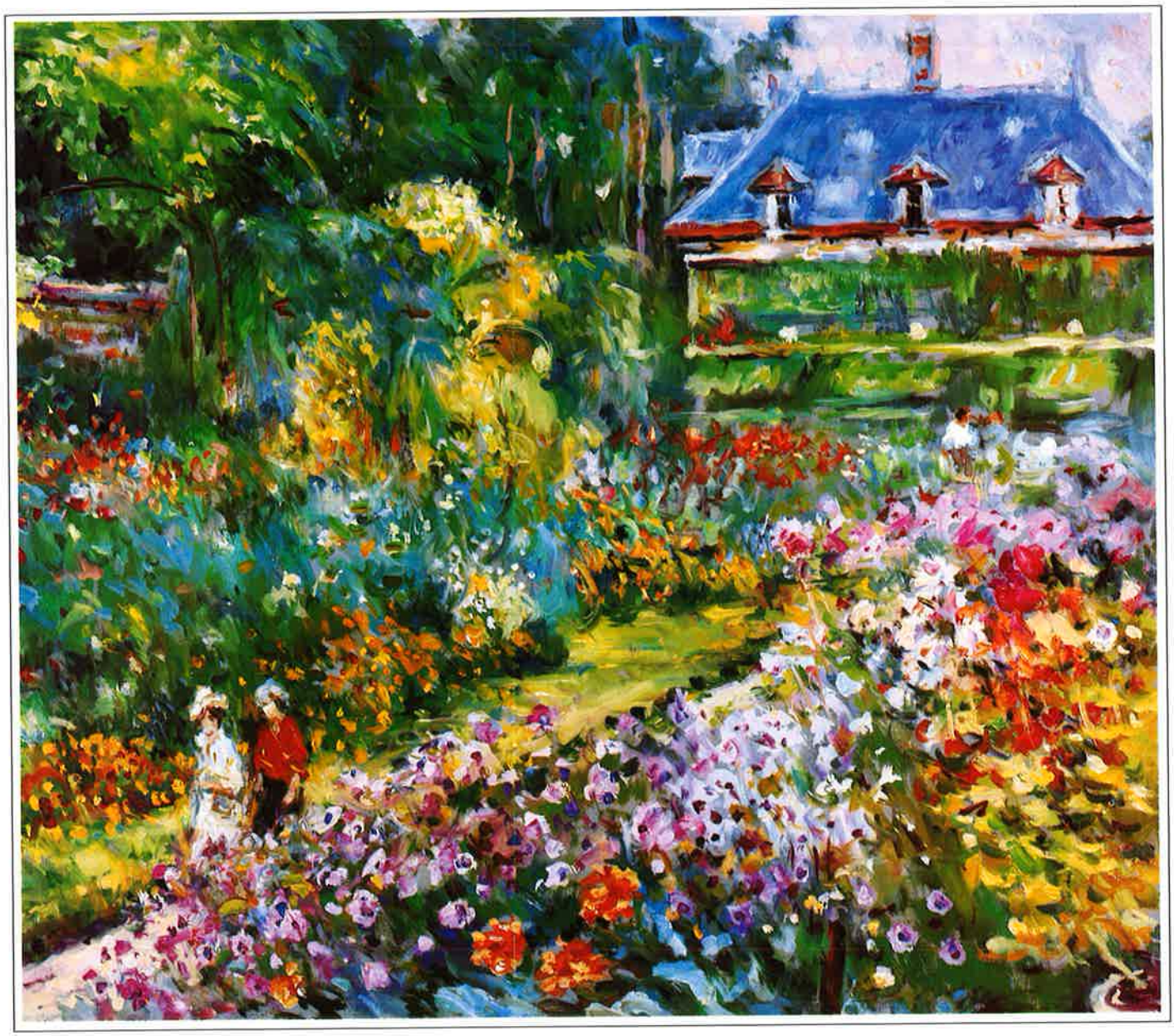
Another consequence of technological complexity is the varied nature of market supply, in terms of both hardware and software, techniques, models and makes of computers. Faced with a puzzling array of choices, users turn for advice to experts who are independent from computer manufacturers.

Beginning at the stage of the DP master plan — which itself derives from a company's particular strategy, its targets, its operating procedures — decisions must be made concerning the DP system's desired architecture: A single general-

Personal Computers and Distributed Data Processing



The PC of the future will be increasingly less isolated. Using a local area network as diagrammed above, it will be able to dialogue with other PCs and dedicated machines (servers) in a variety of applications. The PC will use gateways for the exchange of information with machines connected to other LANs and to mainframe computers (centrally located). (Excerpted from the revue La Recherche.)



purpose central system ? Machines dedicated to specific applications or fields (scientific, management) ? A two-level (central/local) or three-level systems network ?

The process is further refined with the selection of software (operating systems, database management systems, remote processing systems, languages and tools) and hardware (computer and peripheral types, makes and models), without overlooking local area networks (Ethernet or token ring, coaxial or twisted pair, star or bus topology, among other choices) and other networks (protocols, leased lines and/or dial-up access, and so on).

Four Programming Languages for a Transonic Wind Tunnel

CAP GEMINI BRA has developed the control software for the new transonic wind tunnel built by the Swedish Aeronautical Research Institute.

A sizeable project (12,000 man-hours), this software system covers four applications: calibration, measurement acquisition, processing and display of results. The complexity of the project, however, arose from the diversity of problems to be dealt with and environments to be catered to. As a result, no less than four programming languages were used:

- ***FORTRAN**, the basic language, is the standard language employed at the Institute.*
- ***C** was used for real-time modules, data acquisition programs and selected calibration and processing programs. The use of C was also dictated for interfacing with the software for the analog/digital converter, situated between the measurement apparatus and the control computer proper.*
- *Finally, the computer manufacturer supplied two dedicated languages: **RDO** for interfacing with the relational database management system, and **TDMS** for display and user dialogue programming.*

Besides these four languages, the development team used a standard mathematical program library and a standard graphics program library.

Three other languages — COBOL, PASCAL and ADA — were also considered but ultimately rejected.

COMPLEXITY OF DEMAND

Information technology has created strong ties of interdependence between users and corporate services, between companies themselves, between markets, geographic regions and media. Interaction is growing, while information is proliferating. New constraints and requirements are surfacing, the most significant of which are:

■ Human factors related to systems use must be much more systematically and attentively taken into consideration. The thickness of a typical word processing manual is noteworthy: dozens of pages are required to explain how to perform a simple formatting task. The need for microcomputer user-friendliness is well known, but the problem is actually broader in scope. For example, sophisticated systems in control rooms or brokerage offices sometimes generate more information than can be handled by an operator required to make too many decisions in too brief a time. In order to avoid such pitfalls and to make modern systems usable, further research is needed on subjects such as human response times, factors affecting this response, times required for decision-making and action, reactions to light and noise, and so on. The results of this research must then be integrated with all other human factors in applications design. This problem is all the more crucial in that the number of users that it involves has increased at breakneck speed, and it is no longer possible to train them all as specialists.

■ Computer security is a legitimate and growing requirement: losses caused by accident or by what is sometimes called "computer-assisted crime" are estimated in the billions of dollars. Analogies between information technology and biology take on new meaning with the advent of "computer viruses." In the United States, the existence of immense computer networks — many of which are "open" in nature — has fostered recent outbreaks of epidemic scope. Malicious individuals have invaded these "organisms," introducing destructive command sequences which have then replicated themselves like viral infections.

Although the facts are known, few companies have taken concrete protective measures. In France, according to a recent government survey, only 13% of queried companies claim to have a tested security action plan. As an example of possible protective measures, the inset below lists the key points of banking security. The bulk of the work for designing and implementing these actions will be handled by DP professionals, some of whom have specialized in the security field.

■ Data integrity is a major goal of organizations operating multiple databases. In point of fact, identical data items can be updated at different rates and by different operators. Under these circumstances, there is no guarantee of data consistency. An environment of databases integrated at the highest level must then be set up to organize information distribution. Corporate modeling methods have been developed to this end, along with database engineering techniques and tools (see inset, opposite).

We have made no mention of intrinsically complex problems, some of which are destined to remain unsolved until such future time that significant technological advances have been made. A simple example is the game of chess: the fastest computer imaginable today would never be able to perform a simulation of all possible game situations. Another impossibility, and for the same reasons: plotting the shortest network connecting a very large number of points. A third and much less theoretical example is that of the Strategic Defense Initiative championed by former President Ronald Reagan. Without going into detail concerning the many technologies that it would require, we need merely examine the features of its "command, control, communications and intelligence" (C3I) system. This system proposes to continuously monitor 200,000 hostile objects (including 14,000 independent nuclear payloads and 140,000 decoys), while managing the coordinated deployment of an equal number of defensive devices (observation satellites, combat satellites, kinetic energy weapons, radar units, surveillance aircraft, missiles, etc.), for the entire duration of an attack, estimated at 30 minutes. Many American experts have asserted that it is not possible at this time to implement the software for this system. Yet, impressive as it now is, the complexity of demand has obviously not yet reached its peak.

Keys to Banking Security

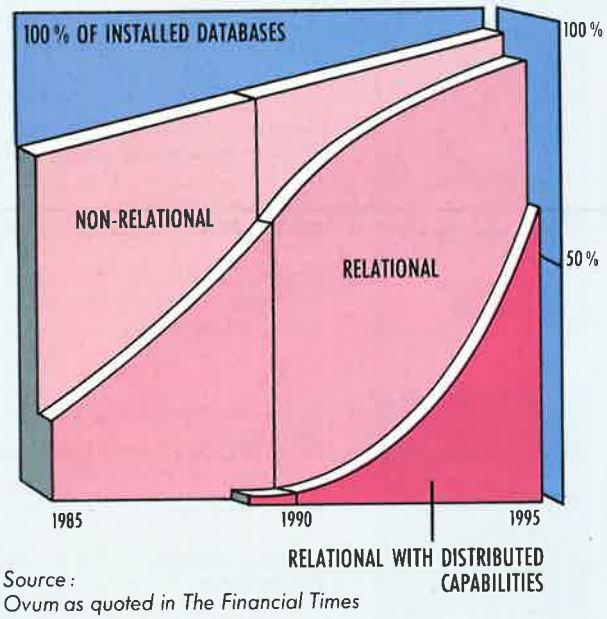
REQUIREMENTS

■ ***Integrity:*** *guarantees that an item or batch of information has not been altered during transfer or storage.*
■ ***Confidentiality:*** *ensures secrecy of information, with access by authorized persons only.*
■ ***Non-repudiation:*** *prevents a party from disclaiming the transmission or reception of a message. In the case of services billed at the time of use, an electronic signature must be obtained in order to ensure non-repudiation.*

RESOURCES

■ ***Authentication:*** *provides the recipient with a guarantee of the sender's identity.*
One may authenticate oneself by three methods: by what one is (biometric identification); by what one has (identification by badge, magnetic-coded or smart card); and/or by what one knows (password, secret code).
Biometric identification techniques are based on dynamic recognition of signature, fingerprint, voice, etc. However, they still pose problems which hinder their widespread application.
■ ***Authorization:*** *e.g., to consult one's bank account from abroad, or to issue stock-market purchase or sales orders.*
■ ***Encryption:*** *transformation, using a cryptographic technique of a plain-language text to produce an encrypted text. Depending on the technique employed, encryption can provide confidentiality, integrity and authentication.*
■ ***Sealing:*** *compression after encryption of a text. Sealing provides integrity and, under certain conditions, authentication of the sender.*
■ ***Signature:*** *attestation of the issuer of an item of information. "Signature" covers authentication and non-repudiation.*
■ ***Software monitoring:*** *periodic verification of software integrity. Provides assurance that programs have not been illicitly modified.*

Relational Databases with Distributed Capabilities



Source :
Ovum as quoted in The Financial Times

The diagram is taken from a study by Ovum, a British firm. It projects the evolution of database use between 1985 and 1995. The growth pattern indicates that a new technique does not really become widespread until the people who must implement it have accumulated enough experience to master its complexities.

The first ***database management systems*** *(DBMS), which emerged during the '70s, allowed only one type of access to each data item. Now, it should be possible for the same basic information — e.g., the cost of a spare part — to be written, read, updated and otherwise used by a variety of corporate departments with different functions, working at different times and according to different criteria. In order to maintain data integrity, this item of information should physically exist in a single copy only. Efforts are therefore made to build DBMS allowing multiple applications to access this same information by different access routes. In such* ***relational database management systems*** *(RDBMS) information can be entered, read, linked, processed or updated at any time by any authorized application. Users (and applications software developers, for that matter) have no need to know anything about the formats in which the information is physically stored.*

As the above graph indicates, the RDBMS concept did not get off to a commercial start until the period 1983-1985, and then it was as a result of the progressive development of a standardized programming language for building interfaces between applications and the RDBMS: SQL, a language designed by IBM for its DB-2 RDBMS.

The design and installation of a relational database is a complex undertaking. Greedy consumers of processing power, RDBMS pose performance problems, in addition to the fact that certain conditions must be assured: data integrity, rapid response, automation of restart procedures in case of malfunction, ease of application programming, etc. Moreover, to prepare the model of such a database requires a knowledge of how its information is distributed, and of the rules and resources for creating and accessing this information. To model a corporation's data is to model the corporation itself! Finally, users do not want to lose the advantages of an RDBMS when information is ***distributed*** *among a network's various types of computers.*

Thus we see the origin of the idea of ***relational database management systems with distributed capabilities****. Environmental conditions, however, prove to be very complex during the installation of distributed RDBMS. Existing applications — which must be kept intact — use data in many forms, scattered among many files and databases. Users are accustomed to specific screen formats... and the list goes on and on. These difficulties of implementation explain why only a very limited number of distributed DBMS have been put in service to date. But the gradual accumulation of experience and know-how required for the installation of these systems, particularly in DP service companies, will ultimately overcome these problems. Today's exception will be tomorrow's rule.*

COMPLEXITY OF THE ENVIRONMENT

Computer resources are so numerous and so intimately linked that, viewed as an entirety, they are showing kinship with that human social organization which today's philosophers like to describe as "growing hypercomplexity." In such a context, there is no longer a contradiction between centralization and distribution, and there is no point in the age-old confrontations of autonomy and dependence, order and chaos.

Likewise, the old squabble over distributed data processing is a thing of the past. Sixty million microcomputer users want to use their machines as standalone units, but they also want to be able to access all of the data available within their economic community, and would be unforgiving of any interruption in ongoing operations at any level of a corporate structure.

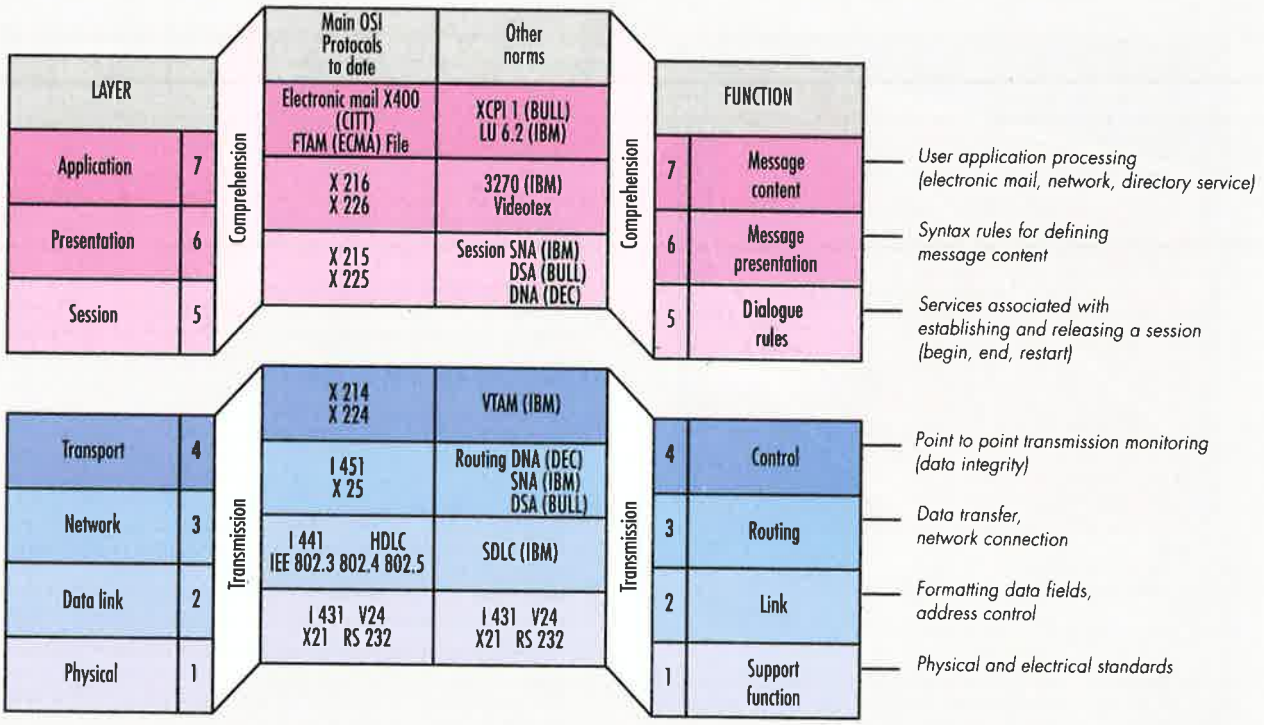
The inertia of existing resources is also related to the diversity of installed facilities. The computer inventory of any sizeable Western country contains thousands of different models. Application software is written in one or more of the fifty-odd languages now current. The basic format (or "word") of information might contain 6,8,12,16,18,24,32,36,48,60 or 64 bits! To get data to communicate, standards have been established by the ISO (International Standards Organization) based on a model defining seven "layers" of communication. Each of the seven layers must be brought into alignment, in the fortunate case where both correspondents are using this model (see inset, page 12).

Naturally, a substantial standardizing effort is being undertaken to facilitate communications and make change less painful. The inset describing the ISO model mentions a few of the standards agreed upon by specialized international organizations. These standards are being applied by manufacturers who judge it advantageous to adopt and implement the ISO model.

Another example: in order to foster computerized transactions between banks and their clients, the official French banking standardization agency has established file transfer standards (ETEBAC) which involve data transfer via the TELETEL network and security functions based on use of the "smart" card.

A huge arsenal of standards has gradually evolved in individual countries and on an international scale. Each standard is extremely useful for its targeted purpose and for the time period in which it was conceived. In any other situation, however, it is a constraint which IT professionals must know and take into consideration. A universal solution to this prob-

The OSI (Open Systems Interconnection) Model for Data Communication Protocols



Each of the 7 "layers" has a specific, independent function, but one which is logically linked to its closest "neighbors." Although different standards or norms exist for each layer, structuring communications according to this model simplifies the exchange of data between heterogeneous systems.

lem would be simply to standardize everything. To begin with, however, this is an impossibility, because differing tools are an absolute necessity (for reasons of application size or type), and these tools must also be made to communicate with one another. Moreover, such universal standardization is probably not even desirable: freedom to create and freedom of choice have their price!

A quick survey of four typical cases will give the reader a notion of the influence of this "inertia of existing resources" on future tasks facing information technology:

1) In large corporations, the main applications were the first to be computerized; this is already ancient history. They have since undergone many maintenance operations. The volume of data to be processed has greatly increased, and central computers have been upgraded accordingly. Department-level machines have been installed, along with quantities of microcomputers and workstations. As a consequence — and this is true for all large organizations — it has become necessary to modify the architecture of cumbersome central computing, to create a corporate network and to integrate new technological developments as they emerge. At any given moment, IT expertise must embrace not only existing, installed hardware and software, old and new, but technological innovations as well.

2) In this context, it is not unusual for applications to be transported from one machine to another. These operations, termed "conversions" or "migrations," as the case may be, are extremely sensitive, for (at least) three reasons: they involve old systems which in many cases have become firmly rooted; they must be performed quickly and as inexpensively as possible; and the changeover must be imperceptible to the end users.

3) Implementation of an intercorporate system presupposes that all parties involved adopt joint standards for each of the seven layers of the ISO model and for operating procedures. It also presupposes that the prime contractor has managed to put together multidisciplinary teams, capable of assimilating the specific problems of different industries or even different cultures. SIT, the interbank remote clearinghouse system described on page 13 is a remarkable example in this regard.

4) All new applications are increasingly taking their environment into account, even if they are restricted to a single corporation, and regardless of their relative simplicity or complexity. In fact, they must be "open," i.e., ready to accept information arriving from outside sources and ready to link up with other applications.

From the foregoing, it is easy to deduce that complexity slows down DP application developments, while increasing its risk factor. This is a fact which must be faced squarely. Clear vision is an aid in risk identification and control. It encourages the search for improvements in productivity, particularly by exploiting the resources of

The SIT Interbank Clearinghouse System

The number of checks issued each year in France has risen to several billion. And every check written prompts a chain of very complicated physical and accounting operations, generally performed on a variety of DP equipment. Until now, exchanges of information for processing interbank transactions have been accomplished by transmission of magnetic tapes and have taken several days.

For the purposes of efficiency, cost and security, the major French banks decided to cooperate with each other in the installation of an Interbank Clearinghouse System. The contract for this project was awarded to CAP SESA. The system will be completely operational in 1990, at which time it will be able to process two billion transactions a year. The chief function of the system (known in France as SIT — Système Interbancaire de Télécompensation) is the continuous and automatic transmission of transfer orders among the various banks.

SIT architecture consists of a closed network linking front-end minicomputers (referred to as stations) — 200 to date — acting as gateways to each bank's mainframes. The network relies on the TRANSPAC packet switching network, with ISO standards systematically applied. For file transfer between network stations (BULL and DEC) and the banks' computers, an appropriate and unique protocol standard has been defined (PeSIT).

Unlike the traditional networks such as SWIFT, SIT is not structured around a central host computer.

This means that when one machine is unavailable, only the transactions from/to that machine are blocked. Furthermore, the architecture chosen, the multiplication of access points and the type of information sent, have imposed a level of security never before achieved in a system designed for civilian use.

Specialized equipment and smart cards assure control of information access and integrity, mainly by means of encrypting all transmissions.

The network management center is one of its most important features. It constantly monitors the proper functioning of the stations and generally assures the integrity of the system. It must also be able to detect any malfunctions and get around them.

And, finally, it has to deliver statistics which track the behavior of the network and make it possible to plan the changes that may be required in order to accommodate the evolution in the type or volume of the transactions performed. The network accounting center registers the transactions, determines and verifies the daily balance of debit/credit operations, which are then sent to the Bank of France to be recorded in the accounts of the member banks.

Because of the many positive features of this system, it was also chosen as the telecommunications and interface network used to modernize the current trading system of the Paris Stock Exchange.

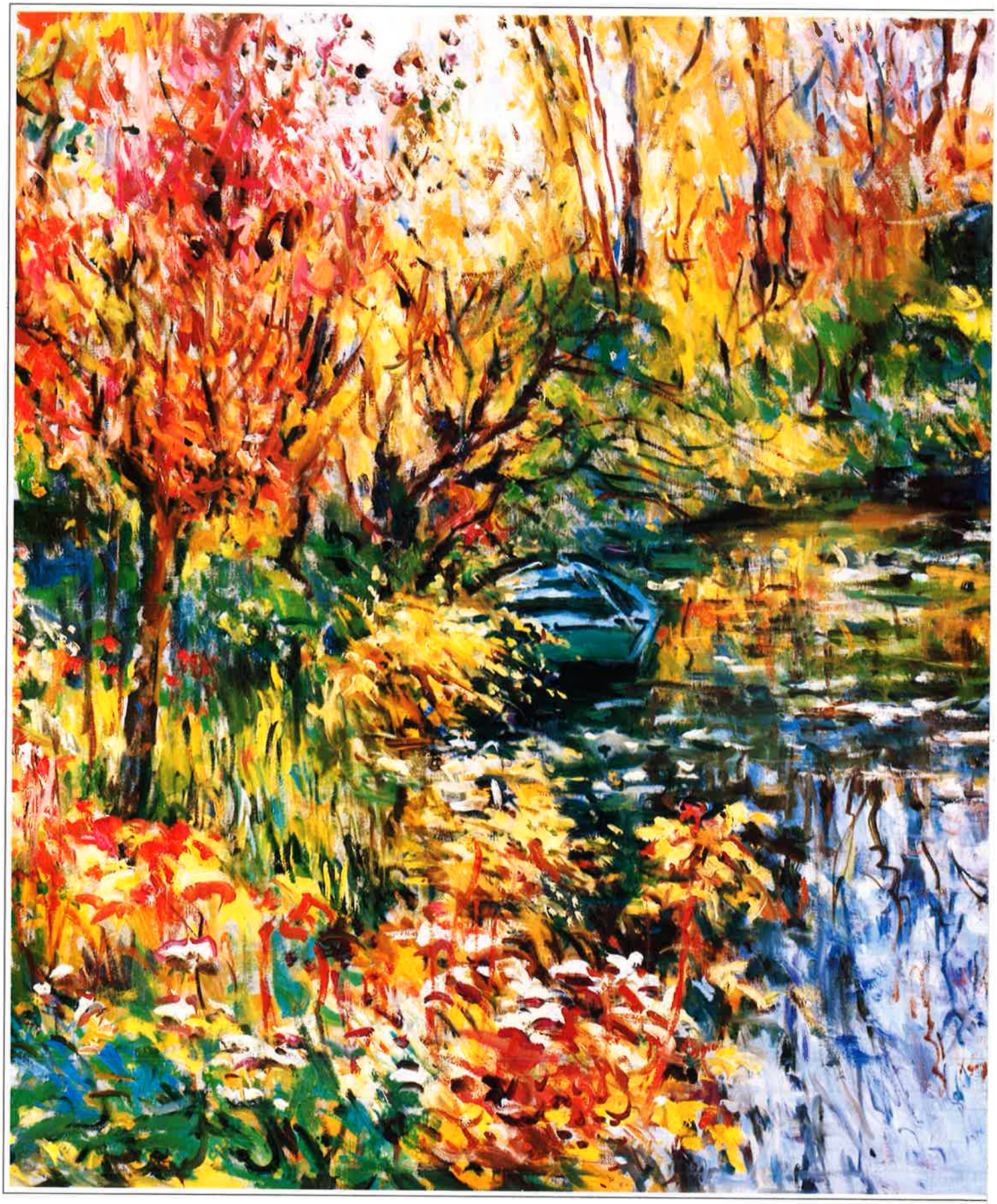
software engineering.* It spurs the imagination to get the most out of complexity, whether from the standpoint of user-friendliness, power, connectivity or reliability of applications.

A concluding example: integration of heterogeneous systems, thus termed because its purpose is to implement systems which incorporate both standard and dedicated hardware and software components. The adjective "heterogeneous" reflects the extreme diversity:

- of the technical fields involved (telecommunications, artificial intelligence, image processing, etc.);
- of the applications to be processed or associated (business, technical, industrial, office automation, etc.);
- of the sharing of resources and data between the various levels of the system, from workstation to central computer;
- of the hardware and basic software to be integrated;
- of the existing computer environment into which the new system must fit, or which it must replace.

