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The company carries out continuous and in-depth research. Working closely with clients on important issues, INPUT's staff members analyze and interpret the research data, then develop recommendations and innovative ideas to meet clients' needs. Clients receive reports, presentations, access to data on which analyses are based, and continuous consulting.

Many of INPUT's professional staff members have nearly 20 years' experience in their areas of specialization. Most have held senior management positions in operations, marketing, or planning. This expertise enables INPUT to supply practical solutions to complex business problems.

Formed in 1974, INPUT has become a leading international planning services firm. Clients include over 100 of the world's largest and most technically advanced companies.

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EUROPEAN TRENDS AND OPPORTUNITIES IN FOURTH GENERATION LANGUAGES

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ABSTRACT

Fourth generation languages appear to be having a significant impact on large information systems organisations and on many end-user departments. This report sets out to examine market trends and developments for fourth generation languages and to provide forecasts for these products within the four major European country markets of France, Italy, the United Kingdom, and West Germany.

The report examines the general characteristics of fourth generation languages and their impact. The user environment is discussed as well as the strategic and tactical issues facing vendors in this marketplace. Some selected products are described to provide examples of fourth generation language characteristics.

This report contains 84 pages, including 16 exhibits.

M-FGE-519

EUROPEAN TRENDS AND OPPORTUNITIES IN FOURTH GENERATION LANGUAGES

CONTENTS

EUROPEAN TRENDS AND OPPORTUNITIES IN FOURTH GENERATION LANGUAGES

EXHIBITS

1 INTRODUCTION

I INTRODUCTION

A. REASONS FOR PREPARING THIS REPORT

- The purpose of this report is to examine market trends and developments in fourth generation languages and to provide INPUT's forecast for these products and services.

- Fourth generation languages (FGLs) appear to be having a significant impact on large Information Systems (IS) organisations and on many end user departments.

- The emergence of these fourth generation languages represents a potentially large market. Vendors that understand and develop strategies for this market can benefit from this area of opportunity.

- One of the major factors in the growth of personal computers has been the acceptance of fourth generation languages in large organisations.

B. SCOPE AND METHODOLOGY

- This report has been produced as part of INPUT's Software and Services Planning Service for the Information Services Industry (SSPS) programme, and addresses the following topics:

- Definition and characteristics of FGLs (Chapter III).

- The current FGL environment (Chapter IV).

- Market trends and forecasts (Chapter V).

- Specific marketing strategy recommendations (Chapter VI).

- The scope of the report includes an examination and analysis of current FGL product offerings. Example product descriptions and vendor names and addresses are included as Appendices A and B, respectively.

- The research programme in Europe encompassed 33 on-site and telephone interviews in France, the United Kingdom, and West Germany. Additional vendor research was also conducted within the Italian market.

- Interviews were used to gather primary data, opinions, and plans for the purposes of performing the analysis for this study.

- In addition, secondary research was conducted using INPUT's library and research conducted into this subject in the U.S. This helped to explore new product developments, overall acceptance of these tools, and the relationship between the end user and the information centre.

C. OTHER RELATED INPUT REPORTS

- Readers are advised to refer to the following earlier INPUT reports:

- The Opportunities of Fourth Generation Languages, September 1983.

  . This report examines opportunities for Information Systems organisations to take advantage of these emerging technologies.

- Organizing the Information Center, August 1983.

  . Since the information centre and FGLs are so tightly coupled, this report looks at internal strategies and methods for coordinating service and products.

- In addition, INPUT produced a series of reports as part of its U.S. 1984 MAPS program that are related and recommended: They are:

  - Micro-Mainframe: Personal Computer Market Opportunities.

  - Market Opportunities for Applications Transfer to Personal Computers.

  - Pricing and Distribution of Personal Computer Software.

II EXECUTIVE SUMMARY

II EXECUTIVE SUMMARY

- This executive summary is designed in a presentation format in order to:
  - Help the reader quickly review key research findings.
  - Provide a ready-to-go executive presentation, complete with a script, to facilitate group communication.
- The key points of this entire report are summarised in Exhibit II-1 through II-6. On the left-hand page facing each exhibit is a script explaining the exhibit's contents.

A. TRENDS AND OPPORTUNITIES IN FOURTH GENERATION LANGUAGES

- INPUT believes that fourth generation languages (FGLs) are gaining acceptance very rapidly with nonprogrammers and programmers. There is continuing market potential for mainframe- and microcomputer-based products. However, there are a number of issues covered in this report that vendors need to analyse and develop strategies for.

- INPUT's research report:

  - Defines FGLs, their uses and economics, current environment, and impacts.

  - Updates the status of FGLs, the current and projected products, and the major strategic and tactical issues.

  - Examines the market trends and the user expectations and provides market forecasts.

  - Summarises the market and provides recommendations for vendor strategies for fourth generation language markets.