The degree of systems diversity is growing substantially, for all the reasons advanced in the preceding pages. DP service companies are being asked to implement increasingly-complex and increasingly-distributed projects. The quality of these implementations is based entirely on the IT expertise of these companies.

*Software engineering is the name given to the ensemble of methods, tools and procedures required to implement and monitor each stage in the life cycle of a software system.



DISSEMINATION OF NEW TECHNOLOGIES

The pace of innovation is rapid in the field of information technology, and there is no indication that it is going to slow down. New products – computers, workstations, data transmission and telecommunications equipment – are increasingly incorporating a mix of software and services. The easier these are to use, the more complex and more specialized in their manufacturing specifications they become. Users, in turn, are experiencing a greater degree of international competition. They want to develop their products and services rapidly, to enable them to offer higher quality to their customers at a lower cost. As a result, they are tending to integrate a larger and larger share of software into their own products and services.

These trends are not unrelated to the fact that expenditures on research and development have been growing spectacularly over past years. In the United States, National Science Foundation figures indicate that R&D outlays rose from $20 billion in 1965 to $35 billion in 1975 (for a 75% increase in 10 years), and then to $109 billion in 1985 (or a threefold increase in another ten-year period).

The reader will not be surprised to learn that research is also placing great demands on IT expertise, in terms of both the number of men and women engaged in the development and dissemination of new technologies, and the quality of their experience and know-how. Large DP service firms are playing a fundamental role in this regard. On one hand, their consulting and service activities place them at the crossroads of the research centers, computer manufacturers and user firms; on the other, they are making their own contribution to innovative research and development. As a result, they are often a step ahead of their clients in business and industry. Their mission is to pass on the benefits of this progress.

RESEARCH AREAS

Innovation does not appear only in the form of products. Techniques, methods and procedures can also inject new life into a company's output, into its ways of producing or operating. As we shall demonstrate further on, the lines of research carried out by large DP service firms are not generally directed toward product development. This is especially true insofar as these firms — CAP GEMINI SOGETI included — often participate in advanced research projects which might take years to yield industrially-viable products (e.g., neuron computing).

Research topics fall into three major categories:

1) **Basic products and technologies** (computers, basic software, peripherals).

The nature of future computer architecture makes it virtually impossible to distinguish between basic software and hardware. A parallel computer will never go beyond the design stage, for example, until provided with software for sharing tasks and distributing resources. CAP GEMINI SOGETI is working on future architectures; current projects include:

- Parallel architecture: CAP SESA INNOVATION (France), Nixdorf (Germany), Olivetti (Italy), Philips (Netherlands) and Thomson-CSF (France) form the consortium carrying out the TROPICS (Transparent Object-Oriented Parallel Information Computing System) project under the auspices of ESPRIT, one of the European Strategic Programs. This project is scheduled to produce a demonstration prototype of a parallel processing machine in 1991. CAP SESA INNOVATION is primarily active in four project tasks: object-oriented design method, user interface, natural language comprehension and dissemination of knowledge bases.
- Neuron architecture: using the analogy of the human brain, which contains some ten billion neurons, each interconnected with hundreds of others, researchers have conceived a new "neuron" machine. Such a machine would contain a large number of relatively simple processing units. Within the framework of ESPRIT's Basic Research program, CAP SESA INNOVATION is undertaking a research project on the behavior of a neuron network, applying a range of hypotheses on the efficiency of connections. Working on the project with CAP SESA INNOVATION are research laboratories in Spain, France, Great Britain and the Federal Republic of Germany.
- Another basic technology, pattern recognition, is still in the experimental stage. Industry is already using computer vision applications, however, such as robot guidance, object identification and sorting, or compliance with dimensional standards. One CAP GEMINI SOGETI subsidiary, ITMI, has made decisive new contributions to this technology, including real-time processing, ambient-light operation, applications software generators and interpretation assisted by expert systems.

2) Other software and services.

This category includes software engineering tools and methods. "Tools" refer to software aids for information systems development, from design to testing and operation. Data professionals use the term "method" (or sometimes "methodology") to designate a set of observations, recommendations, rules and procedures employed to complete a DP application successfully. The understandable wish to construct a universal methodology and an all-purpose set of tools has led more than one company into expensive attempts to develop them. All such attempts have failed, because the universe of DP applications is too wide and too disparate to be embraced by a single methodological ensemble.

CAP GEMINI SOGETI is taking part in two major research programs in the field of software engineering. The ESF (Eureka Software Factory) project is a consortium of thirteen companies and research centers in five European countries. One of its goals is the definition of a logical architecture, i.e., a complete and coherent set of standards intended to facilitate the integration of software components on a software "bus," much as a microcomputer's printed circuit boards are plugged into a hardware "bus."

The EAST (European Advanced Software Technology) project, in contrast, is a relatively short-term one. This EUREKA Program project (part of the EUREKA Program which, along with ESPRIT, makes up the European Strategic Program) is targeted to the implementation of an integrated environment to house program development and project management methods, including a unique user interface, a shared database and a set of coordinated "services" (project management, documentation, etc.).

Other software and services also include areas of research that generate new applications and new services:

a) In the field of man-machine communications, CAP SESA INNOVATION (under license from the French National Telecommunications Research Center) has developed MULTIVOC, a module capable of translating written text into speech. In turn, France Telecom has begun research on a future voice message service. Using MULTIVOC, this service will

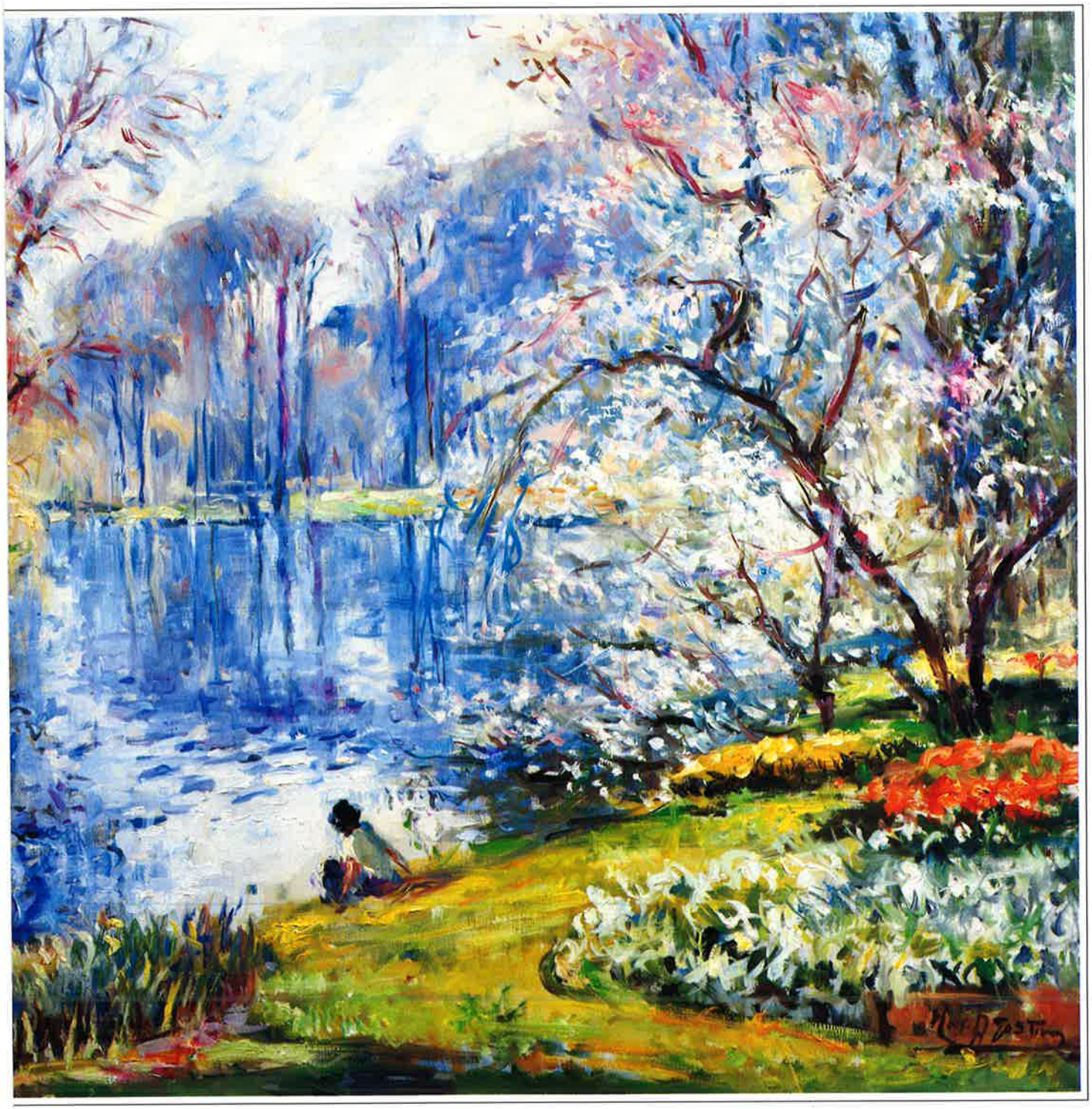
audibly read messages stored in an electronic mailbox to a subscriber calling in from any ordinary telephone. And we should also mention CAP SESA INNOVATION's research on the ergonomics of screen displays. The expertise derived from these operations is at the disposal of any member of the CAP GEMINI SOGETI Group.

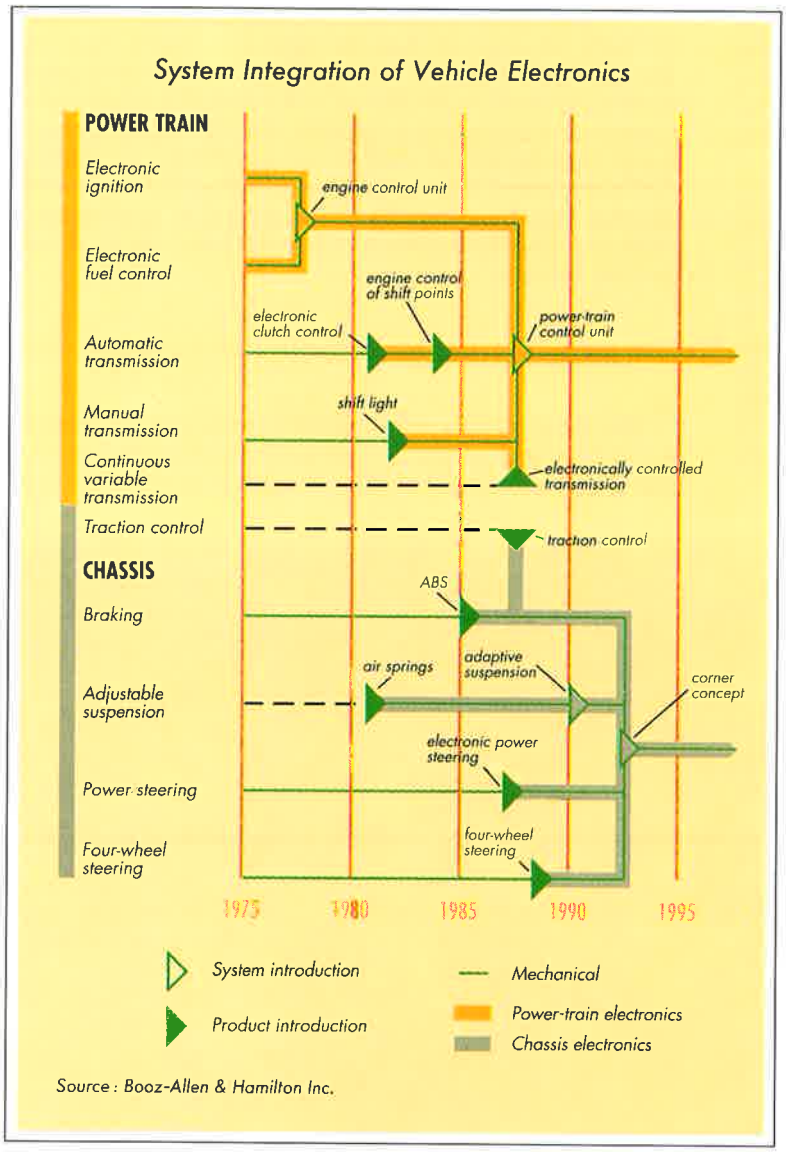
b) Expansion of the area of application of expert systems requires not only mastery of the techniques of artificial intelligence, but also use of dedicated methodological tools. Working under the auspices of an ESPRIT project, CAP SESA has developed the KADS (Knowledge Acquisition and Design Support) methodology, covering a set of techniques for the acquisition and formulation of knowledge. ESTEAM, another ESPRIT project in which CAP SESA INNOVATION is participating, is designed to handle problems requiring the simultaneous use of multiple separate databases.

c) A great deal of research is being devoted to security for large information systems networks. These networks are open and therefore vulnerable, and mere communications enciphering is insufficient. A number of European corporations (including CAP GEMINI SOGETI) have therefore joined together in the OASIS (Open and Secure Information Systems) project, also under the auspices of EUREKA. It will develop security standards to be applied to development methods, systems architecture and hardware and software security features.

3) Integrated data processing

This category covers the countless products and services incorporating elements of information technology. IT is providing the resources for fresh expansion in many sectors,





such as telecommunications, aerospace, industrial process control, automated handling and warehousing, robot technology, ticketing, surveillance, access control and signalling, and so on. IT expertise, supplementing the specific skills of any given sector, is applicable to all phases of the innovative process, from design to the marketing of new products.

To illustrate this, we have chosen three examples from widely differing sectors: telecommunications, the auto industry and medicine.

ISDNs (Integrated Services Digital Networks) offer a range of services accessible from a phone subscriber's touch tone pad. Since telephone networks have been digitized — with signals transformed into a binary code — data processing techniques can be economically applied to the transmission and switching of voice, data and image information.

Independent routing of call data and call signalling provide the basis for features such as caller identification, spoken information on the cost of a call, or storage of a voice message for later "forwarding" to the called party.

A totally unrealistic notion only a few years ago, it is now as easy for a newspaper staff writer to remotely scan a file containing hundreds of press photos as it is to leaf through an album. Once selected, a photograph, transmitted in a few seconds, can be locally printed or inserted in an article on a newsroom terminal.

Electronics has opened new horizons for the auto industry. Electronic ignition systems and the ABS (anti-skid braking system) — two million units of which have already been turned out by the largest manufacturer — are the most striking examples of the application of IT to automobile engineering. This is only the beginning of a series of developments destined to allow manufacturers to reduce costs while enhancing performance levels and increasing product differentiation. Current developments are primarily focused on mechanical systems (engine, suspension, steering), instrumentation (dashboard displays and indicators) and signal transmission (multiplexing).

Improvement in vehicle performance may be expressed in terms of enhanced comfort, handling ease, reliability and safety. New DP technologies will be employed to attain these goals. Examples include simulation-based, real-time status monitoring, high-speed processing (complex equations must be solved rapidly enough to yield extremely brief response times), and architectures permitting uninterrupted operation and management of DP engineering projects.

The diagram above shows that genuine systems integration will be a necessity for coordination of the numerous onboard, IT- based systems.

Among the many research achievements of medical data processing, we should mention those designed to assist the severely disabled by means of complex prosthetic devices. Take the example of persons paralyzed by damage to the spinal cord. In the normal body the brain, receiving sensory information transmitted by the nervous system in the form of electrical impulses, uses the same channels to send instructions to the muscles to obtain coordinated motion. Specialists in medical data processing have designed and built systems for functional neuromuscular stimulation, types of computerized prosthetic

devices which bypass and replace the defective portions of the nervous system. Depending on the kind of physical damage involved, these systems will replace one or more of the following functions:

- acquisition of information such as position of the hands and feet, speed of movement, contact with an obstacle, etc.;
- transmission of this information to the brain;
- control and monitoring of the overall process;
- stimulation of muscle fibers.

Development of these systems has reached the stage of practical feasibility studies and initial clinical trials. Naturally, there are still major problems to be overcome, but the availability of practicable computerized prosthetic devices is now well within view.

THE PROCESS OF INNOVATION

The most critical phase of the innovative process is that of dissemination, because it is the slowest. Users would like to make use of new developments as quickly as possible, but they have a long maturation cycle, particularly where it is necessary to modify working habits or ways of tackling problems. This is often the case with the software technologies. The inset on page 20 shows that it has taken 21 years for expert systems to reach the fourth of seven phases of maturation! Obviously, this time-span shrinks in the case of developments less basic in nature than expert systems.

To simplify for purposes of clarity, we might say that the innovative process within the CAP GEMINI SOGETI Group is the product of five functions (see diagram, following page).

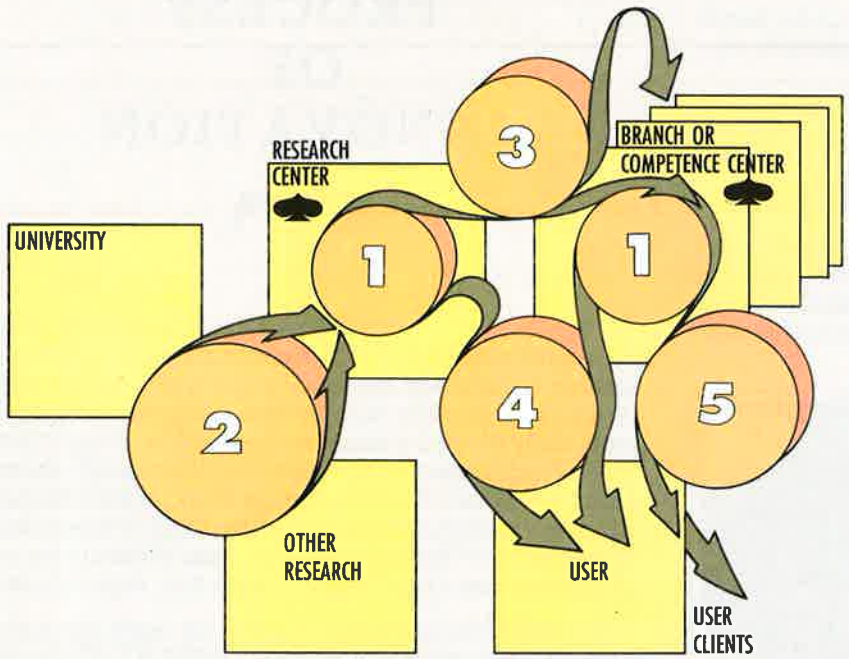
The first two are functions of creation:

- through in-house development, carried out by Group research centers, competence centers or branches;
- through research projects undertaken jointly with universities or corporations.

The following are three examples of "creative innovation" by the Group:

- CAP GEMINI AMERICA is developing an expert system aid for corrosion engineers in oil fields. This diagnostic system, the Downhole Corrosion Advisor, will select and perform economic analyses on the desirable combinations of metals, coatings and inhibitors that can be used to minimize corrosion of oil-field systems at a given site. It will also display all environmental conditions in which those combinations might ideally be applied. The system will reduce the need to replace failed tubing and cut the amount of production downtime.
- PANDATA, one of the two Group companies in The Netherlands, is affiliated with five industrial corporations and three universities to develop a generalized method for allocating resources or scheduling tasks (the DISKUS project: Dynamic Interactive Scheduling and Knowledge Utilization Systems). This method, which makes use of the techniques of artificial intelligence, should be able to be used by non-specialists. PANDATA is currently implementing this innovative approach to production programming in heavy industry and for the computerization of vehicle routes. In addition, it is going to prepare several prototypes for evaluating DISKUS in an actual environment. The prototype systems chosen are programming the installation of various networks in the construction of a building, and production scheduling for a line of food products.
- Recording of an individual's medical record in the chip of a "smart card" could solve a major problem of medical data management. Called the "Biocard," this wallet-sized medical file would be the exclusive property of the bearer. Only an accredited practitioner possessing the appropriate access codes would be able to view the card's contents and enter medical information into it. Medical confidentiality is thus guaranteed. After having studied the concept's feasibility, CAP SESA REGIONS is now participating in the establishment of a large regional medical information network in northern France.

The Innovation Process in the CAP GEMINI SOGETI Group
(simplified diagram)



1. In-house development
2. Research project with a university
3. Informing and training the branches and competence centers: assimilation, documentation, etc.
4. Application: pilot project with a user.
5. Internal development carried out by a user with Cap Gemini Sogeti's participation.

The next two functions involve the process of dissemination of new developments among potential users:

■ on one hand, through the transfer of research centers' know-how and knowledge to the CAP GEMINI SOGETI operational units. There are a number of channels for this transfer: systematic, regular information through bulletins describing current operations (*Technical Newsletter* and *Innovaction*), publication of research results, promotion of these results by means of presentations and demonstrations, individual contacts between experts working in the same fields or joint work on research topics and pilot projects;

■ on the other hand, through joint implementation, by a research center and a branch, of a pilot application for a user. Obviously, this implementation is preceded by the drafting of contractual proposals and the exploration of potential applications for the new development. Another possible preliminary step might be the preparation of "technological demos": mock-ups designed to sensitize prospective users to new developments. For example, CAP GEMINI BRA and the Stockholm public transportation corporation have just jointly implemented a demonstration expert system for diagnostic analysis of certain electrical and mechanical failures of subway cars. The techniques employed for interviewing the five experts selected (three experienced repair technicians and two transportation engineers) were based on the KADS method, developed by CAP GEMINI INNOVATION and its associates (see page 17).

The fifth and last function consists of the participation by professionals from the Group's branches in the development of new products together with users' own specialists. The form of the DP service company's involvement can vary widely, depending on the degree of complexity of the new product (or service) and the client company's subcontracting policy. The task itself might involve the addition of functions, via a microprocessor, into a relatively simple consumer item (e.g., a radiotelephone). It might extend to development of an aircraft's onboard software to match the customer's specifications. Or it might require the complete implementation of a complex system which itself constitutes a new service: an electronic telephone directory (CAP SESA, France), videotex access to the yellow pages (PANDATA, The Netherlands), expert system for telecommunications network management (CAP GEMINI AMERICA, USA), etc.

The outline just presented has been intentionally simplified. There are yet other situations in which the Group participates in the dissemination of new ideas:

■ A Group research center directly supplies a customer with a new product: a mobile 3-D vision system for clutch assembly inspection which ITMI delivered to Valeo.

■ CAP SESA's CIM Software Products' Support Center installs the OPT method (Optimized Production Technology) of the Scheduling Technology Group Ltd. in the production units of its client companies.

■ And, in a broader view, the Group's professionals work with users to implement new applications which invariably embody new approaches. By the very nature of their jobs, these professionals are accustomed to using their imaginations to solve the novel problems which they and their clients encounter.

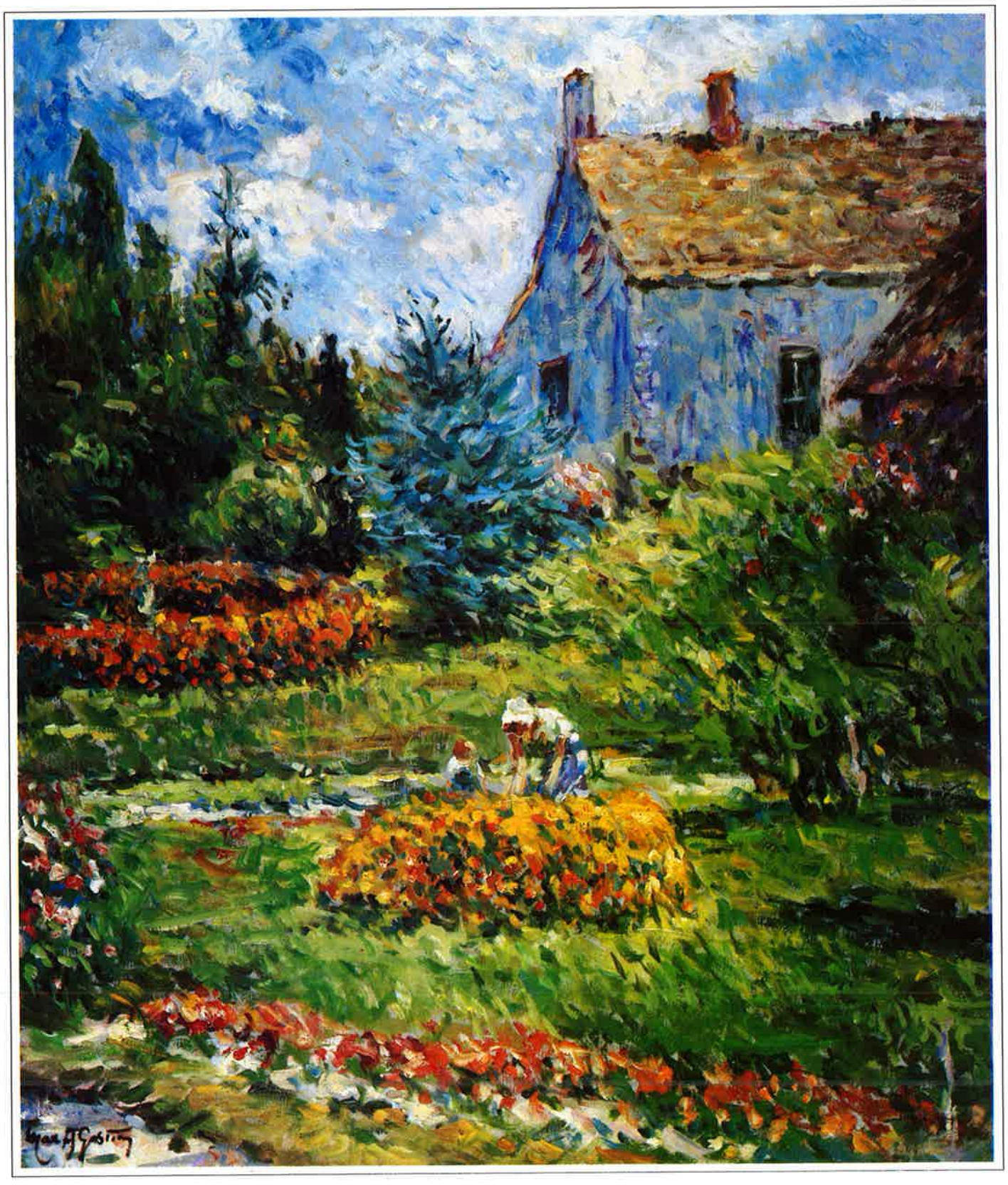
For the CAP GEMINI SOGETI Group, the cost of creating new techniques, methods and tools represents some six percent of annual sales. This figure includes the cost of in-house developments, as well as research projects cofinanced by CAP GEMINI SOGETI (as is the case with all opera-

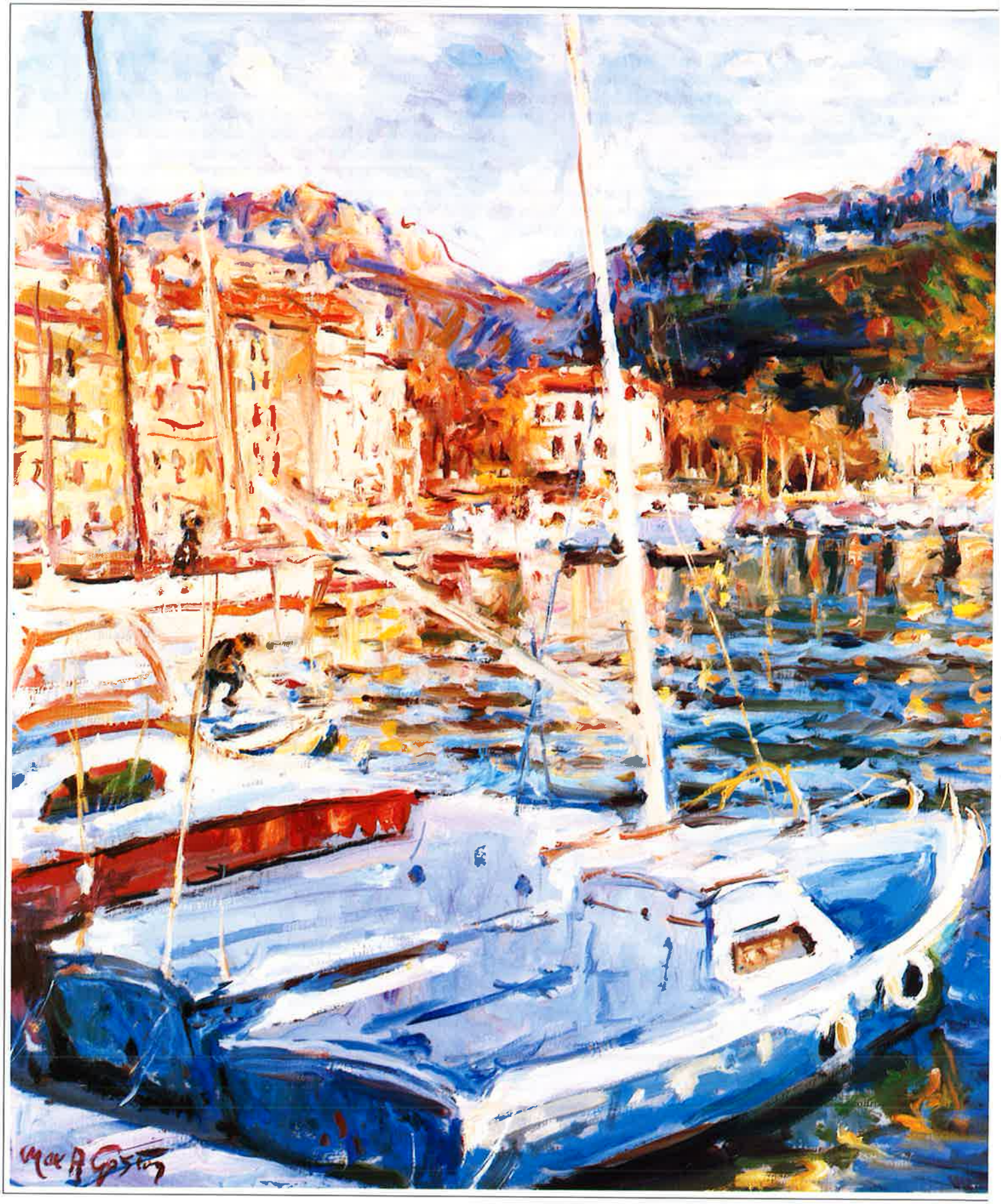
The 7 Phases in the Development of New Software Technologies
(example: expert systems)

	GENERAL CASE		EXPERT SYSTEMS
PHASE 1	Emergence of basic idea	1963	Intelligent assistance
PHASE 2	Concept (conference papers, demonstrations)	1973	Knowledge base
PHASE 3	Testing in laboratory setting	1978	Expert system products
PHASE 4	Utilization outside laboratory	1982	Outside use
PHASE 5	Beginning of general use	1986	Operational applications
PHASE 6	In use by 40% of users		
PHASE 7	In use by 70% of users		

tions undertaken under the aegis of the ESPRIT and EUREKA programs). Unlike that of its industrial counterparts, the Group's investment does not yield products whose sale will generate future revenue. Nonetheless, the rewards for this outlay are substantial, as we shall see.

Active participation in the creation and dissemination of new technologies is the best way to gain mastery over them before they come into widespread use. Possession of this advanced expertise is very important in a realm so technically sophisticated and so intangible as that of DP applications. During the drafting of a client firm's strategic plans — in which IT often plays a key role — this lead enables us to estimate which new techniques the client can rely upon within the scope of its plan. As new systems are developed, it also allows us to anticipate the real advantages to be derived from one new development or another, as well as projected performance levels, costs and times. And, finally, it yields the methodologies required for undertaking and efficiently completing major systems design, implementation and integration.





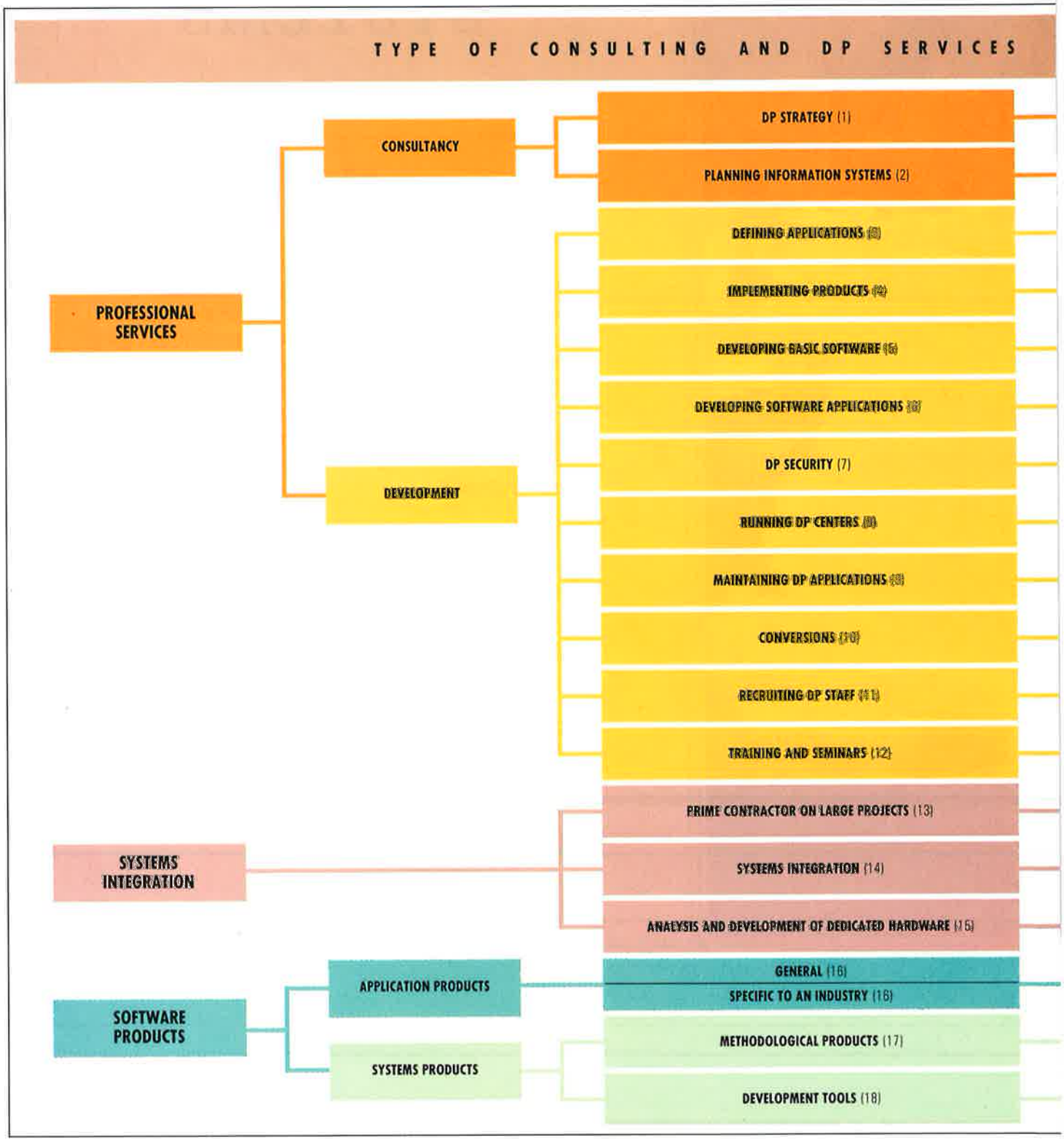
DEVELOPMENT OF INFORMATION SYSTEMS

The bulk of a DP service firm's activity is focused on the implementation of information systems. DP applications may be compared to manufacturing equipment, as they both participate in the creation of goods and services. Obviously, the "fabrication" of such widely-used objects as information systems is putting a lot of people to work. And it is primarily for this reason that the DP service sector is undergoing such strong growth.

The tasks performed by software service professionals relate either to the entirety (or specific segments) of this fabrication process, or to any other target embodying DP resources and their operation. An extensive list of services offered by the CAP GEMINI SOGETI Group may be found on the chart below. These services cover virtually every requirement for the "life" of an application.

In fact, it is customary to define an application's **life cycle** as the interval of time between its conception and its replacement, encompassing the events marking each stage of this cycle: design, specification, coding, testing, operation, conversion, etc.

The life of management applications is tending to lengthen due to the growing difficulty of replacing them, a difficulty itself caused by their interdependence with other applications and with telecommunications networks. Conversely, the lifetime of software "embedded" in industrial products is tending to grow shorter due to the acceleration of product turnover. The life cycle of an information system may thus vary from a few to fifty years.



"Computerization is translation: translation from vagueness into pure form." This concise formulation, from Bernard Lorimy's book, *Data Processing : Instructions For Use*, expresses the reality in which DP professionals are immersed throughout their careers. There is a striking contrast between the general, social and changing (with time, for example) nature of users' needs and the absolute rigor of the code which controls computer operations.

The path to be traveled in translating "vagueness" into "pure form" has been subdivided into numerous phases, varying in accordance with the methodologies employed.

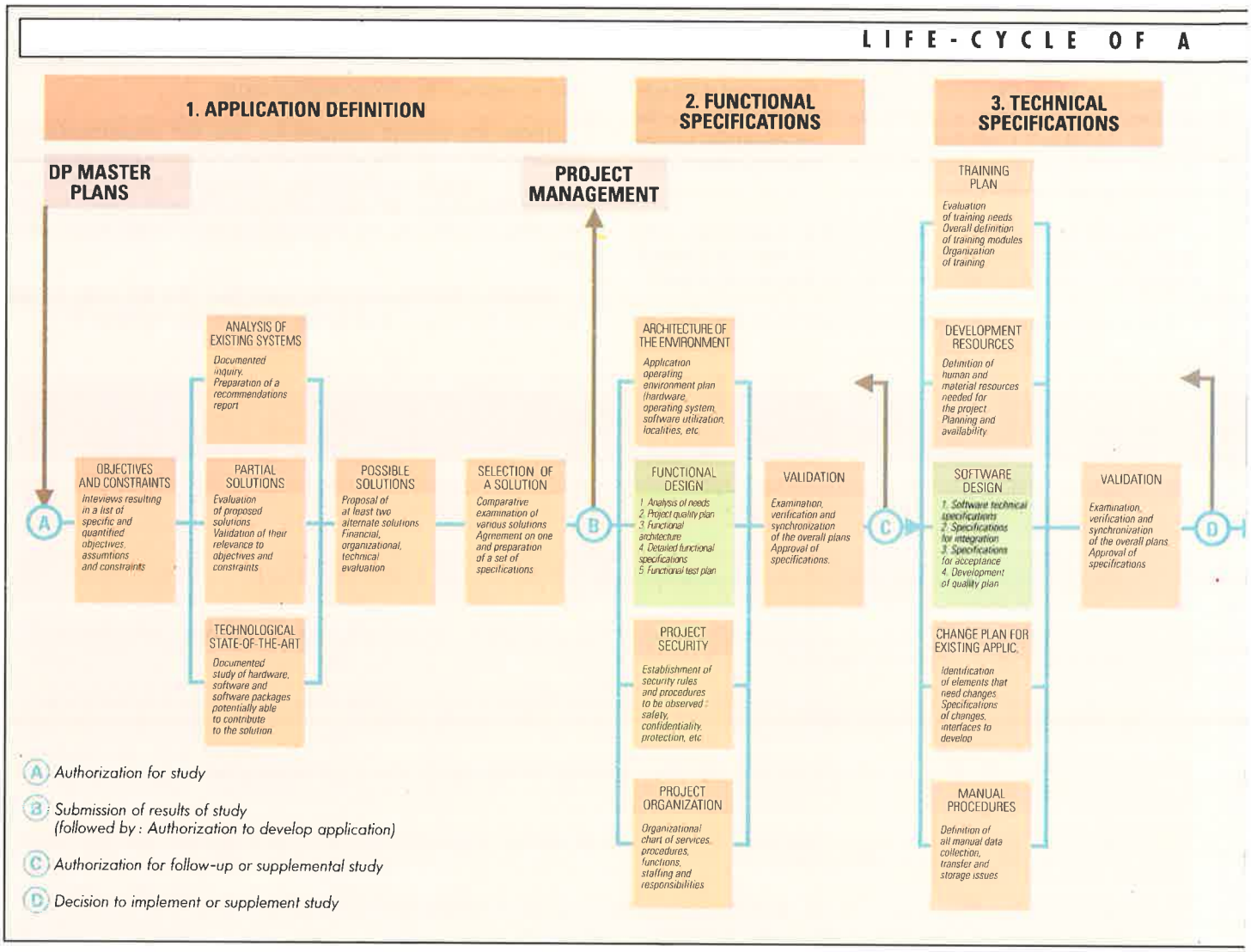
For purposes of clarity, this section has been divided into three phases. In chronological order, they would be: expression of requirements, design and implementation. Contrary to custom, however, the logical order of our presentation is the reverse of its chronological order.

There are several reasons for this: the implementation phase is the most difficult one; its smooth progress generally requires changes to previously-developed plans; presentation of this phase casts light upon subsequent stages; implementing conditions are essential items of initial input data, etc.

Wasn't it Paul Valéry who said that "the full-scale battle won on the map is lost in the detail of the fighting"?

OFFERED BY CAP GEMINI SOGETI

1. CAP GEMINI SOGETI assists businesses and government agencies in making the best use of current and future information processing techniques.
2. Assistance is offered in planning for investments in information systems: medium-term requirements, DP master plans, setting priorities, optimization of systems.
3. The Group provides consulting services and/or conducts studies prior to the development of DP systems or applications. This generally involves the following areas: specifications; advice on methodology; choosing equipment, software packages, new technologies, etc.
4. CAP GEMINI SOGETI helps its clients to implement new products or techniques and, at their request, undertakes adaptations, modifications or specific developments that they would like implemented on software products they are using or are planning to acquire.
5. The development of system software includes the following tasks: specifying software functions and interfaces with existing systems, defining criteria of portability and performance, writing and debugging programs, testing, editing documentation, etc.
6. Developing a software application involves analyzing user needs, defining functional specifications, setting up a team, managing a project, conducting special studies, writing and editing programs, training users, implementing software and formally delivering it to the client.
7. To ensure systems security and confidentiality, the necessary procedures and arrangements must be designed for the physical protection of the facility, the security of files, control of access to information, data encryption (CAP SESA'S SETH 25 system), the restart of DP centers following accidental interruption, etc.
8. Consulting and technical assistance in computer operations covers a wide range of functions from defining the organizational procedures of a DP center to running a computer room. These tasks include auditing operations, training, consulting and technical assistance in the implementation and use of products. Such tasks may finally amount to complete responsibility for operating the DP center.
9. Maintaining DP applications refers, on the one hand, to consulting activities (help with the implementation of required technical and administrative procedures); on the other, to assistance with the actual maintenance tasks themselves.
10. Converting software so that it will operate on a different system (hardware and/or operating systems) requires highly specialized tools. CAP GEMINI SOGETI uses specialized methodologies, computerized planning tools and translators.
11. The Group assists its customers in analyzing staff requirements and in selecting and recruiting appropriate candidates for the various positions within a DP department: design, development, operations, technical support, maintenance, etc.
12. The training provided by CAP GEMINI SOGETI is targeted to both DP users and DP personnel (managers, development staff, operations staff). Several forms of training are available: seminars, inter-company or single-company classes.
13. The Group assumes responsibility for carrying out large projects by taking on the following tasks: definition of needs, functional specifications, consultation with possible sub-contractors, project management and administration, technical coordination, definition of systems architecture, software development and implementation, software and hardware integration, acceptance of the system, follow-up and maintenance, etc.
14. CAP GEMINI SOGETI may undertake a complete DP solution for a customer by integrating standard hardware and software, or by carrying out specific developments that include responsibility for functions, performance and delivery dates.
15. For the design and development of specialized equipment, the Group has at its disposal the necessary plants and teams noted for the quality production of their telecommunications systems (front-end systems, packet switching equipment, exchange and distribution buses, etc.).
16. CAP GEMINI SOGETI's range of generic or industry-specific application products makes it possible to respond to users' needs with the most economical solutions available : Standard Application Modules (SAMs) covering the major business applications, MULTITEL videotex monitors, production and financial management software products, etc.
17. Development support tools feature the MULTIPRO software engineering system and, for conversions, the INFOLIB estimating and scheduling tool, plus a complete range of translators.
18. CAP GEMINI SOGETI offers its clients software development methodologies that have been developed by its own subsidiaries. The Group assists its clients in implementing these methods (some of which are supported by the MULTIPRO and SDW software engineering systems).



IMPLEMENTATION

In the implementation phase, specifications developed during the design phase are translated into fully-tested programs. These programs are then run and maintained. Program instructions are written — or "coded" — based on detailed implementation specifications. Finally, the programs are integrated until they form the complete system, ready for acceptance by the user.

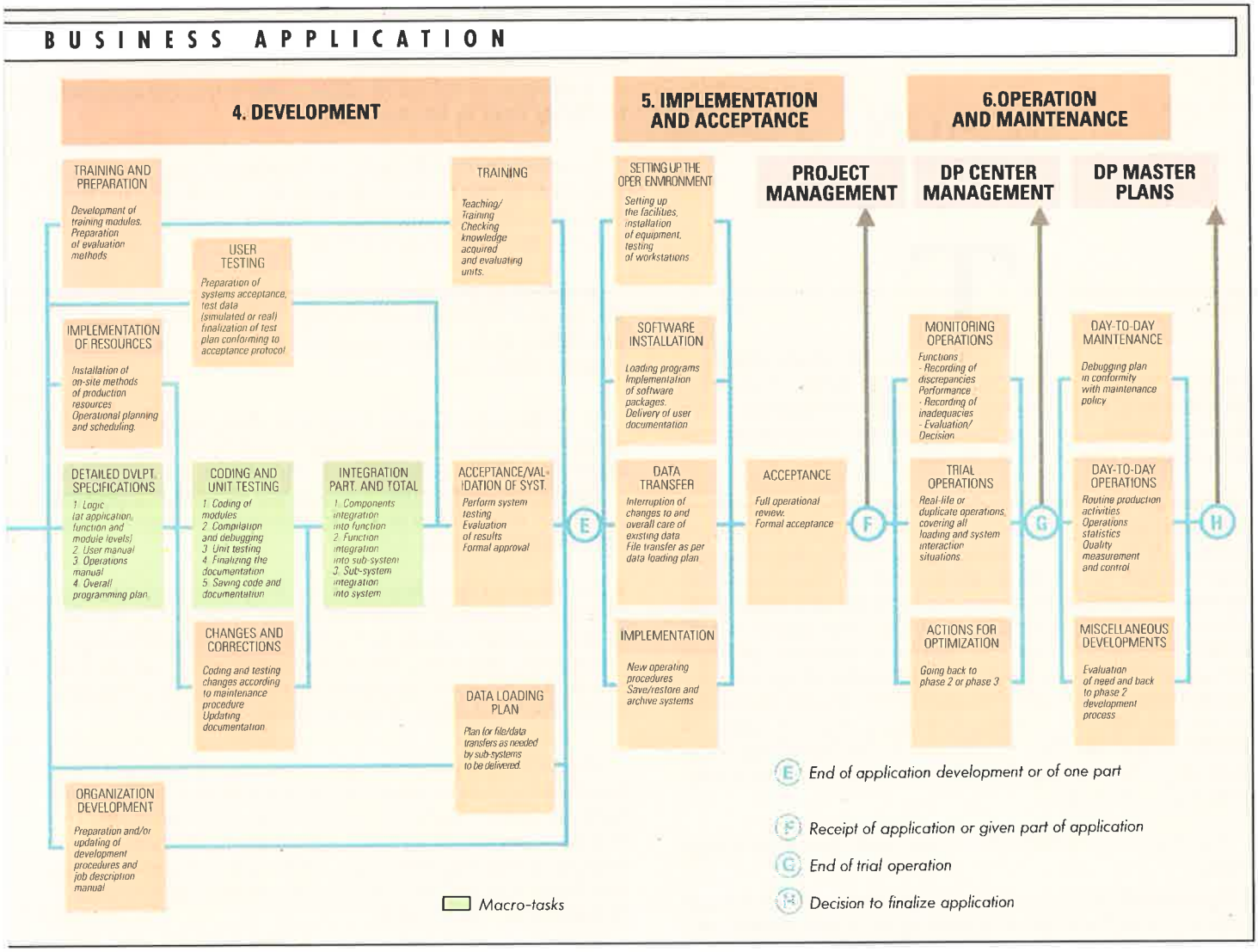
The diagram (above) describes the life cycle of a management application as structured by the EXPERT method (a development management method designed and used by CAP GEMINI SOGETI).

Successive phases — including the implementation phase — are subdivided into "macrotasks" that in turn are broken down into "activities." The result of each activity is entered into documents like those shown in the diagram. These tasks involve only logical types of elementary operations which in no way prejudge the operational organization to be set up for each project on the basis of its specific characteristics.

Individual cases are so diverse that there is no single universal, or even widely-used, methodology. In fact, applications, environments, the wishes of end users and the backgrounds of implementing experts are by nature variable. As a result, coding time — which on average accounts for one-quarter of total design and implementation time — can vary from 10% in the case of a large project to 80% for a spreadsheet application on a personal computer!

Also available is a generous array of technical implementing tools: code generators, high-level languages, subroutine libraries, syntax analyzers, test data generators, etc. Our observation concerning the diversity of projects is equally applicable to tools. One reason why "automatic programming" is impossible under the current state of the art is derived from the contrast evoked at the beginning of this section. Users' needs are expressed in the language of their particular field, whereas code is written in inflexible computer language. Practically speaking, it is not possible for some "super language" to cover both realms at once.

The little diagram opposite (from an article by MIT researchers Rich and Waters in the Journal of the IEEE: Institute of Electrical and Electronic Engineers), illustrates what we have just said, using accounting as an example. The manager expresses his requirements in general terms. The accountant supplies a more detailed list, but one couched in the jargon of the accounting world. The accountant being unfamiliar with



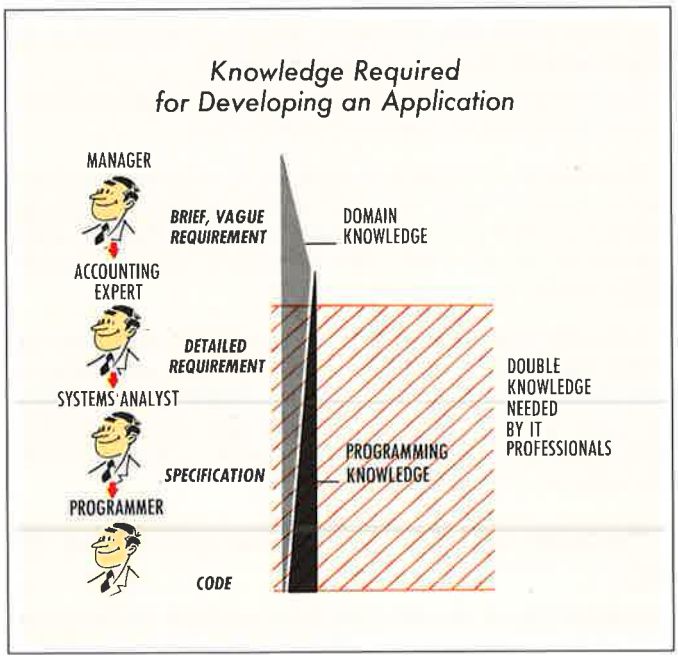
computers, it is up to the IT expert to make the "translation." The diagram shows that, throughout the conduct of their work (although to a lesser degree in the implementation phase), IT experts must possess dual expertise: in their own job, and in the user's. And one may easily deduce from the above that IT expertise includes theoretical and practical familiarity with a large number of tools and methods.

The productivity of implementation operations can vary by a factor of one to ten depending on the choice of tools or the technicians' familiarity with specific techniques employed. The cost of corrective maintenance or, more generally, the quality of the finished product, can also vary over a wide range.

For these reasons, confirmed by the results of its own research, the CAP GEMINI SOGETI Group concluded that the basic lever of success was discipline in all phases and in all its forms, as set forth in the Group's Quality Plan. Simply instructing a project manager to apply a given development management method has proved to be inadequate. The quality of an implementation should not be assessed on the basis of final system tests alone because the user's expectations are broader than that. In particular, they include:

- supply of products and services as per the client's specifications;
- smooth completion of operations to meet contract costs and deadlines;
- observably high quality of operations and results;
- consideration for environmental constraints and compliance with the user's technical and organizational practices.

CAP GEMINI SOGETI established its Quality Plan to meet these expectations. This plan has its methods, of course, but it includes even sterner demands involving special training of professionals at all levels of the Group's structure. Years of effort are needed to imbue people with the "spirit of quality."



DESIGN

The design phase consists of the conception and description, in the form of technical specifications, of an information system meeting the user's requirements. In turn, it is divided into two sub-phases : systems analysis and software design.

Although logic dictates that the specifications expressing the user's needs be drawn up before technical solutions are devised, it is not uncommon for unanticipated technical opportunities to condition an application. Even more frequently, designing the solution leads to changes in the original specifications: perhaps because they conceal incompatibilities uncovered only by technical analysis, perhaps because a minor change can lay the groundwork for a simpler or safer solution. The development of information systems is an iterative process. Technical realities and the need for absolute rigor can lead to changes in functional specifications up to the moment the system is launched...and sometimes even afterwards.