- The remainder of this summary will provide highlights from INPUT's report.

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TRENDS AND OPPORTUNITIES

- Impact of FGLs
- Scope of the Research

B. CHARACTERISTICS OF FOURTH GENERATION LANGUAGES

- The characteristics of fourth generation languages are:

  - They are nonprocedural and focus on results, not on the process of obtaining the result.

  - They use English-like syntax, allowing end users to develop their own applications.

  - They are nontechnical and allow users to specify or even make their own changes.

  - They are flexible, and can be learned quickly and used easily by nonprogrammers.

  - They reduce the time required to develop and maintain applications.

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FGL CHARACTERISTICS

- Focus on Results
- Use English-Like Syntax
- Non-Technical Orientation
- Highly Flexible

C. USES AND IMPACTS OF FOURTH GENERATION LANGUAGES

- Most FGLs are being used for secondary analytical applications, not for production data processing applications. However, there is an emerging trend toward users developing their own "pseudo-production" applications for small production-oriented tasks.

- FGLs are gaining acceptance; in fact, they are gaining acceptance in both programmer and nonprogrammer communities.

- The success of the corporate information centre will be largely due to FGLs and, of course, to personal computers.

- The benefits most often cited for FGLs are their ability to speed system implementation, their increased productivity, and their contribution to overall system quality through prototyping.

- In addition to users becoming computer literate, there will be other organisational impacts, including users maintaining their own programs and information systems becoming more valuable to the overall aims of the business.

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USES AND IMPACTS

- Mainline versus Secondary Applications
- Success of the Information Centre and FGLs
- Benefits of FGLs
- Impacts on the Organisation

D. FGLs: STATUS REPORT

- One of the key values of FGLs is their capability to do prototyping. This process receives praise from users and IS, and makes the application more readily acceptable to both.

- Resistance to FGLs for production systems is being eroded by the appeal of having end users run and maintain these systems on a decentralised basis.

- The most frequently mentioned needs, expressed by both IS and end users, are better product performance, increased security, and improved data structure and I/O support.

- Other areas of concern where current products are rated as unsatisfactory are improved human factors and better micro-to-mainframe links.

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FGLs: STATUS REPORT

- Prototyping has Dual Benefits
- Most Frequently Mentioned Needs
  - Improved Product Performance
  - Increased Security

E. FGL MARKET TRENDS AND FORECASTS

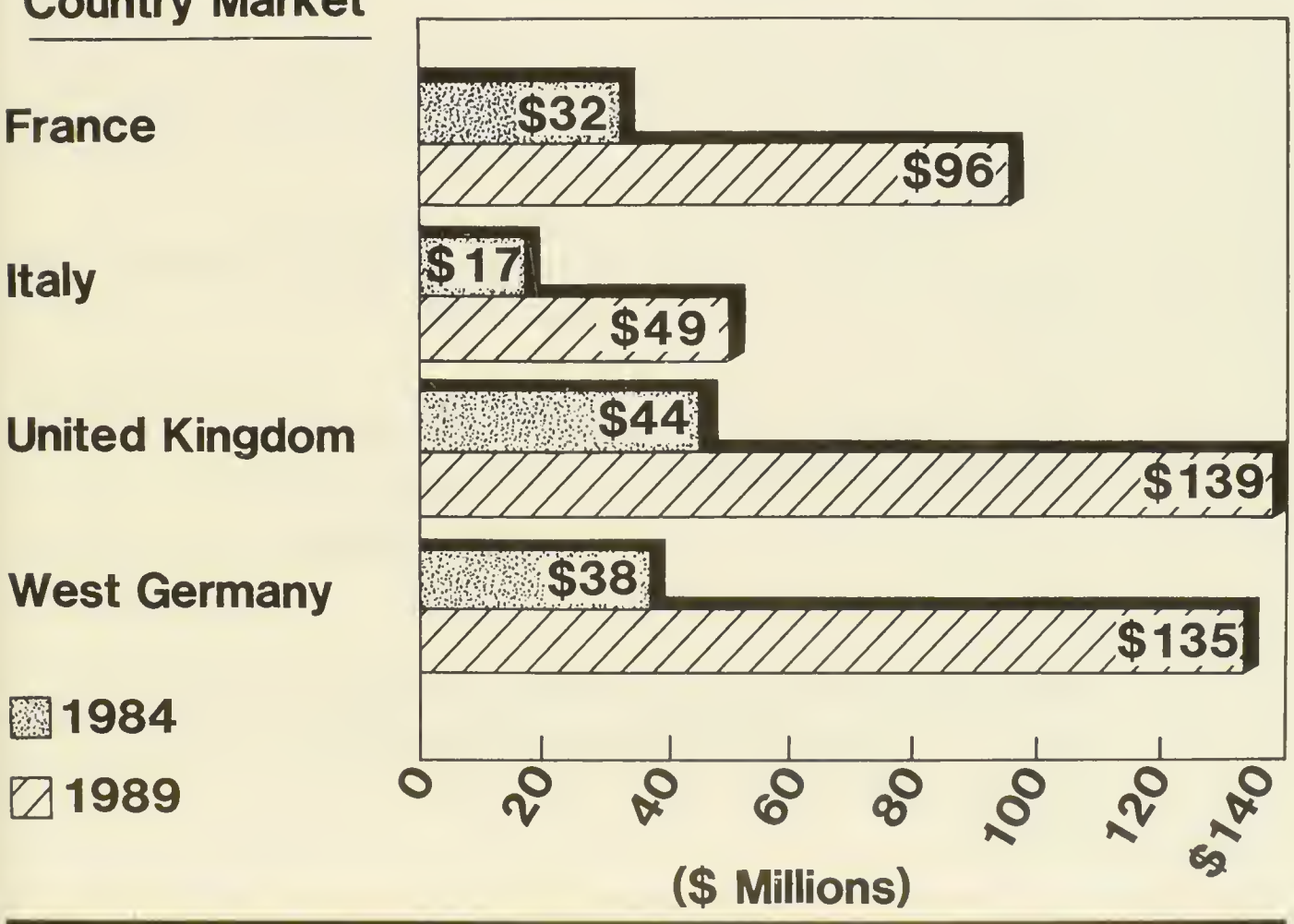
- Most mainframe FGL vendors have developed or are developing micro-based versions of their products. These functionality-rich products should enjoy success in the market.