The major technical decisions are made during the design phase:

- off-the-shelf solution (software product) or tailor-made system. The software product is suitable for rule-bound, routine or universal applications: word processing, standard business, housekeeping routines for DP center operations, technical calculations. The made-to-order approach is the only reasonable solution in most other cases, particularly insofar as it does not exclude the possible use of "standard modules" shared by several implementations;
- system architecture, allocation of processing resources, hardware and operating system types;
- network configuration and selection: public network, access to value-added network services, creation of an in-house network, local area networks, etc.;
- data architecture, with a greater or lesser degree of distribution, database management system type.

Depending on the area of application, other basic technological choices might be made during system design, e.g., microprocessor power (16-bit or 32-bit), production management technique (OPT, MRP, KANBAN), hardware redundancy levels, etc.

A Quality Assurance Plan for each project is also drawn up at this level. This plan is based on a project development methodology such as CAP GEMINI AMERICA's PROJECT QUALITY SYSTEM, PANDATA's SYSTEM DEVELOPMENT METHODOLOGY, CAP GEMINI DATA LOGIC's LOGIC METHOD or CAP SESA's EXPERT.

The Quality Assurance Plan generally contains three sections:

a) definition of the life-cycle best adapted to the job at hand. The life-cycle type (EXPERT, SDM, etc.), the phases involved and the documentation generated to confirm the execution of each task are selected and catalogued. These documents bear sole witness to actual production because — in contrast to industrial output — there is no tangible part or component to be displayed;

b) selection of tools and techniques to be used — analysis and prototyping tools, languages, etc. — including relevant manuals and forms. Also stipulated is the mode of representing data structure and data flow;

c) selection and description of all components required for project management: project management method, scheduling system, risk assessment formula, workload distribution criteria, etc.

In drafting the Quality Assurance Plan, consideration is given to the user's technical environment. For example, users might request the adoption of some of their own methods.

Finally, we shall mention two of the important problems examined at this stage of development, due to their increasingly-sensitive nature.

- The first is security. Specialists in DP security must make an in-depth analysis of every vulnerable point in the system. Measures must be designed to minimize risk of accident (fire, breakdown, data entry and transmission error, operational mistakes capable of causing the destruction of files, etc.) and felony (theft, sabotage, fraud and misappropriation).

Physical access must be controlled: by reinforcing doors, by screening visitors using conventional methods (photocell barriers, badge readers) or more elaborate but costly recognition systems (fingerprint, palmprint). Data and networks must be protected, either by a password management system, by access-authorization management or by encryption of transmitted information.

The vulnerability of businesses is probably destined to become more acute, due to the increased concentration of DP resources and networks. Large organizations have consequently drawn up security plans and have established well-funded, specialized security departments at the highest level.

- The second is "user-friendliness" or ease of use. Naturally, "user interfaces" are planned and specified during the design phase. These specifications stipulate the contents of menus, messages and displays, as well as the logic of man-machine dialogue. We have developed techniques for tackling this problem, combining human engineering with detailed analyses of display states and all possible stages of communication. This work, which accounts for an increasing proportion of design time, is especially justified by the fact that end users spend one-third of their time, on average, identifying and correcting manual errors, a source of frustration and inefficiency.

At present, design of the user interface is the very first of the design tasks carried out. Requirements for ease of use must be expressed in the form of functional specifications, just like any other system specifications.

Another conclusion is that "automatic programming" cannot exist within current state of the art technology, partly because of the contradiction already noted at the beginning of this section. Namely, that users' needs are expressed in their individual professional languages, while code is written in a strict data processing language. And in practical terms, it just isn't possible for a "super language" to cover all specialized areas at the same time.

EXPRESSION OF USER REQUIREMENTS

The phase leading up to the idea of creating a new application and expressing the requirements it must meet cannot be described in the form of a logical sequence of actions. The idea might envision the rejuvenation of an application which has grown top-heavy from too many maintenance operations, or the installation of a network providing the infrastructure for a new service. It might just as well be the response to an unexpected need as the product of a precise, documented step contained in a company's DP master plan.

Techniques for information system planning have evolved with changing technology and as a function of the changing corporate environment. In an era when applications were mainly of a bookkeeping nature, data processing offered no apparent strategic capabilities. "Expression of requirements" boiled down to a set of interviews between appropriate department managers and "the computer man." Times have changed! Corporations are competing in a global market, strategies are carefully planned, new technologies are viewed as factors of competitiveness. Fresh requirements flow out of strategic planning, which now requires the intervention of IT experts. A mistaken perception of the times or the conditions in which new developments are to become available can make applications technically or economically infeasible.

The methodological problem posed, then, is of setting up the conditions for successful, technology-based strategic thinking. The starting-point is the diagnostic of the firm's strategic position: what criteria of excellence must be mastered in order to increase customer numbers, loyalty and good will? How and where — not only within the corporation, but among its suppliers and in its distribution channels — to develop the added value that the customer buys? These key points must be identified, together with the corporation's strengths and weaknesses, in order to obtain the necessary points of reference. Still, this "strategic diagnosis" phase is only a preliminary move. The crucial step remains: figure out just how the use of information technology can apply leverage at these key points in light of identified strengths and weaknesses of the business.

In many industrial sectors, the competitive struggle revolves around prices, in which case productivity is of strategic importance, and IT plays a major role. But productivity has its limits, even if there is still wealth to be found in the integration of a company's functions or in its relations with its environment. Faced with these limitations, a company might try product differentiation or quality competition, by employing superior technologies. Or a corporation might plan to reduce global costs while delivering higher added value; thus an offer of products increasingly accompanied — if not replaced — by services.

The opportunities of "strategic computerization" must be taken under systematic review, regardless of whether they are targeted to an aspect of productivity, corporate information flow or the content of a company's market offering. Selection is then performed at the company's highest decision-making level, supported by expert technical opinion. One point is paramount: an advanced technology should not be implemented unless the advantage it yields is highly valuable. Why? If a competitor can make the same move, but at a later moment, when the technology is much less expensive — since the cost of newly-introduced hardware tends to fall rapidly — the initiative may prove to be inopportune.

It should also be pointed out that systematic examination of the competitive advantages derived from use of new information technologies is not a universal surrogate, either for the definition of corporate strategy (because many other factors must be taken into consideration) or for the expression of overall DP requirements (because other goals might be pursued). Reinforcement of strengths, reduction of specific risks, maintenance of current competitiveness and effectiveness of internal organization: all are distinct approaches, all are the subject of studies launched by corporate management when the need arises. The results of these studies are taken into consideration for the drafting of master plans or, on a more modest scale, specifications for new applications. One obstacle sometimes encountered is a lack of awareness of the importance of technology and, more specifically, of IT expertise. It is impossible to overemphasize the importance of the technical feasibility of projects, from the standpoints of the availability of theoretical solutions and the availability of practical skills required for project implementation. These questions must be first dealt with during preparation of specifications, then reexamined during the design phase.

This is the approach followed by CAP GEMINI SESA DEUTSCHLAND, which is conducting several projects for VOLKSWAGEN, designed to improve assembly line productivity: a global information management system in the plants, and a supply management system (simulation, order start-up). The overall project should be completed by the beginning of the 1990s.

In this regard, we should add that problems encountered and technologies to be implemented depend greatly upon the economic sectors involved. It is thus essential that IT expertise, which comes into play at the moment that requirements are expressed, must be accompanied by profound familiarity with the economic sector in question.

In a broader view, work at any stage in the development of information systems is inefficient unless there is full communication between the user and the information technology expert. The translation of corporate needs into working programs is intolerant of ambiguity and omission. The software professional must go the extra mile to see that clarity and completeness are attained.

INDIVIDUAL EXPERTISE

Individual IT expertise encompasses all the qualities of human intelligence needed to solve a problem through the application of information technology. It is the essential link in the process of making computer resources usable. It includes the know-how and experience of people whose job is to implement systems and perform all associated services, such as consulting and training.

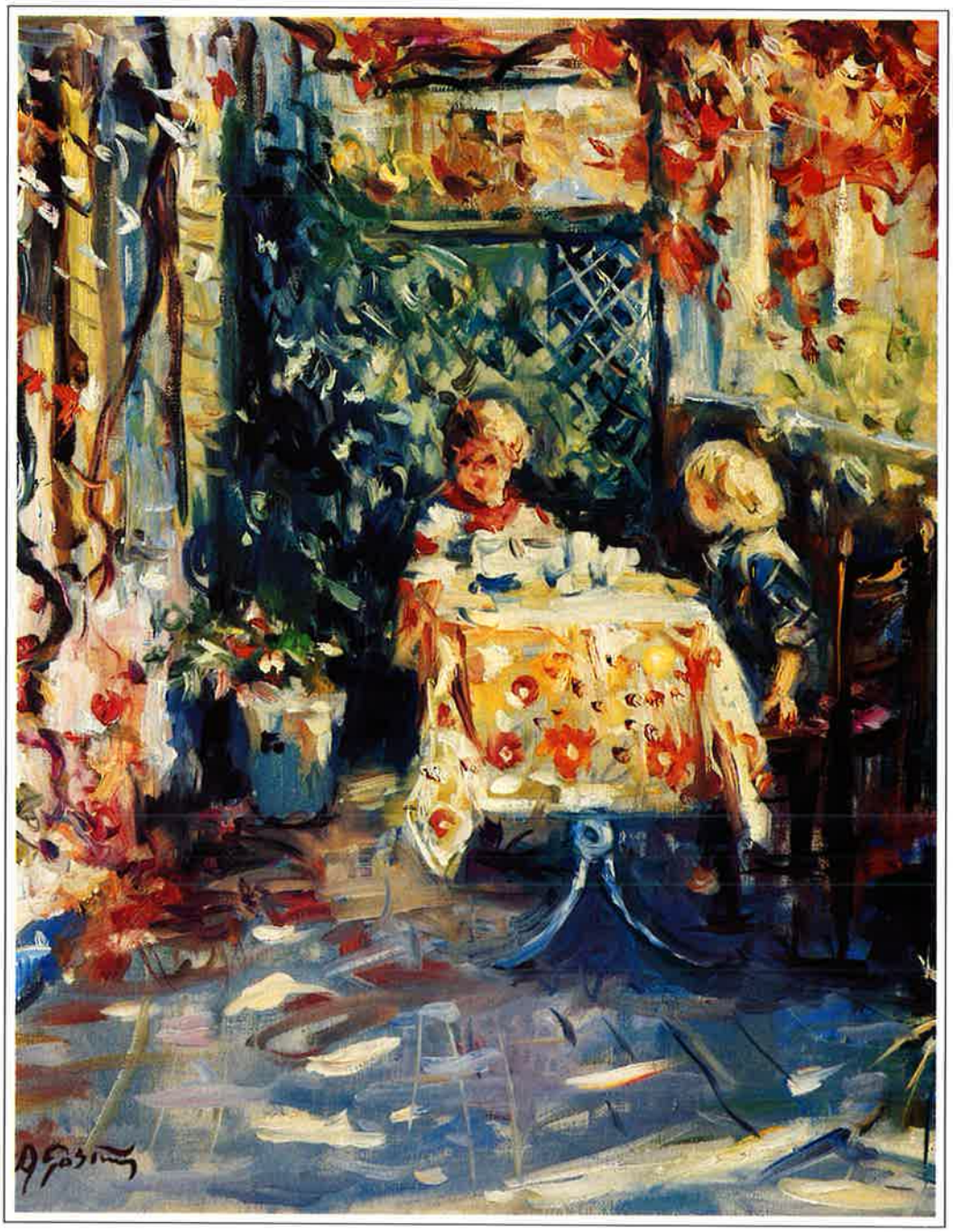
IT expertise is concentrated throughout the world in the hands of one and one-half million people, the vast majority of whom work for end users, DP service firms and hardware manufacturers. Most IT career candidates are looking to the software service sector: in France, for example (according to a study published by *Le Point* in January 1989), 14,000 of the 19,000 DP professionals seeking a new position in 1988 were recruited by computer services companies. In the United States, projections indicate that two-thirds of all DP experts hired between now and 1995 will be employed by the computer services sector.

Long shrouded in mystery, software is no longer a puzzle to the general public. It has been described and explained in innumerable publications and the number of users has grown enormously. The threat of a lasting shortage of data processing skills has not vanished, even though needs have shifted in relation to technological developments.

According to an American expert, Prof. Robert A. Zawacki, a 76% increase in the workforce of analysts will be required in the United States between now and the year 2000, while four of the five professions slated for the strongest growth fall within the data processing field. The Electronics Industry Association claims that in 1990 there will be a shortage of one million software professionals in the American space and defense industries alone. An article published in the March 1988 issue of *Computerworld*, addressing a survey of DP managers, listed the following points as the chief causes of this shortfall, in decreasing order of importance:

- speed of technological evolution and lack of specialists familiar with new technology;
- inadequacies in the educational system;
- applications and hardware specialization, sometimes exceeding the capacity of the pool of trained technicians.

Paradoxically, basic training in the disciplines of data processing is now — at least in appearance — globally adequate. As we point out in the following pages, however, far more than entry-level training is needed to meet current and projected needs.



INITIAL TRAINING

University course offerings in the information technologies have proliferated, undoubtedly because of the intellectual content of the subject matter. The great majority of institutions of higher education — universities, colleges, engineering schools, technical schools — are now training young people in data processing. In recent years, computer science departments have been established in American universities by splitting them away from the electrical engineering departments in which the subject had previously been taught. The Stanford University catalogue alone lists 155 computer-related courses, as shown on the page opposite.

These schools award degrees at a number of levels, and graduates can begin their professional careers as programmers, analysts, design engineers, and so on. The average educational standing of entry-level employees is rising. In France, for example, a study published by *Le Monde Informatique* showed that the proportion of university graduates (e.g., engineers) among new hires rose from 40% in 1979 to 52% in 1986. There are good reasons for this rise, the most important being the increased complexity of the work to be done. But young people with more modest initial training can succeed brilliantly in the software and service fields if they have the necessary character traits (see the following section).

This is even truer as knowledge acquired on the job can quickly replace book learning which soon becomes obsolete or inadequate.

An example of a university curriculum in Computer Science in the U.S.: the Computer Science Department of the School of Engineering at Stanford University in California.

The Computer Science Department of the School of Engineering of Stanford University has a faculty of no fewer than 60 professors of all kinds, supported by a virtual army of part-time teaching assistants.

Five large computer systems are available to all students. Each of these systems is a host on the nationwide ARPAnet network, and Stanford, in turn, can access all other computers on this network. These resources are available for both teaching and research purposes. There are also 11 scientific minicomputers, approximately 70 workstations, 40 artificial intelligence machines and less powerful computers.

This impressive arrangement serves three broad categories of students:

1) Undergraduates coming from high school. They are enrolled in a 4-year program leading to a Bachelor of Science degree (B.S.). Those who wish to specialize in information technology select their courses to prepare for a B.S. degree in Computer Science or in Computer Systems Engineering. The first of these curricula focuses essentially on software issues, the second also covers electronics and hardware issues.

2) Graduate students (holders of B.S. degrees who are continuing their education in Computer Science. Graduate students prepare either for a Master of Science (M.S.) degree, which is usually obtained after six quarters of study following the B.S.; or for a Masters' degree in Engineering, which requires a thesis and which normally takes two years; or for a Doctor of Philosophy (Ph.D) degree, which requires a minimum of three years of graduate study including some teaching, a serious research project, with a dissertation crowning these efforts.

3) Students who are studying for degrees in other departments, whether or not they are part of the School of Engineering. In the School of Engineering the curricula of the Departments of Electrical, Civil, Industrial Engineering and Materials Science all include a high proportion of courses offered by the Computer Science Department. An M.S. in Civil Engineering, for instance, requires course work in Computer-Aided Civil Engineering, Expert Systems, Computational Mechanics and Manufacturing/Construction Automation.

Courses offered by the Computer Science Department

1) Introduction
for non-majors (8 courses)
- Using Computers (3 courses)
- Programming in FORTRAN
- Programming in Prolog
- Programming in LISP
- Introduction to UNIX and C
- Computers and Language

2) Undergraduate (34 courses)
- Computers: Their Nature, Use and Impact
- Introduction to Computers (for non-technical majors)
- Programming Methodology
- Programming Abstractions
- Theoretical Foundations for Computer Science
- Introduction to Computer Programming (Honors)
- Programming Methodology and Abstractions (Accelerated)
- Programming Paradigms
- Introduction to Computer Science (2 courses)
- Introduction to Computer Systems and Assembly Language
- Programming
- Computer Organization
- Artificial Intelligence: Concepts and Applications
- Applied Linear Algebra
- Numerical Methods
- Fundamentals of Numerical Computation
- Concurrent Programming
- Compilers
- Compiler Project
- Introduction to Databases
- Introduction to Automata and Complexity Theory
- Introduction to NP Completeness
- Logic and Automated Reasoning
- Discrete Mathematics
- Discrete Structures and Algorithms
- Senior Project
- Programming Service Project
- Software Project Laboratory
- Microcomputer Consulting
- LOTS Consulting (3 courses)
- Teaching of Computer Science
- Independent Work

3) Undergraduate and graduate (34 courses)
- Logic Design
- Computer Architecture and Organization
- Introduction to Artificial Intelligence
- Declarative Programming
- AI Programming Laboratory
- Expert Systems Application
- AI Programming in Prolog
- Advanced Numerical Analysis (3 courses)
- Operating Systems (2 courses)
- Programming Languages
- Advanced Compiling Techniques
- Computer Networks: Architecture and Implementation
- File and Database Systems
- Software Engineering Laboratory
- Computer Graphics (2 courses)
- Automata, Languages and Computability
- Automated Deduction and its Applications
- Introduction to Programming Language Theory
- Concrete Mathematics
- Sorting and Searching
- Arithmetic and Combinatorial Algorithms
- Introduction to Combinatorial Theory
- Basic Tools in Computer Systems Modeling
- Computer Applications in Medicine
- Computer-Based Medical Decision-Making (2 courses)
- Concepts of Text
- Computational Linguistics
- Computational Models for the Semantics of Natural Language
- Computational Models of Discourse

4) Primarily for Graduate Students (53 courses)
- Departmental Lecture Series
- Programming and Problem Solving Seminar (for Ph.D candidates)
- Recursive Programming and Proving
- Industrial Lectureships in Computer Science – guest lecturers, topics change yearly. This year's subjects are:
  Topics in Computational Geometry
  Communications Security
  Federated Databases
- Processor Design
- Fault Tolerant Computing Systems
- Testing Aspects of Computer Systems
- Topics in Digital Systems
- Autonomous Agent Architecture
- Nonmonotonic Reasoning
- Knowledge and Change
- Planning Methods in Artificial Intelligence
- Introduction to Robotic Manipulation
- Introduction to Computer Vision
- Robot Reasoning
- Computational Models of Cognition
- Applying Cognitive Psychology to Computer Systems
- Advanced Seminar in Perception, Cognition and Human Performance
- Topics in Artificial Intelligence (Advanced)
- Statistical Computing
- Topics in Numerical Analysis (Advanced)
- Distributed Systems (2 courses, one of which is a project)
- Programming Language Design
- Topics in Compilers
- Computer Networks: Modeling and Analysis
- Theory of Database and Knowledge-Base Systems
- Distributed Databases
- Topics in Programming Systems (Advanced)
- Mathematical Theory of Computation
- Introduction to Complexity Theory
- Algebra for Computer Scientists
- Reasoning about Knowledge
- Analysis of Concurrent Programs
- Advanced Computability and Complexity
- Topics in Theory of Computation (Advanced)
- Analysis of Algorithms
- Probabilistic Methods in Combinatorics
- Combinational Algorithms (Advanced – 2 courses)
- Combinatorial Optimization
- Probabilistic Algorithms
- Lower Bounds
- Parallel Computation (2 courses)
- Computational Geometry (Advanced)
- Topics in Analysis of Algorithms (Advanced)
- Medical Decision Analysis
- Phenomenological Foundations of Cognition, Language and Computation
- Interdisciplinary Topics (Advanced)
- Computer Laboratory: Design and implementation of a substantial computer program
- Database Project: Use of database management or file systems for a substantial application
- Independent Project

5) Experimental (7 courses)
- Topics in Knowledge-Based Software Environments
- Parallel Computer Architectures and Programming
- Computer Algebra
- Genetic Algorithms and their Applications
- Topics in ADA Programming
- Matrix Methods in Combinatorics
- Advanced Reading and Research

6) Graduate Seminars
(12 seminars)
- Digital Systems Reliability
- Survey of Research Topics in Artificial Intelligence
- Heuristic Programming
- Readings in Artificial Intelligence
- Rule-Base Expert Systems
- Robotics
- Applied Mathematics/Scientific Computing
- Computer Systems
- Database Research
- Distributed Systems Research
- M.S. Project
- Ph.D Dissertation

7) Sample course

Contents of an undergraduate or graduate course in Computer Networks: Architecture and Implementation
- Motivations and objectives of computer networks
- Overview of network architectures
- Layered architectures and the ISO Reference Model
- Network functions, circuit-switching and packet-switching
- Physical level protocols
- Data link protocols including HDLC and multiaccess link control
- Network control, transport and session protocols including routing, flow control, end-to-end communication and internetworking
- Presentation layer protocols including virtual terminal and file transfer protocols, cryptography, and text compression
- Specific examples and standards are cited for point-to-point, satellite, packet radio and local networks.

THE COMPONENTS OF INDIVIDUAL EXPERTISE

Competence, extensive experience and skill are the terms most frequently encountered in definitions of "expertise." The qualities that comprise individual IT expertise are identical in nature:

Competence must be many-faceted. First, it includes familiarity with the basic techniques of data processing and telecommunications: programming, analysis, testing and validating methods, database management, systems architecture, use of software engineering tools, communications protocols, network architectures, packet switching, etc.

Next, basic competence must be accompanied by specialized knowledge. Expansion of the field of applications and technological development are constantly increasing the number of areas of specialization. Those currently most in demand include data structuring, system architecture, security, project management, knowledge bases, heterogeneous networks, design methods, code maintenance techniques and ergonomics. Still, one should not believe that expertise only in leading-edge technologies is useful. Since there are 77 billion lines of COBOL programming to be maintained at American installations running IBM hardware alone, it is clear just how indispensable "current" skills can be!

The final component of competence involves sectors of activity. The diagram on page 27 shows that IT experts must communicate with users at all stages in the systems development cycle. At the levels of design and expression of user needs, software professionals must be familiar with the user's field of activity and application type. Roughly speaking, there are a dozen major industries, such as finance, manufacturing, trade, telecommunications, defense, government, the DP industry, science, etc. Each of them covers hundreds of standard applications. An appropriate level of competence would involve in-depth familiarity with one sector of activity and at least a dozen standard applications.

Experience teaches how to make effective use of, and to increase, one's knowledge. This is particularly true when a professional is fortunate enough to take part in a variety of projects, which is generally the case when his or her employer is a DP service firm. Within the CAP GEMINI SOGETI Group, a minimum of 7 to 10 years' experience is considered a requirement for promotion to the position of project manager. This time-frame should include participation in a dozen average-sized projects: the experience needed to "scan" an adequate number of cases. The diversity of situations to which experts are exposed enables them to grasp the characteristic features of each case, from the human as well as the technical standpoint, and to take part in the installation of a variety of solutions. Thereafter, experience will help dictate what should be done in a given set of circumstances.

This practical apprenticeship is a prerequisite for the proper exercise of all the skills discussed in this report, whether the practitioner is a systems analyst or a network manager. This is exactly the same as with physicians, lawyers or others who place their expertise at the service of "users" and their virtually-infinite variety of needs and problems.

A group of exceptionally qualified professionals within the CAP GEMINI SOGETI Group has been brought together in the Experts' Club. With 15 to 20 years' experience, they have attained remarkable levels of competence in multiple areas of specialization. Known throughout the Group, they are called upon as consultants in dealing with the toughest technical problems encountered.

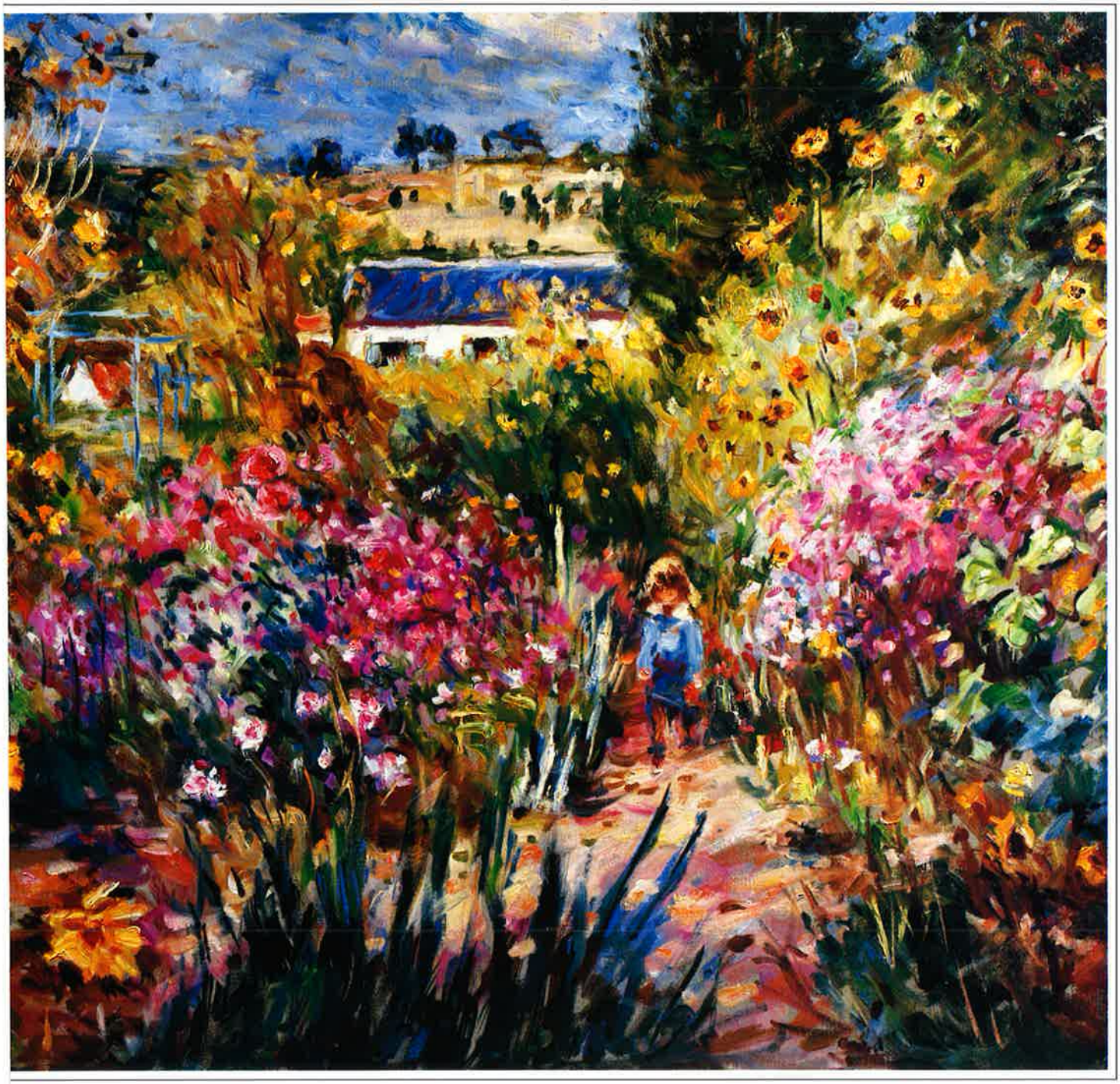
Know-how, the third component of expertise, is actually the sum of four basic qualities:

■ The ability to listen is undoubtedly the first of an IT expert's virtues, as it leads to the identification and ranking of the user's needs. Listening must be attentive and clear-headed. The listener must be able to remember what has been said and to understand the attitudes expressed.

■ The ability to engage in dialogue is a requirement for broadening analysis and for resolving ambiguities. The manner in which this dialogue is conducted should be aimed at preventing the deadlocks that sometimes result from the incompatibility of user demands and the logistical constraints of DP systems.

■ The ability to innovate refers to the capacity to think up new applications and to offer fresh solutions. Creativity is an active element in all stages of the software life cycle, e.g., in the introduction of new technology, in the application of original solutions to problems arising at the operational or technical levels, in the suggestion of additional functions for a given application, and so on.

■ Finally, the ability to get things done is the quality most naturally expected of an expert. The abstract nature of software requires logical thinking and intellectual discipline on the part of professionals. The ability to achieve concrete results — a set of software specifications, for example — is an intrinsic characteristic of IT expertise. An expert must be able to work alone or on a team, implement in compliance with prior recommendations, meet budgeted costs, agreed deadlines



and pledged performance levels. An expert must demonstrate realism, propose solutions which are exactly tailored to requirements, and reuse existing resources whenever possible.

These basic qualities are encountered to varying degrees among all IT professionals depending on the task. In an annual publication on job qualifications, the United States Department of Labor lists the aptitudes required of programmers: logical thinking, precise analytical frame of mind, ease of dealing with abstractions, patience, perseverance, discipline, and the ability to maintain these traits in a tense working environment.

Analysts must also be able to communicate, have a good aptitude for teamwork and the ability to carry out multiple tasks simultaneously. While these profiles might be appropriate for the jobs in question, they are still insufficient in a large DP service firm. To reach the level of expertise set forth in these pages, the professionals in these companies must be able to confront varied and changing requirements. They must possess those qualities of availability, mobility and discipline inherent in the very spirit of the term "service." For these people, service-based duties are mainly characterized by relatively broad independence of action, by the exemplary value attached to their missions, by the obligation of professional confidentiality, and by respect for the client organization's customs and structures.

On the whole, it would appear that IT experts have their own high standards, as shown by the conclusions of a 1987 survey conducted in France (published by *Le Monde Informatique*):

- IT experts' first perception of their work is that "you must always be diplomatic" and that "above all, you have to be convincing."
- 62% responded that "it is necessary to put yourself on the line and to enjoy taking risks."
- In terms of working conditions, the respondents value both their autonomy and the need for teamwork.
- 86% of those beginning their careers are primarily seeking opportunities for personal development.

THE TASKS OF IT EXPERTISE

The table below lists the principal tasks or occupations required at one time or another during the life-cycle of DP applications. And the list is growing longer all the time. One reason is that an increasing workload is turning once-secondary functions into actual professions. In the area of expert systems, for example, this is the case with "knowledge engineers," whose task it is to interview experts and analyze their knowledge and thought patterns in order to specify the expert system under consideration. Another reason is that technical change is rapidly demanding new types of operations. For example, the need to attach as much significance to data as to processing resources has led to the necessity of designing data architectures and managing data as system assets. Thus the advent of the "database manager" and "data analyst" positions. Likewise, the profession of "ergonomist" was born when the design of user interfaces became a major task in the life cycle of applications.

The content of all these IT occupations is also changing with time. A striking example is found in the operation of computer centers. For a number of years we have been observing a progressive "depopulation" of computer rooms. The computers themselves are running more smoothly and reliably in an enhanced environment. Individual computer consoles are being replaced by a single center controlling all machines. Instead of loading tapes and disks, operators now use screen displays to monitor hardware performance, manage malfunctions, balance workloads between individual units and supervise the overall progress of operations. The complex software which gathers basic data and displays needed management information has been installed and debugged by systems engineers. End users have taken over substantial responsibility for running the applications: they check output reports, modify the progress of operations from terminal keyboards, etc. This advanced level of automation and this new allocation of tasks between operators and users can be achieved only if the operations team participates in the design of applications.

New occupations, changing contents: IT expertise is either dynamic...or it is not expertise. Change aside, however, the professions that make up information technology may be classified along three axes:

Summary Table of the Expertise

The Software Industry Occupations

- *dominate information technology: 75% of IT professionals are occupied exclusively or primarily with software;*
- *are extremely diverse in nature, in terms of required knowledge, types of applications and users, marketing resources, assignment sites and methods of exercise;*
- *are basically service occupations: never far from the user, these occupations presuppose a good overall culture, very broad vision, and an excellent ability for dialogue;*
- *are of a highly technical nature; they demand a thorough understanding of complex techniques, which belong to a full-fledged science in the midst of very extensive development;*

MIS Planning and Management – Analysis of Needs *(Occupations linking the IT technologies with a corporation's overall objectives. They involve a twofold culture: that of the corporation and that of information technology.)*	■ *Information Systems Manager* ■ *DP Manager* ■ *DP Studies Manager* ■ *Consulting Engineer* ■ *Consultant* ■ *DP Organizer* ■ *Office Automation Supervisor* ■ *Expert Systems Consultant*
Applications Design and Development *(Occupations including development work. They require broad understanding of both users' needs and DP techniques, in varying degrees.)*	■ *Software Development Manager* ■ *Software Projects Manager* ■ *Projects Group Manager* ■ *Project Manager* ■ *Systems Integration Manager* ■ *Design Analyst* ■ *Systems Architecture Analyst* ■ *Database Design Analyst* ■ *Network Analyst* ■ *Methods and Software Engineering Tools Supervisor* ■ *Chief Programmer* ■ *Programmer-Analyst* ■ *Programmer* ■ *Ergonomics Consultant* ■ *Expert Systems Designer (Cognitician)* ■ *Dialogue and Screen Designer* ■ *Educational Software Designer* ■ *Computer Games Designer* ■ *Technical Documentation Analyst*
Design and Development of Basic Software *(Occupations related to system and utility software, between the DP hardware and the applications software. The technical aspect is paramount.)*	■ *Systems Department Manager* ■ *Operating Systems Analyst* ■ *Database Systems Analyst* ■ *Remote Processing Systems Analyst* ■ *Networks and Telecommunications Analyst* ■ *Systems Software Package Designer* ■ *Telecommunications Software Designer* ■ *Systems Programmer*
DP Systems Operation *(Occupations related to running DP centers and networks. They may be referred to as "production" jobs.)*	■ *Operations Manager* ■ *Operations Analyst* ■ *Shift Supervisor* ■ *Systems Technical Support Supervisor* ■ *Systems Engineer* ■ *Security and Access Control Supervisor* ■ *Database Administrator* ■ *Network Manager* ■ *Network Controller* ■ *Console Operator* ■ *Operator*
Quality Assurance *(Occupations related to research and verification of software quality.)*	■ *Quality Assurance Supervisor* ■ *Quality Assurance Consultant* ■ *Standards Supervisor* ■ *DP Auditor*

■ a hierarchic (or "skills") axis used to rank the basic occupational categories: programmer, programmer-analyst, analyst, engineer, etc.;

■ a technical specialization axis, covering major fields such as systems, operations, scientific DP, basic software, etc.;

■ a functional specialization axis, most prominently featuring software and systems development, but also including research, sales, training, consulting, management, etc.

Professionals increase their expertise and promote their careers by advancing along one or more of these axes. For example, they might choose:

■ specialization in a given technique, involving either an increase in knowledge of software design and implementation or familiarity with a new application field and its corresponding DP tools;

■ enhancement of skills leading to a new job qualification. For example, programmer-analysts tasked with implementing complex processing units must acquire training in systems analysis and program linking. This new knowledge will allow them to become full-fledged analysts;

■ assumption of completely new functions, requiring the acquisition of new know-how. Moving into a management position, for example, presupposes — apart from certain particular talents — specialized learning in the art of group leadership, in techniques for defining and monitoring objectives, in the evaluation of results, etc. These new skills are closely tied to the field in which they are to be applied: leadership of a project team, for example, is quite different from management of a training team.

The richness of content and the dynamic aspects of IT expertise are the chief attractions of the IT professional's job. This is why experts are motivated and find a means of self-fulfillment in their work. Their professional surroundings must present opportunities to do varied types of work, to increase their knowledge and to advance their careers. Large DP service companies offer precisely this favorable environment. No greater diversity is imaginable, whether from the standpoint of application types, techniques employed, development and consulting duties, client size, professional environment, hardware configuration, and so on. And while professional advancement is a direct result of this diversity, it is also encouraged by supplementary training courses and seminars. In these companies, career development can progress through specialization, addition of new skills or change of function.

Naturally, individual advancement is primarily dependent on each professional's own choices, pace, talent and determination. But organizations endowed with "collective expertise" — discussed in the following section — enable professionals to discover prospects likely to satisfy their ambitions.

and Occupations in the Software Industry

■ are occupations in continual evolution; certain specialties vanish, others appear; everyone working in these fields must expect to change jobs several times during his or her professional life;
■ require an increasingly higher level of education, but are not reserved for those who hold the most prestigious degrees; these are professions open to all with a solid education and the desire and ability to continue learning;
■ are not limited to those with technical backgrounds: business administration, finance and accounting specialists; marketing and sales people; lawyers; literary types; doctors; philosophers can all find careers in the software professions;
■ are practiced among users, hardware manufacturers, in universities and research centers, in software service companies. It is only in the largest of the latter firms that professionals are offered the full range of occupations listed in the table below, in the most diversified environment and in close touch with the latest techniques.

Research *(Basic or applied research jobs often associated with teaching assignments.)*	***Research, Assistant Research Engineer in:*** ■ *Artificial Intelligence* ■ *DP Systems Architecture* ■ *Databases* ■ *Expert Systems* ■ *Natural Language Processing* ■ *Speech Recognition* ■ *Computer-Aided Vision*
Education and Training *(At an advanced level, these jobs are closely linked to research.)*	■ *Professor of Computer Science* ■ *Technical Training Assistant* ■ *Product Training Assistant*
Recruitment *(In businesses or professional service companies, these occupations assume a broad knowledge of the client's corporate culture, of information technology and of psychology.)*	■ *Recruitment Supervisor* ■ *Recruitment Consultant for high-level DP Executives* ■ *Recruitment Consultant of DP Professionals*
Support of End Users *(Jobs involving permanent contact with end users. The ability to listen and to teach are of primary importance.)*	■ *Infocenter Manager* ■ *Infocenter Consultant* ■ *Security and Database Integrity Consultant* ■ *Database Consultant* ■ *Office Automation Consultant* ■ *"Desktop Publishing" Consultant* ■ *Application Software Support Manager* ■ *Microcomputer Software Packages Consultant* ■ *User Training Manager* ■ *Application Software Instructors* ■ *Microcomputer Software Packages Instructor* ■ *User Documentation Editor*
Marketing *(Occupations associated with the sale of software and services. When related to specific projects, these functions require a broad knowledge of applications and techniques. With regard to microcomputer software packages, distribution issues are most important.)*	■ *Marketing Manager* ■ *Sales Manager* ■ *Branch Manager (Professional Service Companies)* ■ *Business Consultants* ■ *Product Manager* ■ *Sales-Technical Support Engineer* ■ *Sales Representative* ■ *Software Package Publisher* ■ *Importer/Distributor of Software Packages* ■ *Salesperson - Microcomputer Retail Store*

COLLECTIVE EXPERTISE

Collective expertise refers to the professional capabilities demonstrated by a team. It is greater than the sum of the individual qualities of the team's members because, brought together, they organize, encourage and complement one another. In a rugby team – which Alfred Sauvy once called "the ideal microcosm of the well-ordered society" – the fun or the result of playing does not come from an aggregate of star performances, but instead from the quality of team play: how the scrum holds together, how the forwards move the ball to the backs, precision and speed of passing between the three-quarters, smooth blending of plays worked out during practice... and the pleasures of the "third half" !

The value of a DP service firm also resides in its collective expertise. Some information professionals are freelancers, providing their clients only with the fruit of their individual expertise. The offering of DP service companies differs in the collective expertise of the professionals that it has been able to gather, train and motivate. Collective expertise is the decisive factor behind the formation of a project team, the launching of a pilot application, the training of a consortium set up to integrate large systems, the organization of training courses on network operation, and so on.

In the following pages, the components of a DP service firm's expertise are described under three headings: operational teams, cohesive activities and values.

OPERATIONAL TEAMS

Formed to match the specific jobs to be done, teams of IT professionals generally work within the context of operational units. In the CAP GEMINI SOGETI Group, this operational unit is the **branch**, which is tasked with meeting the needs of its customers for a given geographical area and with managing a staff of about fifty employees. Branch Managers recruit their own people, provide them with any necessary additional training, advise them in the performance of their duties and guide their career development.

The branch also provides the framework for interchange of experience. Branch professionals pool their knowledge, forming a highly valuable local "databank." If this databank is inadequate, more extensive assets can be tapped by turning to other operational units. The professionals of a large DP service firm are never isolated or unequipped, even when confronted with a new or difficult problem.

When necessary, supervisory consultants or specialists are called to the project site for assistance and advice. They also form a valued link between the branch and the company as a whole. They disseminate accumulated experience and ensure the promotion of good concepts.

Many tasks are set up as "projects." A project brings together experts in a range of disciplines and, where necessary, specialists in the application under development. Together, they form a team whose structure varies during the course of the project. The team is born with the definition of its goals and the naming of its leader. It takes shape with the selection of its first members. As it is organized, it adapts its capabilities to successive requirements. It designs and develops the system, carries out initial tests and installations, and is disbanded upon the user's final acceptance of its product.

Smooth completion of a project is largely dependent on the men and women who implement it. Obviously, selection of the project manager and the technicians who will be working on the team is a matter of fundamental importance. The client is the project's master craftsman. As needed, the client can turn to a DP service firm for consultancy, subcontracting segments of the work to be done, or designate the DP service company as prime contractor for the entire project. In such cases, the parties involved often join to form a consortium for implementation of the overall project.

Conducting a DP project involves the assembly of a large number of closely-interdependent program modules. They must sometimes be integrated within a system made up of disparate computer resources. Each program is at once the origin and the termination of many links joining it to many other programs. This network of links and its necessary coherence are the result of operations whose duration and cost increase with project scope.

The project manager is responsible for creating and maintaining a pleasant working environment for the IT professionals implementing these tasks. This mission is not an easy one; there are many pitfalls, require-

The CAP GEMINI SOGETI IT Professional on Assignment in Consulting or Technical Support

On all their assignments, IT professionals are assisted by the technical manager handling the project and by their Branch Managers. At the beginning of an assignment, the Branch Manager provides the IT professional with an accurate description of the work and the environment in which it will be performed.

The professional is also urged, whenever the necessity arises during the project, to seek advice from the technical manager, who will provide assistance in one of the following ways:

- *joint analysis of the situation;*
- *assignment of an expert to the project;*
- *research of appropriate technical information;*
- *contact with another IT professional who has already encountered the same problem;*
- *organization of a meeting with the customer's representatives, etc.*

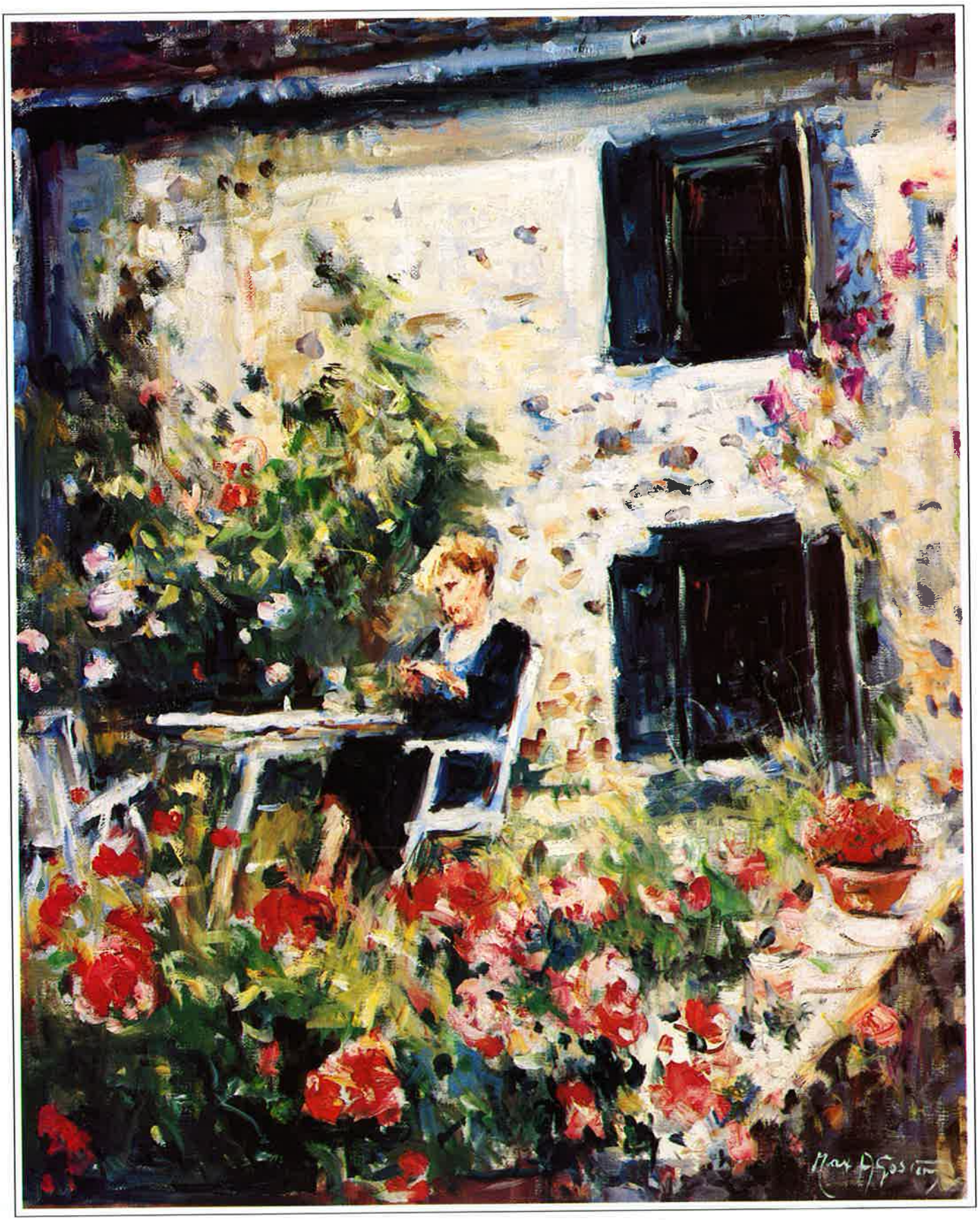
All IT professionals have a chance to review all aspects of their assignments during every on-site visit by their Branch Manangers.

Branch meetings also offer an opportunity for extensive exchanges of information on individual experiences and problems.

The IT professional's activity takes place within a carefully-defined administrative framework which addresses the concerns of both the client firm and the professional assigned to it.

The review system set up is based on a number of documents. We have selected a few examples from among them:

- *the "work order" stipulating job procedures, as well as the nature and duration of the work to be done;*
- *the "activity report" providing supervisory information on the job, which is then used for billing purposes;*
- *the "event report" logging any unusual incidents occurring during project implementation, thereby making it possible to troubleshoot operational problems as they arise;*
- *the "technical work report," which is an in-house document denoting the tasks performed during the month, any scheduling discrepancies, etc.;*
- *the "end-of-agreement report," which terminates the job and provides a technical summary of the work performed.*



ments change with time, and people, systems and machines are not always available when needed.

IT professionals pass the greater part of their working time in this vocational framework. This is where they actually acquire the experience they need. This is where they find satisfaction in a job well done. And this is where they make lasting friendships, guaranteeing even more effective cooperation on future projects. An organization's ability to manage numerous IT projects simultaneously is a major component of collective expertise.

COHESIVE ACTIVITIES

One concern of a good DP service company is to carry out a range of cohesive activities, gauged to maintain and enrich its collective expertise. Whether in the realm of technology, methods or references, specific support groups are set up when operational teams encounter a need for assistance. In today's CAP GEMINI SOGETI Group, for example, cohesive actions are being undertaken in the following areas: training, research, methods, competence centers, transfer of know-how and international projects.

As a leader in its profession, CAP GEMINI SOGETI had to establish this set of cohesive activities without recourse to any existing models. Each operation was developed precisely to enhance the quality of collective expertise and, consequently, the quality of the Group's services.

Let us summarize some of the main fields in which large DP service firms carry out these cohesive activities:

1) Training

It is generally accepted that IT professionals must put in ten hours of reading weekly and ten days of theoretical course work yearly in order to keep abreast of their areas of specialization. Naturally, an even greater investment of time is needed to exceed this modest target. But this extra effort is precisely what is demanded of a DP service firm, which must have the ongoing and substantial technical edge which bestows a premium on its services.

DP service companies therefore provide their staff with continuing training in three main areas:

- IT techniques, including a Quality Plan, systems development methodologies and all subjects related to advanced technologies;
- application of IT to relevant sectors of the economy, covering problems to be solved so that this technology will satisfy the requirements of users in each individual sector;
- techniques specifically related to the service activity, particularly interviewing skills, evaluation of technical tasks, project auditing, human resources management, etc.

2) Research

As we pointed out in Section 2 of this report, large DP service firms are active participants in the process of creativity and innovation. Naturally, their customers are the first to benefit from this participation.

We might simply stress two points:

- Research operations by DP service firms are primarily targeted to software techniques and their applications to the economy.
- Dissemination among users takes place through direct collaboration with a DP service firm on a research project, through implementation of pilot projects or through "technological demonstrators" or prototypes.

3) Methods

Information systems are designed to structure, codify and process information. The core of such systems, namely its software, is produced from intangible, invisible matter. Under these circumstances, working methods must simultaneously:

- be sufficiently stringent to guarantee end-product quality;
- afford professionals the measure of personal initiative required for thinking out problems encountered as efficiently as possible.

The simplicity of these observations is only apparent given the well-known temptation of one day discovering "the universal method." Major

Nine Facets of Network Expertise	
Network architecture	Neither "standard" nor "dedicated," a network tailored to an individual company's needs involves a subtle blend of commercially-available products and personalized solutions. CAP GEMINI SOGETI proposes a traditional method: identification of needs (throughput, security, etc.), inventory of existing resources, drafting of specifications including functional analysis, quantitative analysis of information flows, network management analysis. The Group can then define the architecture, design the network, identify standard products available in the marketplace — concentrators, switches, program products, etc., and integrate these products and develop custom applications.
Management and administration center	A network must be **monitored** so that availablility is known and reconfiguration is possible at any moment. It must be **administered** in order to yield operating statistics, permitting modification on the basis of changes in traffic. CAP GEMINI SOGETI installs management centers to carry out these two key functions. The activities of these centers are based on a core of standard functions (definition of network configuration, activation of components, routing, uploading and downloading, querying of components, etc.) and custom software modules which handle the client's specific environment.
Interconnection of heterogeneous DP equipment	Every company equipped with varied architectures, hardware and software, wants these resources to communicate with one another and with the outside world. CAP GEMINI SOGETI offers an original and economical solution to this problem. First, identify the greatest possible number of common denominators in order to create a basic standard which will conserve all possible existing resources. Next, insert connection units for conversion of communications between non-standard components. These connection units exclusively use standardized protocols to facilitate subsequent technological evolution of the "renovated" network.
Test and validation	Computers, management centers, switches and terminals all converse by means of protocols which in turn are governed by standards. Qualitative tests are performed on communications and applications protocols in order to make sure that installed resources are working correctly. These tests "under load" providing a check on the behavior and performance of the network. CAP GEMINI SOGETI offers test methodologies, simulators and test data generators, and is participating in a Europe-wide effort to unify test center procedures.
File transfer	Banks need to exchange orders for transfers, deposits, withdrawals or bank-card transactions. Businesses exchange purchase and delivery orders or invoices with their customers, suppliers and subcontractors. These transfers can be carried out by electronic mail, or by EDI (Electronic Data Interchange) to the extent that communication mechanisms are standardized, information is structured and utility services are provided. CAP GEMINI SOGETI is active in implementing all three of these prerequisites.
Corporate communications and videotex	CAP GEMINI SOGETI offers concrete solutions to facilitate access to, and sharing of, information: voice, text, image and data. Its OAK 400 server software (meeting the X 400 standard) incorporates communication-oriented word processing, sophisticated electronic mail (linkage between word processing systems, management of mail and mailboxes, message distribution, access control) and utility services, all to be customized with the integrated "toolkit." Services offered by MULTITEL videotex software include electronic mail, appointment calendar, telephone directory, text retrieval, etc. Now incorporating ISDN support, MULTITEL 100 provides multimedia communications, including image-enriched videotex.
Value-added networks	Building a value-added network means automating the communications between a company and its business partners. It also means an increase in the quality and speed of the circulation of information. CAP GEMINI SOGETI is involved in both strategic and technical issues: identification of those critical applications which will yield decisive advantages to the client company; definition and planning of the network: analysis of the existing architecture and of the information to be transmitted, connection of heterogeneous systems; implementation of a prototype network handling part of the client's operations prior to the installation of the definitive network.
Security	Security has become an unavoidable dimension of the modern network, due to the hazards of interception and theft of information. CAP GEMINI SOGETI tackles security from two directions: upstream, an audit, followed by the development of a network security plan; downstream, command of the full range of security resources, such as network access protections, on-line encryption of transmitted data, signature certification of the transaction (to this effect, MULTICAM software uses smart card technology), physical security of installations.
Operations	CAP GEMINI SOGETI provides three types of service for network operations. The first, operations management, includes acquisition of data on network operation. Next, network surveillance, monitors all network components thanks to the installation of detectors, surveillance microcomputers and line test units. Finally, system architecture administration permits both qualitative and quantitative network development (opening of new lines, clusters and services). With its trained technicians, CAP GEMINI SOGETI can carry out all or part of these services, locally or remotely (remote network monitoring and management). An expert system adaptable to all network types has been developed to assist network operators in their tasks.

users and DP service firms with several decades of experience know that the greatest rigor must be exercised in a) the establishment and form of a Quality Plan, and b) the content of the project management method. In particular, the latter must include principles and procedures for estimating real production and work remaining to be done, thus permitting periodic and systematic monitoring of the progress of a development project. This approach yields the most effective means of identifying deviations as they appear. In contrast, other methods must be selected on the basis of the specific characteristics of the job at hand and the cultural sensibilities of the parties involved. They may be specialized by life cycle phase and by application type and are of necessity numerous. Examples of method targets might include plant maintenance, design of small business applications, conversions, master plans for industrial applications, etc., and may take the form of manuals, expert systems or more conventional software products.

By applying this policy, and by creating this methodological framework, large DP service firms offer customers the benefits of collective expertise without which the development of extensive software products could not be undertaken under satisfactory conditions of efficiency and security.

Conversion Competence Centers

A conversion assignment — whether it involves a change of hardware or only a change of operating system — is a delicate and often dreaded operation for heads of DP departments. That is why the Group has set up a strong support organization which can be used by all its branches in all countries. This support organization includes:

The MUNICH (W. Germany) center, which has developed the INFOLIB method and accompanying software tools for precise estimates of the cost and delay of each conversion;

The PARIS center for training and management of projects in France;

The NEW YORK center specializing in software tools for translation and production planning;

The LOS ANGELES center (CompAct Data Systems, a subsidiary of CAP GEMINI AMERICA) which, since its acquisition in 1989, has been providing a very specialized skill. This highly automated facility is devoted entirely to conversions on IBM hardware from a DOS/VSE environment (medium-sized computers) to an MVS environment (large mainframe computers).

4) Transfer of know-how

The greater a group's wealth of know-how, the greater the demands placed on the professionals holding a share of this knowledge and the greater the care and attention which must be devoted to its transfer. CAP GEMINI SOGETI offers the benefit of all its "expertise assets" to each of its customers from a number of mutually-complementary approaches, five of which are mentioned here:

■ The Experts' Club brings together the Group's leading specialists in the most sensitive areas of IT. With the approval of management, these specialists must structure their time in such a way as to be genuinely available to, and at the service of, the entire organization. As an example, the inset below reproduces the "Expert's Charter" in force within the CAP GEMINI SOGETI Group.

■ Specialized study groups enable experts with mutual technological interests to meet and share their experiences with one another. Participants expand their skills by discussing actual situations.

■ Technical publications containing descriptions of noteworthy projects are disseminated throughout the Group.

■ "Contract reference" databases provide a description of each project, accompanied by information on project implementation. These databases are supplemented by relatively detailed descriptions of applications, including functional specifications and descriptions of installed solutions.

■ Competence centers provide operational units with the resources for tackling, with maximum efficiency, problems related to a given technique or application sector. These resources are varied in nature: standard proposals, program products, consulting, specialized methods, brochures, etc.

Three types of competence centers within the CAP GEMINI SOGETI Group have been selected to illustrate our theme:

■ The computer-aided manufacturing program product support center in Lyons has reviewed and selected a number of commercially-available software packages, recommending them to the Group's specialized branches as components of project implementation. The center also helps to install these products and train future users.

■ The Group has four "conversion" competence centers: two in Europe (Munich and Paris) and two in the United States (New York and Los Angeles). The activities of these centers are briefly described in the inset above.

■ In France, CAP SESA's "network" activity has developed an approach to the various problems encountered by corporations in this field. This approach is described in the inset on page 43, which also outlines some of the methods developed by CAP GEMINI SOGETI.

The Expert

- *takes on an assignment upon the written request of a Branch Manager or General Manager;*
- *is committed to respect the assignment rules, i.e.,: to provide one's services for 1 of the 5 business days which follow the written request, or 5 days out of the month following said request. The Expert should commit to at least 20 days of accumulated assignments outside of his/her Branch during the year;*
- *concludes assignments with a summary report prepared according to standard guidelines and distributed to the Branch or General Managers directly involved, as well as to the Quality and Technical Support Manager of the company and to the President of the Experts' Club;*
- *represents the Group and demonstrates his/her expertise, either through participation in a conference devoted to his or her speciality, or by writing papers for a specialized publication;*
- *promotes the Experts' Club within the Group;*
- *is a technical and technological pace-setter within the Group;*
- *is in control of how his or her time is most constructively used;*
- *broadens his or her knowledge in the service of the Group;*
- *is responsible for promotion of the Group's technical policies.*

VALUES

Like any other company, a DP service firm explicitly or implicitly chooses the values and principles which continuously guide its decisions and actions. Values and principles may vary from company to company, of course, but some of them are inherent in the very concept of "service." Among the most fundamental of these are undoubtedly the principles of independence and responsibility. When they are explicit, formalized, published and drilled into all the DP service company's employees, and then translated into rules of behavior and procedures, these principles guarantee the free practice of expertise and honesty in business dealings. Any expert, indeed any professional, must be able to express himself or herself with complete independence and objectivity, and be able to formulate advice and recommendations solely with the client's interests in mind, free of any other considerations or constraints. When the expert proposes a systems architecture or a solution to a given requirement, no attempt is made to sell an item of hardware or an application software product.

Regardless of its strategic orientations, a DP service firm must be free and independent of any industrial, political or financial force in the choice of its alliances or in the content of the education that it provides to its employees. A service company's independence is even greater if it has only a single line of business, as it receives no particular assistance from — and does not have to answer for — the performance of any other activity.

Whenever freelancers state a position or implement a project, they are committing only themselves. In contrast, employees of a DP service company are making a commitment for the firm which employs them. And the scope of this commitment increases — through the intermediary of the operational unit to which the expert belongs — with the size of the employing company and its ability to accept responsibility.

The capacity of large DP service firms to assume obligations lays the groundwork for implementations that would otherwise be infeasible. There are practical obstacles to feasibility, technical as well as human.

The reasons for which this capacity for assuming obligations might prove necessary are:
- project scope;
- formation of a consortium made up of large associate companies;
- technical difficulty of solutions adopted, and the possibility of proposing alternate solutions, as applicable;
- confidential nature of a study or application;
- speed of assembling large project teams.

Like individual expertise, collective expertise derives from a combination of distinct qualities, especially in a large DP service firm. It is a locus of analysis and dissemination of experience gained from many past assignments. It is a framework in which to develop the professional capability of all its members, as well as an acute awareness of the meaning of "service." It is an arsenal of resources for the creation and circulation of new information techniques, as well as the methodological means for the smooth implementation of information systems. Finally, it is a reservoir of the technical and financial capability required for undertaking sophisticated or large-scale operations with complete independence.

CONCLUSION

Expertise in information technology has been closely scrutinized in the foregoing pages. It is made up of a large number of skills and the know-how specific to information technology and its use. Over one million people and some thousands of companies have acquired that expertise, the chief *raison d'être* of DP service firms.

One thing is certain: "expertise" is a dynamic concept; it must be continuously updated, under penalty of losing its vital capacity to distribute innovation. The idea of rapid technological change has become so commonplace that one might easily be led to underestimate the importance – and even the necessity – of the "dynamics" of expertise. It is thus opportune to emphasize the extraordinary prospects offered by the development of information technology.

From the technical standpoint, some broad directions of this evolution are known today: parallel processing, pattern recognition, knowledge bases, universal networks. There are also more specific areas of application: the (finally !) computerized office, increasingly intensive automation, multimedia (voice/data/image) management, and so on. And, between the two, an ever-increasing measure of intelligence. Expertise is going to be required more than ever before, especially in the development of basic techniques. There will also be advances in software engineering, but even a complete elimination of the coding phase for routine applications will not reduce the need for expertise.

And all this refers only to the foreseeable future. It is actually too early to envision the ultimate consequences of computerization for society. It is also too early to imagine the full range of possible applications. Take a look at the telephone for example: a century ago, it was intended for business use, and so it continued for many years. It had a profound influence on corporate existence. It facilitated decentralization, shortened the sales cycle, etc. Then came its increasing use for personal communications, to the point that real solitude, even in one's own home, is a thing of the past. On the other hand, the most remote outpost is no longer cut off from the rest of the world. And with the assistance of information technology, new telephone applications are emerging. Electronic mail, for example, is going to replace some of our pen-and-ink correspondence of yesterday.

As information technology is at a much less advanced stage of development than that of the telephone, people who have chosen careers in IT expertise can count on having to keep on learning for the rest of their lives. Those holding positions of responsibility in the IT service sector know that their business will endure only insofar as it undergoes continuous regeneration, and that they themselves will have to continue to supplement their individual skills and enrich their collective expertise to keep in step with new technology.

PRESENTATION
OF
CAP GEMINI SOGETI

To assure its growth while at the same time preserving its unity, CAP GEMINI SOGETI, from the very beginning, has chosen a very strong, decentralized organization, supported by a central authority structure responsible for a certain number of "general interest" functions.

DECENTRALIZATION
237 Branches as of 1/1/89

The Branch is the basic operational unit of the Group. The average Branch consists of about 50 professionals, although the largest of them may have as many as 100 or even 150 in staff. Each Branch serves a specific geographic territory or business sector, under the leadership of a Branch Manager who has total responsibility for his or her resources and results.

The Branch Manager is therefore best able to perform the two basic functions underlying all service and consulting activities: to lead and manage a team of consultants and professionals and to act as a direct intermediary with the clients of the Branch. As a result of this kind of organizational structure – which allows the Group, despite its size, to stay in close touch with its clients – CAP GEMINI SOGETI is able to maintain an excellent observation post from which it can keep watch over advances in technology as well as the concerns of its clients. This makes it possible for the Group to appropriately adapt its services to market requirements.

The growth of the Group is achieved not only by increasing the size of individual Branches, but also by the creation of new operational units which improve its ability to concentrate on a given market sector. So it was that on January 1, 1989, 28 new Branches were created.

The Branches are organized into Regions or Divisions, then into the companies themselves, which are in turn divided into three operational groups. Each of these groups is given a detailed presentation in the following pages.

Serge KAMPF
Executive Chairman

Philippe DREYFUS
Vice Chairman

Daniel SETBON
Chief Financial Officer

Michel JALABERT
Vice President
Development and Control

Michel BERTY
Secretary General

François MAIRE
Vice President
Corporate Marketing

Financial and Legal Management:

Pascal GIRAUD
Accounting

Philippe HENNEQUIN
Legal Counsel

Manuel JAVARY
Treasurer

Hervé MARIN
Internal Audits

Nicolas du PELOUX
Planning and Budgets

Corporate Development and Control:

François CHOLLEY
Market Studies

Eric LUTAUD
External Development

Jean-Louis MICHELET
Business Control

Corporate Communications and Human Resources:

José BOURBOULON
Manager Development

Didier CASADO
Internal DP

Jacques COLLIN
Communications

Jacques de COMBRET
Manager Development

Tom PATTI
Manager Development

Catherine THOMAIN
Press Officer

Jean VACHERON
General Business

Marketing and International Business:

Jean-Claude AMIEL
International Projects

Michel DANON
International Accounts

Dan DEVILLE
International Accounts

Jean-Jack LOUDES
International Business

Kaï MARTHINSEN
International Accounts

Yannick RETAILLEAU
International Projects

CAP GEMINI SOGETI'S GENERAL MANAGEMENT

Decentralization – the guiding principle behind CAP GEMINI SOGETI's organizational structure – infers the existence of an informed, efficient central body in charge of a certain number of basic functions.

The primary responsibility of CAP GEMINI SOGETI's General Management is to ensure the cohesion of the entire organization: choosing strategy, defining general Group policy, evaluating risks, allocating resources, analyzing costs, auditing and internal control, monitoring the environment and organizational structures, supervising managers' career development, arbitrating and managing conflicting interests, managing and presiding over governing or coordinating bodies, promoting and defending the company's system of values, enhancing the Group's corporate image.

The Executive Committee, headed by Serge KAMPF, Executive Chairman of the Holding, brings together the eight principal managers of the Group. It is here that CAP GEMINI SOGETI's broad strategic directions are defined and that the major decisions concerning the entire Group are made. It is the Executive Committee which ensures that the basic principles which underlie the actions of all the operational units are respected.

The Holding company is organized in four broad Management divisions:

- **Legal and Financial**: preparing the Group's annual plans and budgets; managing central staff expenses, monthly consolidation; analyzing results; setting up the Group's consolidated accounts; overseeing legal, fiscal, insurance and real estate problems; determining the financial policy of the Group; cash management; checking on the opportunitites for and profitability of investments; conception and implementation of financial arrangements needed for the growth of the Group; financial information and liaison with the stock exchange.
- **Development and Control**: monitor and analyze trends in the environment, prepare development scenarios, assist in defining general Group strategy, select and implement equity investments, cooperate with companies in which the Group holds a minority interest, business control, follow-up on audit recommendations and Executive Committee decisions.
- **Communications and Human Resources**: defining communications strategy and approving topics and methods; coordinating actions internationally; determining guidelines for use of the Group's image; internal communications (managers and staff); external communications; press relations; the Annual Report; internal DP system; manager development program; supervising the stock option plan; Executive Committee reporting; central services.
- **Marketing and International Business**: strategic considerations for adapting major marketing trends and making sure they are consistent; coordinating certain international activities; stimulating internal cooperation and exchanges; assisting the operational units; heading certain Groupwide marketing programs; contacts with multinational clients; liaison with the computer manufacturers; large international projects; commercial actions in countries in which the Group is not located.

Principal companies in which the Group holds a minority interest:

- THE BOSSARD GROUP (management consultants), reporting 1988 revenue of FF 632 million. CAP GEMINI SOGETI's interest: 49%.
- CISI (professional services), reporting 1988 revenue of FF 1.1 billion. CAP GEMINI SOGETI's interest: 36%.

CAP SESA

Jacques ARNOULD (*)
Co-Chairman

Alain LEMAIRE (*)
Co-Chairman

André SACHS (*)
Secretary General

Dominique ILLIEN (*)
Administrative and
Financial Manager

Jean-Paul FIGER (*)
Deputy General Manager
Operational Support

Jean-Claude BUSELLI (*)
Deputy General Manager
Development

Francis BEHR (*)
Deputy General Manager
Development Area

Jacques BERTHELOT (*)
Deputy General Manager
Technical Assistance Area

Jean-François DUBOURG (*)
Deputy General Manager
Logistics Area

CAP SESA COORDINATION AND SUPPORT FUNCTIONS

Xavier STEFANI, Edouard BAZEILLE, Annie LEBRUN
Human Resources

Christine GOAVEC
Communications

Marcel SELLEM
DP Management

Richard CASTERA
Marketing and Sales Support

José BREVAL, Jean HARIVEL,
Jacques HEITZMANN, Didier MITHOUARD
Networks and Special Projects

Nadine MOSCA
Videography

Christian GALLIN
National Defense

Claude DRAY
Office Automation and
Business Communications

Fernand PONCET
Quality and Technical Support

Claude-Pierre DENIAUD, Michel LISSANDRE
Quality Assurance

Jean-François MILETTO
Hardware Support

Bruno PERRIN, Gérald VIAN
Software Engineering System and Multipro

François de la PORTE, Paul OLCESE
Branch Technical Support

Christian CONSCIENCE
Quality Audit

(*) Member of Cap Sesa's Management Committee.

CAP SESA was created on January 1, 1989 from the merger of CAP SOGETI and SESA's French business. If we use an equivalent structure for 1988, the French Group realized revenues of FF 2,695 million. This figure, up 25.2 % from 1987, places CAP SESA well in the forefront of its profession and strengthens its regard as a favored partner in the consulting, DP professional services and telecommunications marketplaces. Despite its size (5,100 employees that make up its workforce as of the first of the year), CAP SESA still represents barely 10 % of the DP professional services market in France (which itself is continuing to grow by about 20 % per year). CAP SESA's combined skills in information technology and telecommunications – unique in France and a recognized marketing advantage – are an additional asset for the new group during a time when the convergence of these two techniques is becoming a requirement of all information systems.

Although everyone agreed on the need for and desirability of this merger, it was nevertheless a very ambitious undertaking. We wanted to mutually reinforce one another's activities without losing sight of what made each of us special: technical expertise and commercial strength, profitability and team spirit, etc. We wanted to offer interesting work and fair wage incentives to every employee, plus the training to expand his or her skills. We wanted to provide possibilities for career growth. We wanted to create a new development structure and to share with everyone the values that are important to us.

The birth of CAP SESA was the result of a process that unfolded at intervals throughout 1988. The principal stages of this long and meticulous effort may be outlined as follows:

- May 6, Rome. At the CAP GEMINI SOGETI Group Rencontres, an announcement was made of the merger decision and of the major guidelines involved in preparing for it.
- At the end of the Rencontres, 15 task forces were formed to handle the many jobs related to the merger.
- September 30. A detailed organizational proposal was presented to all employees.
- December 14. A press conference was held in Paris at which CAP SESA was officially launched.

In terms of its OPERATIONAL STRUCTURE, CAP SESA has been organized into six market-specialized companies, whose services are further enhanced by eleven technically-specialized companies. In the first category (CAP SESA Régions, Défense, Industrie, Finance, Télécom and Tertiaire), the companies all conduct the same business – design and implementation of information systems – within a specific geographic area. Each of the companies in the second category is in command of a particular technique (operations, maintenance, technical assistance, training, research and development, software engineering, consultancy, artificial vision) and conduct their activities throughout France.

Formalizing the ADMINISTRATIVE AND LEGAL aspects of this reorganization was a difficult task that included stock purchases, partial contributions of assets, mergers and reassignment of personnel.

Collective employment STATUTES were drawn up and negotiated. Keep in mind that these are the rules which govern a company's employment practices and which are closely linked to its history and background. Changing these regulations is no easy matter, even when it is both necessary and beneficial.

The IMAGE of a new group plays a very important role, especially during a merger period, from the standpoint of the employees, the clients and the market in general. The choice of the name CAP SESA was a clear indication of the desire on both sides to integrate two previously competitive entities. Preparation and distribution of a newsletter known as "En Route to CAP SESA," made it possible to keep all our employees regularly informed about every aspect of the merger operation.

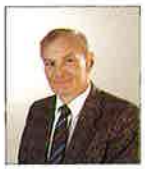
In closing we might mention the adoption by CAP SESA of the Group project accounting procedures with the additional analytic reporting by project. And on the technical side, the unification of our project methodologies.

Launching CAP SESA required considerable effort during 1988. It was successfully accomplished without any interruption of operations and with no reduction in the growth of our business.

However, being THE number one DP and telecommunications service company in France carries with it certain responsibilities:

- first, of quality: considerable resources are devoted to ongoing employee training and to monitoring the quality of the work performed;
- next, of growth: to assure every member of a team the possibilities for career development tailored to his or her abilities;
- finally, of openness which, in and of itself, creates and helps preserve an atmosphere of trust vis-à-vis CAP SESA's clients.

CAP SESA REGIONS


Alexandre HAEFFNER (*)
Chairman


Michel FAINGOLD
Deputy General Manager

Hervé CANNEVA	AFM
François RIAS	QTSM
Pierre MARTINET	MSSM Industry Section
Jacques LAGORCE	MSSM Administration Section
Jean-Michel PARMENTIER	MSSM Service Section
Françoise DOUTRIAUX	HR

NORTHERN REGION


Marcel de TAEVERNIER

Michel TURPYN	Lille Government and Finance
Michel GUINARD	Lille Industry
Jean-Marie THIBAUT	Lille Services
Jean-Jacques NICOLLE	Rouen
Bernard BOGAERT	Senlis

WESTERN REGION


Bertrand de TROGOFF

Hubert NOYER	Brest
François LE PETIT	Industry Center
Gilbert BAURIN	Services Center
Jacques RASCOL	West Industry
Patrick de BOISFOSSE	West Services and Government
Bernard GUEHENNEC	Networks and New Techniques

SOUTHWESTERN REGION


Jean-Loup BOUDINEAU

Jean-Louis BURDET	Bordeaux Industry
Jean-Michel ROY	Bordeaux Services and Government
Jean-Pierre MAZIN	Pau and Pays de l'Adour
Henri LAGRASSE	Toulouse industry
Joëlle MEKIES-VANDAME	Toulouse Services and Government
Josyane TESTA	Toulouse Aerospace 1
Jean-Pierre GLEYSE	Toulouse Aerospace 2

MEDITERRANEAN REGION


Paul CHAFFARD

Charles-Henri LIMOUSIN	Marseilles Industry
Patrice HENRY	Marseilles Services and Government
Alain GIRAUD	Montpellier
Philippe BRACONNIER	Nice

RHONE-ALPS REGION


Jean ROCHET

Alain VINCENT	Rhône Industry
Raoul RUIZ	Grenoble Industry Valence
Luc DUSSART	Isère Industry
Patric BARBEROUSSE	Grenoble Services and Government
Jean-Pierre REY (acting)	Lyons Industry/ Auvergne
Michel BASTIAN	Lyons Services

EASTERN REGION


Denis SERGENT

Eric BRIDE	Luxembourg
Denis DEYBER	Mulhouse
Marc MINISINI	Nancy
Bernard REGNAULT	Reims
Jean-Pierre DRACA	Strasbourg

CAP SESA DEFENSE


Yves VERET (*)
Chairman


Jean-Marie BARRE
Deputy General Manager

Christian GLEYO	AFM
Jean-Jacques CHAUVIN et Jean-Paul PELISSIER	QTSM
Yves PITON	MSSM

Gérard HINAULT	Army
Albert RAGOT	Joint Military
Olivier ROSSIGNOL	Airforce
Jean-Marie BARRE (acting)	Navy Paris
Jean-François de LA GASNERIE	Navy Var

CAP SESA TERTIAIRE


Henri STURTZ (*)
Chairman


Laurent BALLY
Deputy General Manager
Operational Support


Pierre DURAND
Deputy General Manager
Development

Yann GROLIMUND	AFM
Christian RENARD	QTSM
Christian BERLEUR	LPSI

Philippe MACE	Télématics
François PHULPIN	Government
Michel ROUZAUD	Energy
Dominique SILVESTRE	Transportation
Hervé GRIFFON	Insurance
Gérard PAYEN	Services

CAP SESA FINANCE


Joseph GUEGAN (*)
Chairman

Frédéric PLACES	AFM
Francis DROUIN	QTSM
Daniel PREVOST	QTSM


Bernard SARRAZIN

LARGE BANKS DIVISION

Jean-Pierre RENAULT	Société Générale/ Crédit Lyonnais
Jean-Pierre BLONDELON	Crédit Agricole/ Cie Bancaire
Patrick NAVARRO	BNP/SUEZ


Joseph HURTUT

BANKING AND FINANCIAL INSTITUTIONS DIVISION

Bernard LONJON	Real Estate
Paul BOUVIER	Trading Rooms
Dominique HENRY	Finance Branch 1
Christian SAINT-ARROMAN	Finance Branch 2
Miguel de FONTENAY	Finance Branch 3


François HUCHER

CLEARINGHOUSE AND FINANCIAL MARKETS DIVISION

Roland QUET	Payroll
Jacques RICHER	Financial Markets
André CICHOWLAS	Security

CAP SESA TELECOM


Maxime DONAL (*)
Chairman


Jacques TIXERANT
Deputy General Manager
Operational Support


Jean-Paul VAUTREY
Deputy General Manager
Development

Christian GLEYO	AFM
Pierre KRAUS	QTSM
Alain GERSET	MSSM
Michel BERTON	QCM

Jean-François LEFEBVRE	Telematics
Raymond COMMAULT	Telecommunications and Advanced DP

Jacques TIXERANT (acting)	PUBLIC INFORMATION SYSTEMS DIVISION
Jean-Claude DUBOURG	Public Information Systems 1
Pierre SEMUR	Public Information Systems 2
Jean-Paul VAUTREY (acting)	SYSTEMS DIVISION
Alain DUMONT	Systems 1
Xavier CHAMPION	Systems 2
Richard BARROY	Systems 3

CAP SESA INDUSTRIE


Jean-Philippe GAILLARD (*)
Chairman


Jean-Marc CLAUDON
General Manager


Gilbert ELOIRE
General Manager

Christian BOURRIAGUE	AFM
Eric PIAT	QTSM


Jean-Pierre FOUSSIER
ENERGY AND TRANSPORTATION DIVISION

Jean-Louis JACQUET
Petro-chemical and Food
Anne HUGUET-ROSMORIN
Electronics and Engineering
Serge CHIARINI
Chemical and Pharmaceutical


Alain WILBOIS
MECHANICS AND AERONAUTICS DIVISION

Yannick GONNEAU
Mechanics and Automobile
Marie-Christine PICARD
Aerospace and Communications
Tanneguy de FROMONT
Aeronautics and Nuclear


Alexandre LEVY
SYSTEMS AND TELECOM DIVISION

Bernard MOULENE
Telecom Industry
Pierre CARRIO
Aviation and Navy
Jean-Marc BERNABEU
Weapons Industry


Bruno CHAPUIS
ENGINEERING AND DP DIVISION

François LANGLAIS
DP Manufacturing
Yves POUSSIN
Computerization and Instrumentation
Thierry KOCH
Engineering and Equipment

LOGISTICS AREA Jean-François DUBOURG

CAP SESA EXPLOITATION

Georges COHEN (*)
Chairman

Jacques AUGER
General Manager

François NEANT
Deputy General Manager

François-Xavier FLOREN	AFM
Luc-François SALVADOR	MSSM
Jean-Marc BY	PLSM

Gérard JAMAIS
INSURANCE SERVICES DIVISION

Gérard JAMAIS (acting)	Services 1
Jean-Pierre LESEC'H	Insurance
Michel CADOUX	Services 2

Jean-Pierre POUTEAU
INDUSTRY DIVISION

Claude FORSANS	Aeronautics
Christian TOURNIER	Electronics
Gérard STEFAN	Petro-chemical
Didier CRESP	Toulouse

Dominique DUFLO
ADMINISTRATION AND FINANCE DIVISION

Philippe BELPERCHE	Government
Michel BERJAMIN	Banking
Claude CHIABRANDO	Finance
Neb LAFERT	Switzerland

CAP SESA MAINTENANCE

Jean-François DUBOURG (*)
Chairman

Olivier MERY	AF
Philippe WINSBACK	Telematics
Philippe WINSBACK (acting)	Military

TECHNICAL ASSISTANCE AREA Jacques BERTHELOT

HELIAS

Alain du BEAUDIEZ
Chairman

Bernard KROTIN	QTSM
Geneviève MICELI	AFM
Gilles BURDET	HELIAS 1
Bassam BAKDACHE	HELIAS 2

SCOFI

Alain du BEAUDIEZ
Chairman

Bernard KROTIN	QTSM
Geneviève MICELI	AFM
Hélène LAPALU	SCOFI 1
Pascal LEROY	SCOFI 2

LOGISTA

Alain GHERSON (*)
Chairman

Hervé CAPTIER	MSSM
Geneviève MICELI	AFM
Hervé CAPTIER (acting)	Ile-de-France 1
Christian DESCHEEMAEKERE	Ile-de-France 2
Alain CHAMPION	Lille/Lyons

ARVICA

Alain GHERSON
Chairman

Geneviève MICELI	AFM
Jean-Marc HERB	OM

DEVELOPMENT AREA Francis BEHR

CAP SESA CONSEIL

Gérard SCHREDER
Chairman

Alain SARRAZIN
Deputy General Manager

Guy EREL	AFM
Jean-Pierre LEVY	DM

CAP SESA INSTRUMENTS

Francis BEHR (*)
Chairman

Martine BIGE	AFM
Bernard LY	SM

CAP SESA FORMATION

Bernard JOULIE
Chairman

Cornel SIMIU
Deputy General Manager

Guy EREL	AFM
Alain LE BRETON	Training Center
Frank O'MEARA	Managment and Communications
Cornel SIMIU (acting)	Institute
Jean SAINT-HUBERT	Selection

CAP SESA INNOVATION

Francis BEHR (*)
Chairman

Roland VARENNE
General Manager

Martine BIGE	AFM
Paul DECITRE	
Paris Research Center	
Maurice SCHLUMBERGER	
Grenoble Research Center	

ITMI

Gérard MEZIN
Chairman

Martine BIGE	AFM
Yann GALLAIS	MSSM
Bruno DUFAY	Artificial Intelligence Department
Yannick DESCOTTE	Research Department
Pierre MONTCUQUET	Vision/Automation Department

AF	Administration and Finance
AFM	Administration and Financial Manager
DM	Development Manager
HR	Human Resources
LPSI	Large Projects and Systems Integration
MSS	Marketing and Sales Support
MSSM	Marketing and Sales Support Manager
OM	Operations Manager
PLSM	Personnel Logistics Support Manager
QCM	Quality Control Manager
QTSM	Quality and Technical Support Manager
SM	Sales Manager

(*) Member of Cap Sesa's Management Committee.

CAP GEMINI EUROPE

Christer UGANDER
Chairman and C.E.O.

Michel FIEVET
President

Aad UIJTTENBROEK
Senior Vice President

Chris van BREUGEL
Vice President

Adolfo CEFIS
Vice President

Kaj GREEN
Area Vice President

Jean RONCERAY
Area Vice President

Pierre DALMAZ
Vice President
Administration & Finance

Werner ZÜLLIG
Secretary General

Paul HOFMANN
Vice President
Business Development

Richard BLAUSTEIN
Administration & Finance

Jacques-Pascal BONNAFONT
Administration & Finance

Philippe DESTISON
Space Support

Meinard DONKER DE MARILLAC
Communications

Klaus FEKETE
European Support Center

Harry KOELLIKER
Finance

Jean PRADES
Technical Development

Gerd WATZINGER
Conversions Support

For CAP GEMINI EUROPE, 1988 was characterized by strong growth and the establishment of an organization adapted to maintain this growth.

GROWTH

The largest part of this growth was achieved by the operational units in place at January 1, 1988. This internal growth rate of 23.4% was greater than that of the market (approximately 20% a year), which means that we are continuing to increase our market share, currently estimated at about 4%, thus providing considerable potential for future expansion.

The rate of growth was not consistent throughout Europe, however. Stronger than average results were recorded in Spain and Italy, in conformity with the general economic trends in those countries. In our recently-created companies in Denmark and Finland, the help of certain acquisitions (described below) contributed to the progress made in these two countries.

During 1988, four Scandinavian companies joined the Group:

- In Denmark, two companies, SOFCON and AD&D, were acquired early in 1988. This provided additional strength to CAP GEMINI DANMARK which, during the year, had already succeeded in establishing itself as one of Denmark's leading DP professional services companies.

In Sweden, a public bid was made in March 1988 to acquire 100% of DATA LOGIC, which, with a staff of 350, is one of the country's major DP professional services companies. This take-over bid – which, we might emphasize, was totally "friendly" – was accepted in May and completed in June.

- In Finland, the company HEIKKAMÄKI was acquired toward the end of the year, thereby adding strength and increased competence to our Finnish subsidiary CAP GEMINI SUOMI.

In Denmark and Finland, the acquired companies were integrated into our existing subsidiaries, whereas in Sweden, DATA LOGIC, and its subsidiary TECHNO LOGIC, continue to operate as independent companies alongside CAP GEMINI BRA.

These acquisitions bring our total Scandinavian workforce to more than 1,000 people, making CAP GEMINI one of the leading professional services firms in the region, with a market share of approximately 9%.

CURRENT ORGANIZATION

Major actions in 1988 involved adapting Group Europe's structures to encourage expansion through the incorporation of companies having very different origins: those of the "former CAP GEMINI EUROPE," SESA as well as the newly-acquired companies.

The new organization set up in 1989 is now operational, with a total workforce of more than 4,500 people and projected revenue for the year of about $400 million.

There has been a merger of the CAP GEMINI and SESA companies in Belgium and the Federal Republic of Germany. In Germany, a single operational unit, CAP GEMINI SESA DEUTSCHLAND, made up of almost 500 professionals, has been created from CAP GEMINI DEUTSCHLAND, SESA DEUTSCHLAND and CAP GEMINI IBAT. The branches of this company, which occupies a major position in the German market, are situated in three regions. In Italy, on the other hand, SESA ITALIA continues to operate alongside CAP GEMINI GEDA.

With these operations, CAP GEMINI EUROPE has not only increased the number of its professionals, but it is also – and this is most important – increasing its expertise, especially in the fields of systems integration, networks, data transmission, and in space and military applications.

This new organizaton is founded on the basic CAP GEMINI SOGETI principles that have proven so effective in the past:

- local branches, the "cornerstone" of our organization, which assure a close working relationship with our clients and an in-depth understanding of their needs;
- central support: support and/or competence centers providing our clients and our branches (particularly with the help of other Group companies) with the know-how and resources that may not be available locally, or that are required because of the size or complexity of a given project.

We believe that this organization is the one which best allows us to offer any client in Europe – wherever that client may be located – whatever solution, expertise and/or resources may be required for whatever information system needs to be developed. And that, we think, is what it means to be ready for Europe in 1993.

CAP GEMINI NEDERLAND

Chris van BREUGEL
General Manager

Hans BOOM
Deputy General Manager

Rob STARREVELD
Deputy General Manager

Arie EDELMAN	AFM
Jan PIETERMAN	TSSM
Daan RIJSENBRIJ	DTSM
Louk WINKELHAGEN	MSSM

Public Sector Division

Theo BOUWMEISTER	Branch 1
Nico COENEN	Branch 2
Rob BAKKER	Branch 3
Tom BRANS	Branch 4
Louis PANEN	O. & I.

Henk BREMER
Division Manager

Banking and Insurance Division

Hans BOOM
Division Manager

Johan WAAIJER	Branch 1
Vincent LUCAS	Branch 2
Toine PHILIPPA	Branch 3
Arnold BRUGGEMAN	Exploitation
Vincent LUCAS (acting)	O. & I.

Industry and Trade Division

Theo GIELIS	DDM
Hans VISSER	Branch 1
Dick van EEDEN	Branch 2
Koos BERGSMA	Branch 3
Alan TATTERS	Branch 4
Hans van LEEUWEN	O. & I.

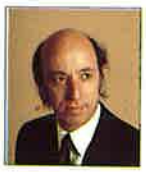
Wim HEUKELS
Division Manager

Jop DUYVENDAK	Training

CAP GEMINI GEDA (Italy)

Adolfo CEFIS
General Manager

Enrico RUSCA
Vice President



Ettore ZANAZZO
Deputy General Manager
Transport and Government sector

Christopher COLEMAN	AFM
Maurizio FOTI	AM
Luigi DURAND DE LA PENNE	DTSM Transport and Government sector
Roberto SAFFONCINI	TSSM Transport and Government sector
Pietro ROSSI MARCELLI	MSSM Transport and Government sector

Transport Division

Paolo GIORGI
Division Manager

Central Government Division

Claudio MARRA
Division Manager

Antonio COLUCCI
Rome

Industry & Local Administration Division

Claudio TELONI
Division Manager

Manlio PETRIS	DDM
Mario PASTI	Milan 1
Ennio ROSSINI	Milan 2
Enrico MAGANI	Milan 3
Daniele CAVALLERO	Turin

SESA ITALIA

Gennaro DE STASIO
General Manager

Giulio Cesare CHIARINI
Deputy General Manager

Roberto VASTA	AFM
Marcello ANTICHI	Network Engineering
Giulio C.CHIARINI	System Engineering
Vincenzo GIOVANNITTI	Information Systems

PANDATA (Netherlands)

Aad UIJTTENBROEK
General Manager

Ton KNOTSCHKE
Deputy General Manager

Eric PLANTE
Deputy General Manager

Paul FOCKENS
Deputy General Manager

Bert NOLLEN	FM
Janet CLARK	AM
Dick van VERSEVELD	DTSM

Public Sector Division

Hans NOUWENS	Rijswijk
Paul van ZUL	Amsterdam
Geerlof LODE	Zwolle
Bernard LUTTIKHUIZEN	Information Network Services

Jilt SIETSMA
Division Manager

Trade and Services Division

Jacques JOOSTEN	PTT The Hague
Gerard WISSELINK	PTT Groningen
Ben LEUSVELD	Amsterdam
Menno NORDER	Zwolle
Theo PETERS	Eindhoven

Peter BARBIER
Division Manager

Industry Division

Jaap BOON	Amsterdam
Wim VERKAIK	Zwolle
Marten LA HAYE	Eindhoven

Peter BUISMAN
Division Manager

Informatics Institute

Hans SCHEVERS	Marketing Manager
Wim VISSER	Management Education
Steef GEENEN	Methods & Techniques Education
Hubert KROS	User and Maintenance Education

Jan van WISSEN
Division Manager

Products Division

Hank RICHTERS	Office Information Management
Ronald LANGERHORST	Computer Aided Software Engineering
Jeroen BOON	Health Care

Derk DUIT
Division Manager

EMCI Management Consultancy

Joop van BOKHOVEN	DDM

Hans van der HOEVEN
Division Manager

CAP GEMINI SESA BELGIUM

Jean MILAN
General Manager

Jean-Pierre DORLHAC
Deputy General Manager

Robert DUCOFFRE	AFM
Johnny HUYSENTRUYT	DTSM
Aimé d'HELFT	Finance and International Institutions
Robert MALOMGRE	North
Xavier BREL	Public Sector
Pierre MONNOYER	Services
Jean PEETERS	South

CAP GEMINI SUISSE

Peter WEBER
General Manager

David SANTANDER	AFM
Jean-Yves GILLET	DTSM
Willi KAUF	Basle
Walter WEISS	Bern
Michel ABIKZER (acting)	Genève
Michel ABIKZER	Lausanne
Annette SEGESSER	Zurich Finance and Services
Peter WEBER (acting)	Zurich Commerce and Industry

CAP GEMINI ESPAÑA

Philippe DANGLADE
General Manager

José AGUILANIEDO	AFM
Francisco LARIOS	DTSM
Antonio RUIZ-LILLO	Public Sector Computer manufacturers
José-Ignacio CARRIBERO	Banks
Philippe DANGLADE (acting)	Industry
Georges ESCOLA	Barcelona

CAP GEMINI SESA DEUTSCHLAND

Bernd LANTERMANN
General Manager

Wolfgang KOEHLER
Deputy General Manager

Werner BONGARTZ
Deputy General Manager

Richard BLAUSTEIN (acting)	AFM
Wolfgang KOEHLER (acting)	DTSM

North-West Division

Werner BONGARTZ
Division Manager

Dieter NOGA	Hamburg A
Wolfgang PUMP	Hamburg K
Jurgen HOEBORN	Düsseldorf K
Reiner KONITZ	Braunschweig
Gerd-Wilfried HOCKENHOLZ	Essen A

Mid Division

Wolfgang KOEHLER
Division Manager

Paul Josef LEUSCHNER	Frankfurt K
Volker JODELEIT	Frankfurt C.A.
Horst Dieter WAGNER	Frankfurt T.A.
Hans Christof KALLER	Düsseldorf D

South Division

Bernd LANTERMANN
Division Manager (acting)

Uli NOLLE	Munich K
Jorg HEILMANN	Munich A
Ulrich REITER	Stuttgart
Josef BACKWINKEL	Nuremberg office

CGS (UK)

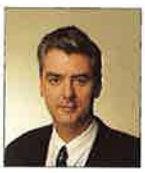
John MARSH
General Manager

Mark CUNNINGHAM	AFM
Brian OXLEY	MSSM
Sandy CLAIREAUX	Public Sector
Robert CAVAN	North
Oliver HOPKIN	Manufacturing
Eric HALL (acting)	Finance

CAP GEMINI DANMARK

Jan JOHANSSON
General Manager

CAP GEMINI DATA LOGIC (Norway)



Arne OEN
General Manager

Dag POULSSON	AFM
Jens-Petter MATHISEN	MSSM
Svein WEINHOLDT	DTSM
Erik RINGSBY	Private Sector
Leif BREKKE	Public Sector
Kjell WARHOLM	Industry
Jan Erik ANDERSEN	Monitor
Bjorn SOEVIK	Bergen
Per HETLAND	Stavanger

CAP GEMINI SUOMI (Finland)

Markku SILÉN
General Manager

Heli UUSI-ILLIKAINEN	AFM
Sirpa RUUTH	DTSM

CAP GEMINI BRA (Sweden)

Lars-Olof NORELL
General Manager

Gunnar ALDÉN	DTSM
Eva KARNEHED WERNE	AFM
Bertil MATTSSON	MSSM
Lars OLSSON	Technical Training Manager
Torsten PRAHL	Finance
Stefan OLOWSSON	Public Service
Tore HAGENBLAD	Industry
Leif BJÖRDELL	Mid
Berndt OSMUND	West
Hans WIRFELT	North

TECHNO LOGIC (Sweden)

Björn NORRBOM
General Manager

DATA LOGIC (Sweden)

Leif NOBEL
General Manager

Kent PETTERSON	Personnel Manager
Håkan WILÉN	FM
Ander HÖK	Controller
Thomas TROLLE	Stockholm
Anita FRYXELL	Eskilstuna
Jan EKSTROM	Gothenburg
Lars-Göran NILSSON	Malmö
Leif GRANE	Monitor

AFM	Administration and Finance Manager
AM	Administration Manager
DDM	Division Development Manager
DM	Development Manager
DTSM	Development and Technical Support Mana-ger
FM	Finance Manager
MSSM	Marketing and Sales Support Manager
TSSM	Technical Staff Support Manager

CAP GEMINI AMERICA

CAP GEMINI AMERICA ("CGA") completed 1988 with substantial growth in revenues and an even greater increase in profits. Total staff grew 20% to over 2500 employees, revenues reached $163 million, a 21% increase over 1987, and profits grew even faster, increasing by 40%. The Company expanded to 45 operating branches, plus five satellite offices, located in eleven geographic regions.

Significant progress was made towards realizing our strategic goals of enhancing our project management capabilities and growing this component of our business. CGA has continued to augment its technical assistance services with high quality project management capabilities and specialized technology and industry resources. Supporting this approach, over 30% of our offices are specialized in such areas as Finance, Telecommunications, Insurance, Energy and Manufacturing. This strategy should result in increased market share and consistently higher margins.

To achieve its goals, CGA enhanced its ability to effectively manage large Information Technology based projects. During 1988 our proprietary approach to project management – the CGA Project Quality System (PQS) – with its embedded quality assurance procedures, resulted in the high level of customer satisfaction essential for future project opportunities.

Increasingly, the Company is called on to assume complete responsibility for conversion of systems and applications software, development of new and enhanced applications and total systems integration projects.

Professional development of our staff figures prominently in our growth strategy. There is a focus on providing training programs that augment existing skill levels and ensure a consistent level of quality services to our clients. In the past year, over 90 project managers, who completed an intensive Project Manager training and certification program, developed skills in working with clients to provide solutions to the business problems involved in technology implementation.

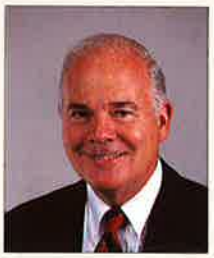
In strategic industries where CAP GEMINI AMERICA expertise is particulary strong, Specialized Solution Groups (SSGs) were formed to offer services tailored to meet the specific demands of these environments. Based on favorable client response, we established industry SSGs in Manufacturing and Finance as well as technology SSGs specializing in conversion services.

Early in 1989, CGA announced the acquisition of CompAct Data Systems, one of the leading DOS to MVS conversion services firms. CompAct will continue to operate under the direction of its founder, Patrick N. CONTI.

Also at the beginning of the second quarter of 1989, we finalized the acquisition of SYSTEMATION, INC., a Cleveland-based firm providing systems integration and DP professional services. SYSTEMATION has approximately 400 employees and will be led by its founder, William C. STILSON, and its current management team.

Robert J. SYWOLSKI (*)
Chairman, CEO and President

Ronald EZRING (*)
Executive Vice President



William C. STILSON (*)
Executive Vice President, and CEO
SYSTEMATION

James J. WOODWARD (*)
Vice President,
National Project
Support Group

Patrick N. CONTI (*)
President
CompAct DATA SYSTEMS

Paul J. FORREST (*)
Chief Financial Officer

Bruce D. POSNER (*)
Vice President, Controller

Susan M. JORDAN (*)
Vice President,
Human Resources

MAIN SUPPORT FUNCTIONS

Geoffrey W. BARNES
Director, Technical Productivity Center

Kenneth L. BERRIDGE
Director, Specialized Solution Group, Conversions

Joanna ELLIS
Director, Human Resources

Jack L. GOODSITT
General Counsel

Edward P. LOSS
Director, Market Development

Bruno F. SICURANI
Director, Financial Administration

Bruce R. ZEWE
Director, Internal Communications

(*) Members of the Cap Gemini America Operating Committee.

NORTH AREA

Ronald EZRING (*) Executive Vice President

SOUTH AREA

Robert J. SYWOLSKI (*) Chairman, CEO & President
(Acting Area Manager)

MIDWEST REGION

Eugene J. FRANZ (*)
Regional Vice President

John V. NOVAK	Chicago Commercial
James M. DUFFY, Jr.	Chicago Communications
Eugene J. FRANZ (acting)	Chicago Insurance & Finance
Linda D. STOCK	Chicago Manufacturing

CENTRAL REGION

Glen E. MILLER (*)
Regional Vice President

Michael S. WRIGHT	Cincinnati
Thomas H. CARLSON	Cleveland
Rebecca JOHNSON (acting)	Columbus
Glen E. MILLER, (acting)	Dayton

MIDSTATES REGION

Jon JENSEN (*)
Regional Vice President

Susan S. LARSON	Denver
Robert E. CROWLEY	Des Moines
Ronald FISCHER	Kansas City
Jon JENSEN (acting)	Omaha
Jeffery F. HITCHCOCK	St. Louis Commercial
Thomas SMITH	St. Louis Manufacturing
	Satellite : Memphis

MID-ATLANTIC REGION

Ralph A. KING Jr. (*)
Regional Vice President

John T. PINK	Baltimore Commercial
Steven N. LANDSMAN	Baltimore Financial
Anthony MORETTO, Jr.	Philadelphia
Leonard C. ANDERSON	Richmond
William M. FLANNERY	Washington, D.C.
Ralph A. KING (acting)	Wilmington

NORTH CENTRAL REGION

Gerald J. QUARTANA (*)
Régional Vice President

David A. BALLERING	Central Wisconsin (Appleton)
Wayne D. OSTRUSZKA	Milwaukee Financial
James P. WALKER	Milwaukee Manufacturing
Terry L. FRAZIER	Minneapolis Financial & Commercial
Joseph M. REILLY	Minneapolis Manufacturing & Services
	Satellite : Madison

SOUTHERN REGION

John R. HAMON (*)
Regional Vice President

Roger L. SPTIZ	Atlanta General/Commercial
J. Michael MASON	Atlanta (ICF)
Douglas C. BERRYHILL	Orlando
Steven R. SWANSON	Tampa
	Satellite : Miami

NORTHEAST COMMERCIAL REGION

Donald J. KELLY (*)
Regional Vice President

Ernest G. BAGO	NJ Commercial
Donald J. KELLY (acting)	NY Commercial
	Satellite :
Donald A. SCHATZ	Westchester/Connecticut

SOUTHWEST REGION

Michael SCHERMER (*)
Regional Vice President

Richard H. BINGHAM	Dallas Commercial
William S. WIMBERLY	Dallas Energy
John DE FILIPPO	Houston

NORTHEAST COMMUNICATIONS REGION

Thomas M. KLIMUC (*)
Regional Vice President

Thomas M. KLIMUC, (acting)	NJ Business Communications
Thomas M. KLIMUC, (acting)	NJ Advanced Technologies
Ludson WORSHAM	NJ Telesystems
Stephen KRANE	NJ Teleproducts

WESTERN REGION

Craig D. NORRIS (*)
Regional Vice President

Craig D. NORRIS, (acting)	Los Angeles
LaVelle DAY	Portland
Craig D. NORRIS (acting)	Seattle

NORTHEAST FINANCIAL REGION

Michael S. ORSNTEIN (*)
Regional Vice President

Matthew J. BEZINSKI	Metro Finance
Michael S. ORNSTEIN, (acting)	NY Banking & Insurance
Henry A. SMITH	NY Securities

NATIONAL MANAGEMENT CONSULTING GROUP

Ralph A. KING Jr. (*)
Regional Vice President

William E. BARKER	Washington, D.C.

THE PROFESSIONALS IN THE CAP GEMINI SOGETI GROUP

Growth, extraordinary technical ability, the outstanding performance for which CAP GEMINI SOGETI is so highly applauded by press and public alike, these are really the achievements of the men and women who make up the Group: dedicated people, "fighters" who are deeply committed to what they do; in other words, true professionals.

On December 31, 1988 there were exactly 12,297 of these professionals working in the Group, as opposed to 10,593 at the end of 1987, which represents an increase of 1,704 people in one year (or +16%). This increase results from the creation of more than 1,300 new jobs, and the addition of the staffs of DATA LOGIC Sweden (376 people) and the Finnish company HIEKKAMÄKI (20 people), both having joined the Group during 1988.

The geographic distribution of Cap Gemini Sogeti's workforce as of December 31, 1988 was as follows:

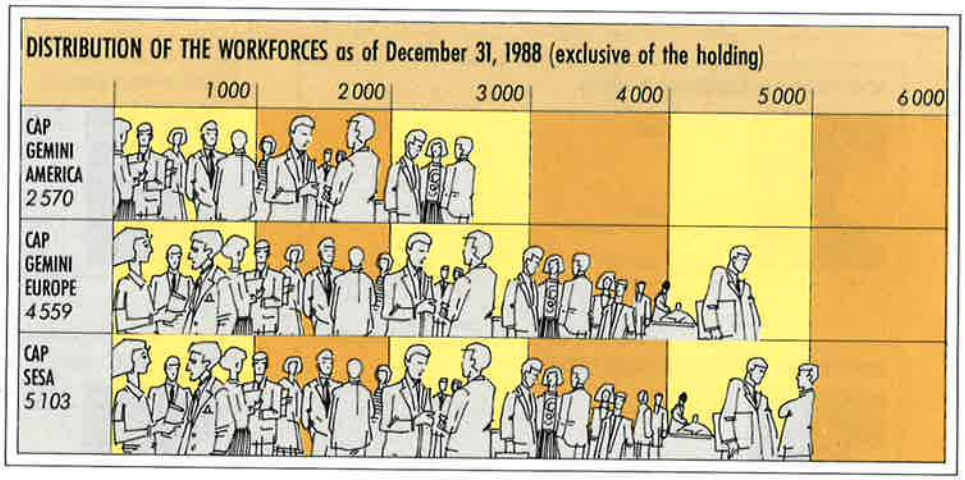
- 42% in France,
- 37% in the rest of Europe,
- 21% in the U.S.

The profile of Cap Gemini Sogeti's professionals has remained remarkably stable:

- They are young: the average age in all professional categories combined is 32.6 in the Group Europe companies, 35 in CAP GEMINI AMERICA and 31.2 in Group France.
- The ratio of women continues to increase: 23% in Group Europe, 29% in Cap Gemini America and 27% in Group France.
- The general level of training is high: nearly two-thirds of the technical professionals have degrees from major American and European universities.
- There are many possibilities for career development as serious training efforts, along with the continued expansion of the Group, have created numerous job opportunities. Thus, in 1988 there were 2,350 promotions throughout the Group companies.

Being a Cap Gemini Sogeti professional brings with it certain benefits:

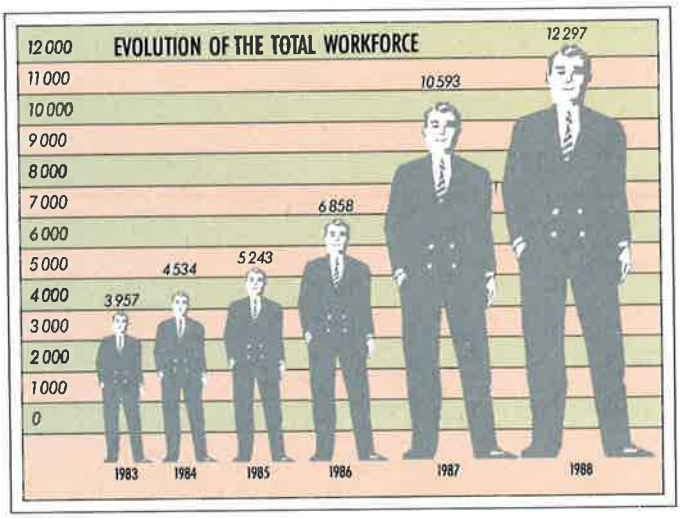
It is an international Group, one in which many nationalities and cultures exist side by side, and in which one may acquire not only a world view but also respect for others. English is the official language of the Group and an English version of all internal documents is systematically prepared.



It is a Group that both inspires motivation and offers security :

■ Its research and development effort (the Cap Sesa Innovation and ITMI research centers among others) represents 6.7 % of total revenue.

■ Its expansion is ongoing, as is its capacity to reorganize periodically. This encourages the creation of new jobs and increases the opportunities for career development.



■ Its policy of delegating decision-making at all levels (which, among other things, enables the Branch Managers within the operational units actually to "run" their medium-sized companies) fosters professional development and promotion.

It is a Group which clearly demonstrates its trust in the individual:

■ Contacts are regular and frequent: from branch, region or company meetings, to a club bringing together the most outstanding Branch Managers, to annual "Rencontres" of all the managers, either at the France, Europe or USA group levels or the full contingency of Cap Gemini Sogeti Group managers;

■ Rules governing promotion dictate that attempts be made to fill all vacant positions internally before recruiting from outside.

■ The training effort is especially important. The percentage of total salary devoted to training continues to increase. The current average is 3 % for Cap Gemini America, 4.4 % in the Group Europe companies and 4.75 % in the companies of Group France. Using models appropriate to each country, these programs provide personal, ongoing training based on individual experience and career aspirations. Training is one of the keys to the professional development of the Group's technical staff and, by extension, to the quality of the services provided to its customers.

■ A portion of the managers' compensation is determined by company results.

■ A stock option plan has been set up for all personnel in France and Europe (and key managers in the U.S.).

■ Information is widely developed in each operational subsidiary and at the Group level.

For its clients, Cap Gemini Sogeti is a guarantee of quality service and technical skill. For its investors it represents financial stability combined with a leadership role in its business. And to the men and women who make up its technical staff it assures an exceptionally rich professional environment.

PRINCIPAL LOCATIONS

HOLDING

Head Office: Grenoble
CAP GEMINI SOGETI
6 bd. Jean Pain B.P. 206
38005 Grenoble Cedex
33.76.44.82.01

Finance: Lyons
CAP GEMINI SOGETI
190 rue Garibaldi
69003 Lyons
33.78.62.20.44

General Management: Paris
CAP GEMINI SOGETI
Place de l'Etoile - 11 rue de Tilsitt
75017 Paris
33 (1) 47.54.50.00

OTHER LOCATIONS IN FRANCE

PARIS	Cap Sesa (Holding)	264 Rue du Fg St-Honoré 75008 Paris	33 (1) 47.54.50.00
	Cap Sesa Conseil	30 Quai de Dion-Bouton 92806 Puteaux Cedex	33 (1) 49.00.40.00
	Cap Sesa Défense	30 Quai de Dion-Bouton 92806 Puteaux Cedex	33 (1) 49.00.40.00
	Cap Sesa Exploitation	5/7 Avenue de Bouvines 75544 Paris Cedex 11	33 (1) 40.24.10.10
	Cap Sesa Finance	26 Rue de la Pépinière 75008 Paris	33 (1) 42.93.22.00
	Cap Sesa Formation/ Institut	Tour Mattei 207 Rue de Bercy 75587 Paris Cedex 12	33 (1) 43.46.95.00
	Cap Sesa Sélection	Tour Mattei 207 Rue de Bercy 75587 Paris Cedex 12	33 (1) 43.46.95.00
	Cap Sesa Industrie	92 Boulevard du Montparnasse 75682 Paris Cedex 14	33 (1) 43.20.13.81
	Cap Sesa Industrie	15 Rue de la Vanne 92120 Montrouge	33 (1) 46.56.52.08
	Cap Sesa Innovation	118 Rue de Tocqueville 75017 Paris	33 (1) 46.22.60.27
	Cap Sesa Instruments	92 Boulevard du Montparnasse 75682 Paris Cedex 14	33 (1) 43.20.13.81
	Cap Sesa Maintenance	30 Quai de Dion-Bouton 92806 Puteaux Cedex	33 (1) 49.00.40.00
	Cap Sesa Régions	14-20 Rue Leriche 75738 Paris Cedex 15	33 (1) 45.39.22.25
	Cap Sesa Télécom	30 Quai de Dion-Bouton 92806 Puteaux Cedex	33 (1) 49.00.40.00
	Cap Sesa Tertiaire	129 Rue de l'Université 75007 Paris	33 (1) 45.55.91.57
	Arvica	Tour Anjou 33 Quai de Dion-Bouton 92814 Puteaux Cedex	33 (1) 49.00.00.15
	Hélias	Same location	33 (1) 47.73.60.13
	Logista	Same location	33 (1) 47.76.21.40
	Scofi	Same location	33 (1) 47.73.60.06
ANNECY	Cap Sesa Régions	2 Rue Georges Martin 74000 Annecy	33 50.27.63.23
BORDEAUX	Cap Sesa Régions	31 Rue de l'École Normale 33073 Bordeaux Cedex	33 56.02.00.57
BREST	Cap Sesa Régions	Z.I. du Vernis Sainte-Anne du Portzic 29200 Brest	33 98.05.44.54
CAEN	Cap Sesa Régions	9 Rue du Général Giraud B.P. 41 - 14010 Caen	33 31.85.12.69
CLERMONT-FD	Cap Sesa Régions	La Pépinière Parc Technologique Pardieu 1 Rue Patrick Depailler 63000 Clermont-Ferrand	33 73.27.44.88
GRENOBLE	Cap Sesa Régions	6 Boulevard Jean Pain B.P. 206 - 38005 Grenoble Cedex	33 76.44.82.01
	Cap Sesa Innovation	Centre de Recherche de Grenoble Avenue du Vieux Chêne ZIRST - 38240 Meylan	33 76.90.80.40
	ITMI	12 Chemin-des-Prés ZIRST - B.P. 87 38243 Meylan Cedex	33 76.90.33.81
LILLE	Cap Sesa Régions	276/6 Avenue de la Marne B.P. 21 59704 Marcq-en-Barœul Cedex	33 20.72.95.09
	Logista	Parc Club des Prés 31 Rue Denis Papin 59650 Villeneuve-D'Ascq	33 20.56.05.50
LYONS	Cap Sesa Régions	190, rue Garibaldi B.P. 3166 69212 Lyon Cedex 03	33 78.62.20.41
	Logista	Immeuble "Le Prestige" 110 Avenue Jean Jaurès 69007 Lyon	33 78.69.00.62
MARSEILLES	Cap Sesa Régions	Les Bureaux Borely-Bât. A 40 Avenue de Hambourg B.P. 332 13271 Marseille Cedex 08	33 91.25.11.00
METZ	Cap Sesa Régions	Le Technopôle 2 Bât. B 8 - Rue Graham Bell 57000 Metz-Queuleu	33 87.37.11.23
MONTPELLIER	Cap Sesa Régions	Immeuble Le Triangle Allée Jules Milhau 34000 Montpellier	33 67.92.20.17
MULHOUSE	Cap Sesa Régions	14 Boulevard de l'Europe 68100 Mulhouse	33 89.45.10.60
NANCY	Cap Sesa Régions	25-29 Rue de Saurupt 54000 Nancy	33 83.51.43.96
NANTES	Cap Sesa Régions	Immeuble Horizon 12 Rue Gaetan Rondeau B.P. 2015 44065 Nantes Cedex 02	33 40.47.80.23
NICE	Cap Sesa Régions	179 Boulevard René Cassin 06200 Nice	33 93.21.01.41
ORLEANS	Cap Sesa Régions	35 Avenue de Paris 45000 Orléans	33 38.53.86.50
	Logista	10 Quai de la Madeleine 45000 Orléans	33 38.43.24.28
PAU	Cap Sesa Régions	Centre Activa Boulevard Louis Sallenave 64000 Pau	33 59.84.12.23
REIMS	Cap Sesa Régions	Galerie des Sacres 18 rue Tronsson-Ducoudray 51100 Reims	33 26.47.38.38
RENNES	Cap Sesa Régions	Rue de la Rigourdière 35510 Cesson-Sevigné	33 99.83.85.85
	Cap Sesa Télécom	ZIRST Rennes Atalante 5 Allée de la Croix-des-Hêtres B.P. 1809 35018 Rennes Cedex	33 99.63.50.50
ROUEN	Cap Sesa Régions	Immeuble Montmorency I Place de la Verrerie Centre Régional Saint-Sever 76100 Rouen	33 35.63.50.45
SENLIS	Cap Sesa Régions	17 Rue Léon Fautrat 60300 Senlis	33 44.60.06.71
STRASBOURG	Cap Sesa Régions	20 Place des Halles Tour Europe B.P. 29 67068 Strasbourg Cedex	33 88.32.22.42
TOULON	Cap Sesa Défense	Immeuble "Le Concorde" 314 Avenue du Maréchal Foch 83000 Toulon	33 94.91.11.19
	Cap Sesa Défense	(address as of 07.01.89) Parc d'Activité Burotel Quartier Bassaquet 83140 Six-Fours	
TOULOUSE	Cap Sesa Régions	Immeuble Péripole 1 Chemin du Pigeonnier de la Cépière - B.P. 1155 31036 Toulouse Cedex	33 61.40.55.58
	Cap Sesa Régions	Parc Technologique du Canal 1 Avenue de l'Europe 31400 Toulouse	33 61.73.46.91
	Cap Sesa Exploitation	Burolines Bât. 2 2 ter Rue Marcel Doret ZAC de l'aéroport 31700 Blagnac	33 61.30.48.30
TOURS	Cap Sesa Régions	5 Place Jean Jaurès 37000 Tours	33 47.20.67.67
VALENCE	Cap Sesa Régions	Le Métropole 2 10-12 Rue du Parc 26000 Valence	33 75.42.56.19

PRINCIPAL LOCATIONS IN EUROPE

FEDERAL REPUBLIC OF GERMANY

BRAUNSCHWEIG	Cap Gemini Sesa Deutschland	Wolfenbüttelerstrasse 33 3300 Braunschweig	49 (531) 72 096
DÜSSELDORF	Cap Gemini Sesa Deutschland	Grafenberger Allee 54-56 4000 Düsseldorf 1	49 (211) 67 50 05
ESSEN	Cap Gemini Sesa Deutschland	Moltkestrasse 29 4300 Essen 1	49 (201) 26 620
FRANKFURT	Cap Gemini Sesa Deutschland	Am Salzhaus 4 6000 Frankfurt 1	49 (69) 29 00 71
	Cap Gemini Sesa Deutschland	Bockenheimer Landstrasse 24 6000 Frankfurt 1	49 (69) 71 00 50
HAMBURG	Cap Gemini Sesa Deutschland	Winterhuder Weg 27 2000 Hamburg	49 (40) 22 70 954
MÜNICH	Cap Gemini Sesa Deutschland	Ridlerstrasse 35 a 8000 München 2	49 (89) 51 99 10
NUREMBERG	Cap Gemini Sesa Deutschland	Staffelsteinerstrasse 23 8500 Nürnberg 90	49 (911) 34 825
PADERBORN	Cap Gemini Sesa Deutschland	Klöcknerstrasse 16 4790 Paderborn	49 (5251) 35 466
RATINGEN	Cap Gemini Sesa Deutschland	Airport Center Gothaerstrasse 4 4030 Ratingen (West)	49 (2102) 46 041/45
STUTTGART	Cap Gemini Sesa Deutschland	Zettachring 12 7000 Stuttgart 80	49 (711) 71 50 053

BELGIUM

ANTWERP	Cap Gemini Sesa Belgium	Mechelsesteenweg 127-131 2018 Antwerpen	32 (3) 218 77 52
BRUSSELS	Cap Gemini Sesa Belgium	49, rue du Chatelain 1050 Bruxelles	32 (2) 649 96 40
	Cap Gemini Sesa Belgium	144, avenue Plasky 1040 Bruxelles	32 (2) 736 00 07
	Cap Gemini Sesa Belgium	Av. Roger Vandendriessche 18 1150 Bruxelles	32 (2) 771 98 16
LIEGE	Cap Gemini Sesa Belgium	10 A Quai Churchill 4020 Liège	32 (41) 42 74 63

DENMARK

COPENHAGEN	Cap Gemini Danmark	Produktionsvej 2 2600 Glostrup	45 (42) 94 44 44

SPAIN

BARCELONA	Cap Gemini España	Rambla Cataluna 123 08008 Barcelona	34 (93) 218 85 40
MADRID	Cap Gemini España	Velazquez 140 28006 Madrid	34 (1) 261 37 05 34 (1) 563 03 06

FINLAND

HELSINKI	Cap Gemini Suomi	Itätuulenkuja 11 a 02100 Espoo	358 (0) 455 3455

UNITED KINGDOM

ALTRINCHAM	CGS (UK)	2 Victoria Street Altrincham, Cheshire WA14 1ET	44 (61) 941 19 22
YIEWSLEY	CGS (UK)	133 High Street Yiewsley, Mdx UB7 7QL	44 (895) 44 40 22

ITALY

MILAN	Cap Gemini Geda	Via Cesare Lombroso 54 20137 Milano	39 (2) 54 231
	Sesa Italia	Via Benigno Crespi 70 20159 Milano	39 (2) 69 58 269
NAPLES	Sesa Italia	Via Arenaccia 128 80141 Napoli	39 (81) 780 80 43
ROME	Cap Gemini Geda	Via Flaminia 872 00191 Roma	39 (6) 32 87 351 39 (6) 32 83 312 39 (6) 32 79 377
ROME	Sesa Italia	Centro Direzionale Cineccitta' 2 Via Vicenzo Lamaro 21 00173 Roma	39 (6) 722 961
TURIN	Cap Gemini Geda	Via San Pio V/30 bis 10125 Torino	39 (11) 65 08 282

LUXEMBOURG

LUXEMBOURG	Cap Gemini Sesa Belgium	Val Saint-André 28-30 1128 Luxembourg	32 (352) 44.10.87
	Cap Sesa Régions	12-14 Bd d'Avranches 1160 Luxembourg	32 (352) 48 42 43

NORWAY

BERGEN	Cap Gemini Data Logic	Lars Hillesgate 30 5008 Bergen	47 (5) 31 11 17
FREDRIKSTAD	Cap Gemini Data Logic	K.G. Meldals vei 9 1600 Fredrikstad	47 (9) 34 08 99
OSLO	Cap Gemini Data Logic	Havnelageret Langkaia 1 0150 Oslo 1	47 (2) 42 07 60
SKIEN	Cap Gemini Data Logic	Telemarksgate 8 3700 Skien	47 (3) 52 75 45
STAVANGER	Cap Gemini Data Logic	Kirkebakken 10 4012 Stavanger	47 (4) 52 29 35
TILLER	Cap Gemini Data Logic	Trekanten Vestre Rosten 81 7075 Tiller	47 (7) 88 89 66
TØNSBERG	Cap Gemini Data Logic	Havnegate 2 3100 Tønsberg	47 (33) 18 711

NETHERLANDS

AMSTERDAM	Pandata	Joan Muyskenweg 48 1099 CK Amsterdam	31 (20) 668 29 91
EINDHOVEN	Pandata	Dorpstraat 104 5504 HK Veldhoven	31 (40) 53 96 85
GRONINGEN	Pandata	Queridolaan 5 9721 SZ Groningen	31 (50) 27 20 70
LEEUWARDEN	Pandata	Brandemeer 33 8918 CT Leeuwarden	31 (58) 67 33 80
RIJSWIJK	Pandata	Verrijn Stuartlaan 28 2288 EL Rijswijk	31 (70) 95 71 71
		Visseringlaan 19-23 2288 ER Rijswijk	31 (70) 95 72 21
UTRECHT	Cap Gemini Nederland	Admiraal Helfrichlaan 1 3527 KV Utrecht	31 (30) 91 02 46
UTRECHT	Pandata	Brennerbaan 150 3524 BN Utrecht	31 (30) 89 91 11
ZWOLLE	Pandata	Dr. Stolteweg 68 8025 AV Zwolle	31 (38) 28 64 00

SWEDEN

BORLÄNGE	Cap Gemini Bra	Forskargatan 3 781 27 Borlange	46 (243) 734 80
ESKILSTUNA	Data Logic	Rademachergatan 17 631 20 Eskilstuna	46 (16) 12 00 30
GÖTHENBURG	Data Logic	FG Petersonsgatan 32 421 31 Vastra Frölunda	46 (31) 45 03 40
	Cap Gemini Bra	Stora Badhusgatan 18-20 411 21 Göteborg	46 (31) 10 06 10
JÖNKÖPING	Data Logic	Oxtorgsgatan 3 552 55 Jönköping	46 (36) 19 08 40
KARLSTAD	Cap Gemini Bra	Packhusgatan 1 652 26 Karlstad	46 (54) 11 55 30
LINKÖPING	Cap Gemini Bra	Ågatan 39 582 22 Linköping	46 (13) 11 42 20
MALMÖ	Data Logic	Stora Nygatan 63 211 37 Malmö	46 (40) 772 10
ÖREBRO	Cap Gemini Bra	Törngatan 6 703 63 Örebro	46 (19) 10 55 95
STOCKHOLM	Cap Gemini Bra	Kungsgatan 34 111 35 Stockholm	46 (8) 700 22 00
	Data Logic	Danmarksgatan 46 Box 26 163 42 Kista	46 (8) 750 74 50
		(from 07.03.89) Norgegatan 2 Box 26 164 93 Kista	703 50 00 46 (8) 703 50 00
	Techno Logic	Danmarksgatan 46 163 42 Kista	46 (8) 750 74 50
		(from 07.03.89)	46 (8) 703 51 00
	Data Logic	MONITOR AB Halsingegatan 2 113 23 Stockholm	46 (8) 30 07 10
SUNDSVALL	Cap Gemini Bra	Storgatan 10 852 30 Sundsvall	46 (60) 12 55 40
UMEÅ	Cap Gemini Bra	Norrlandsgatan 7 902 48 Umeå	46 (90) 12 55 30
VÄNERSBORG	Data Logic	Kyrkogatan 22 452 00 Vänersborg	46 (521) 126 70
VÄSTERÅS	Data Logic	Vallby - Institutet 720 14 Västerås	46 (21) 30 30 90
	Cap Gemini Bra	Sigurdsgatan 9 721 30 Västerås	46 (21) 11 55 40

SWITZERLAND

BASLE	Cap Gemini Suisse	Grosspeterstrasse 23 4052 Basle	41 (61) 50 13 13
BERN	Cap Gemini Suisse	Koenizstrasse 74 3008 Bern	41 (31) 46 01 31
GENEVA	Cap Gemini Suisse (*)	2, chemin de Beau Soleil 1206 Geneva	41 (22) 46 14 44
	Cap Gemini Suisse	4, Chemin de Beau Soleil 1206 Geneva	41 (22) 47 88 00
GENEVA	Cap Sesa Exploitation	8c, Avenue de Champel 1206 Geneva	41 (22) 46 95 90
LAUSANNE	Cap Gemini Suisse	25, rue du Simplon 1006 Lausanne	41 (21) 26 31 33
ZURICH	Cap Gemini Suisse	Brauerstrasse 60 8004 Zurich (F+D)	41 (1) 242 28 26
	Cap Gemini Suisse	Brauerstrasse 60 8004 Zurich (H+I)	41 (1) 241 06 70

(*) General Management

CAP GEMINI AMERICA

Corporate Headquarters: New York
1133 Avenue of the Americas
New York, NY 10036
1 (212) 221-7270

Finance: Holmdel
960 Holmdel Road
Holmdel, NJ 07733
1 (201) 946-8900

OTHER LOCATIONS IN THE UNITED STATES

APPLETON	4321 West College Avenue Appleton, WI 54914	1 (414) 730-3856
ATLANTA	1800 Century Boulevard Atlanta, GA 30345	1 (404) 633-2600
BALTIMORE	401 East Pratt Street World Trade Center Baltimore, MD 21202	1 (301) 837-0343
CHICAGO	2 Westbrook Corporate Center Westchester, IL 60154	1 (312) 531-1300
	1001 Warrenville Road Lisle, IL 60532	1 (312) 810-0052
CINCINNATI	10921 Reed Hartman Highway Cincinnati, OH 54242	1 (513) 791-9421
CLEVELAND	5800 Lombardo Center Drive Cleveland, OH 44131	1 (216) 642-1491
COLUMBUS	3386 Snouffer Road Columbus, OH 43235	1 (614) 792-6767
DALLAS	2 Galleria Tower 13455 Noel Road Dallas, TX 75240	1 (214) 385-3290
DAYTON	3401 Park Center Drive Dayton, OH 45414	1 (513) 890-1200
DENVER	5299 DTC Boulevard Englewood, CO 80111	1 (303) 220-1700
DES MOINES	3737 Woodland Avenue W. Des Moines, IA 50265	1 (515) 226-0504
HOUSTON	1700 West Loop South Houston, TX 77027	1 (713) 622-0105
KANSAS CITY	6900 College Boulevard Overland Park, KS 66211	1 (913) 451-9600
LOS ANGELES	606 S. Olive Street Los Angeles, CA 90014	1 (213) 624-0855
MADISON	International Office Center 2317 International Lane Madison, WI 53704	1 (608) 244-4880
MEMPHIS	1355 Lynnfield Road Memphis, TN 38119	1 (901) 683-7900
MIAMI	1000 West McNab Road Pompano Beach, FL 33069	1 (305) 942-6522
MILWAUKEE	10150 West National Avenue Milwaukee, WI 53227	1 (414) 546-4644
MINNEAPOLIS	7300 France Avenue South Edina, MN 55435	1 (612) 835-7779
NEW JERSEY	25 Commerce Drive Cranford, NJ 07016	1 (201) 272-7950
	Raritan Plaza III Raritan Center Edison, NJ 08837	1 (201) 225-7880
NEW YORK	369 Lexington Avenue New York, NY 10017	1 (212) 883-0900
OMAHA	10810 Farnam Drive Omaha, NE 68154	1 (402) 333-2863
ORLANDO	2700 Westhall Lane Maitland, FL 32751	1 (407) 660-8833
PHILADELPHIA	150 Monument Road Bala Cynwyd, PA 19004	1 (215) 668-4626
PORTLAND	6915 Southwest Macadam Avenue Portland, OR 97219	1 (503) 246-4777
RICHMOND	808 Moorefield Park Drive Richmond, VA 23236	1 (804) 320-0787
ST. LOUIS	1034 South Brentwood Boulevard St. Louis, MO 63117	1 (314) 721-0123
SEATTLE	16400 South Center Parkway Seattle, WA 98188	1 (206) 575-4911
STAMFORD	72 Cummings Point Road Stamford, CT 06902	1 (203) 977-1116
TAMPA	100 West Kennedy Boulevard Tampa, FL 33602	1 (813) 273-0059
WASHINGTON, DC	8381 Old Courthouse Road Vienna, VA 22180	1 (703) 734-1511
WILMINGTON	Baynard Building 3411 Silverside Rd. Wilmington, DE 19810	1 (302) 478-1295

SYSTEMATION

CLEVELAND	Three Commerce Park Square 23200 Chagrin Blvd. Cleveland, OH 44122	1 (216) 464-8616
COLUMBUS	Westerville Office Center 635 Park Meadow Road Westerville, OH 43081	1 (614) 898-3044
PITTSBURGH	302 McKnight Drive Pittsburgh, PA 15237	1 (412) 364-2080
YOUNGSTOWN	Ohio One Building Youngstown, OH 44503	1 (216) 743-4200

COMPACT DATA SYSTEMS

LOS ANGELES	21107 Vanowen Street Canoga Park, CA 91303	1 (818) 992-4361

AFFILIATED COMPANIES

Group BOSSARD 12, rue Jean Jaurès
92807 Puteaux
33 (1) 47.76.42.01

CISI 31, avenue de la Division-Leclerc
92260 Fontenay-aux-Roses
33 (1) 40.91.50.00

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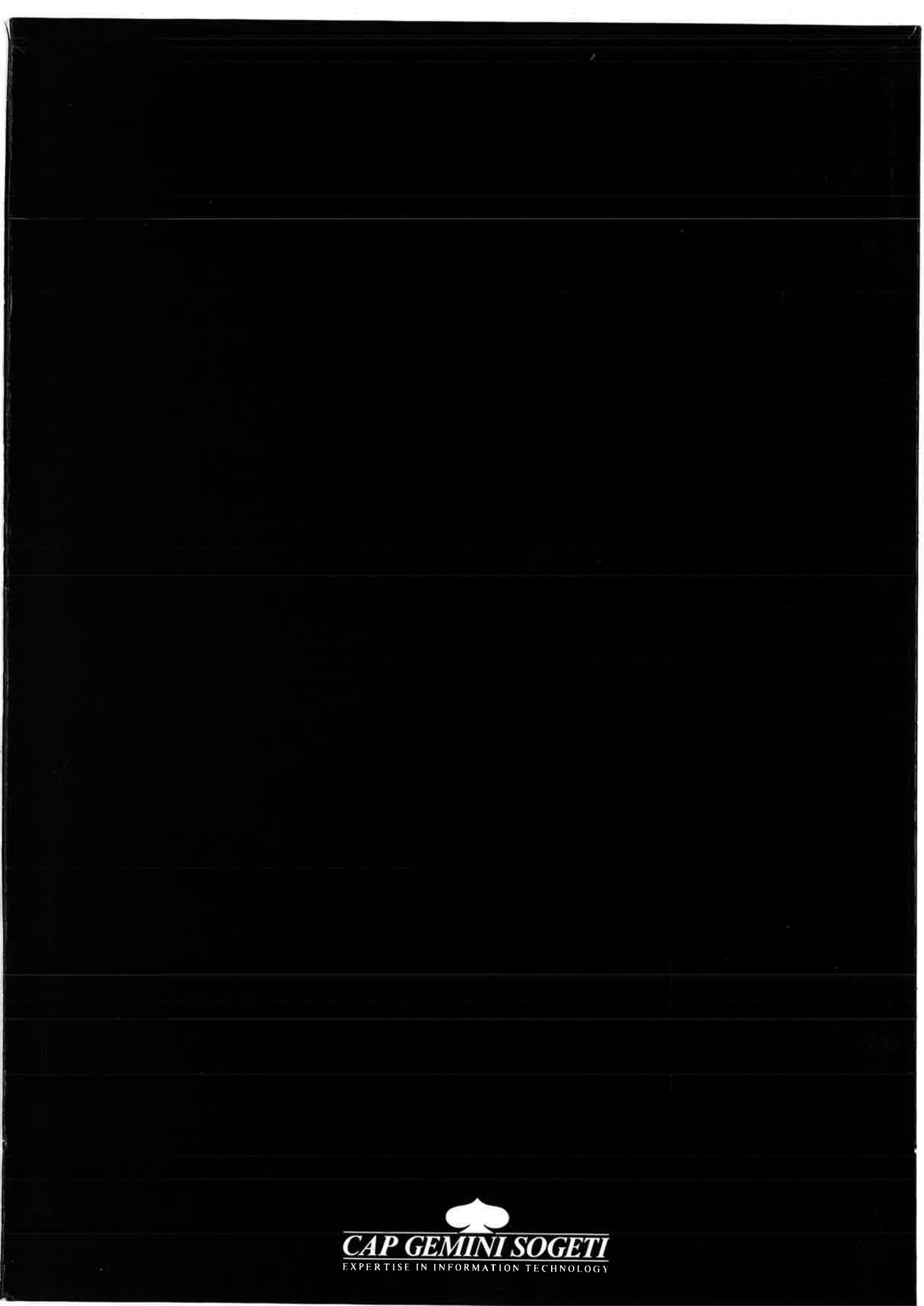
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