- FGLs will be one of the fastest growing software markets over the next five years. This growth would be even more dramatic if INPUT considered the application- specific programs developed by systems integrators using these fourth generation tools.

- Growth is expected to slow toward the end of the forecast period because of the emergence of "expert systems" products.

- The Italian market is relatively underdeveloped in comparison with France, the U.K., and West Germany. High interest in FGLs has not yet been translated into product purchases, but accelerated acceptance is expected towards the end of the forecast period.

FGL MARKET TRENDS



F. CONCLUSIONS AND RECOMMENDATIONS

- The proliferation of personal computers as management workstations will fuel the desire for more FGL products.

- INPUT expects to see the product differentiation between micro and mainframe products diminishing.

- Micro-to-mainframe links will support today's needs and are needed for office automation. Improved human factors in microcomputer software are needed to compete in the markets of the future.

- Long-range strategies are needed to sell production applications to IS management and to enhance relationships with IS.

- INPUT feels vendors should take advantage of the opportunity to extend their services in training and support.

- Vendors should develop products or services to address the pending problems of data management, data control, and administration.

- The development centre is evolving as a concept for application development. If successful, the development centre will be the group developing production applications. INPUT urges vendors to plan for this potential market.

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CONCLUSIONS AND RECOMMENDATIONS

- Many Factors Fuel FGL Market
- Opportunities Exist in Support and Training
- Address Products and Services to Pending Problems of Information Systems
- Opportunities Exist in the Evolution of the Development Centre

III FOURTH GENERATION LANGUAGES: GENERAL CHARACTERISTICS

III FOURTH GENERATION LANGUAGES: GENERAL CHARACTERISTICS

A. DEFINITIONS AND CHARACTERISTICS

- A fourth generation language has the following general characteristics:
  - It is nonprocedural; i.e., the language focuses on the result rather than the process of obtaining the result.
  - It uses English-like syntax and interfaces, allowing end users to actually develop their own applications.
  - It is nontechnical and provides facilities for users to specify or even make their own changes.
  - It is flexible, has a fast initial learning period, and allows for frequent changes without creating difficult maintenance problems.
  - It has built-in functions such as a DBMS, statistics, text editor, and graphics.
  - It reduces the time required to develop applications and, through end-user involvement, can improve the quality of the result.
- In contrast, COBOL is the leading example of a third generation language.

- Exhibit III-1 demonstrates the evolution of fourth generation languages. It also demonstrates how these fourth generation languages have dramatically increased end-user involvement in corporate information processing.

- Although suited to the hardware available, first-generation languages were very restrictive and only useable by a few skilled programmers. Second generation products only made some improvement on this situation.

- The third generation languages represented a stage where the power of the computer was opened up to a much larger body of professional programmers.

- The excitement generated by fourth generation languages is that an even wider audience of potential computer users can be reached.

- Fourth generation languages are pervasive and many products are viewed by users and promoted by vendors as fourth generation languages.

- It appears that fourth generation languages are, by and large, discrete products. INPUT believes vendors should examine these products to develop product lines containing several discrete products. Further, fourth generation environments consisting of a set of tools that fully shelter the user from the complexities of the operating system could also be developed.

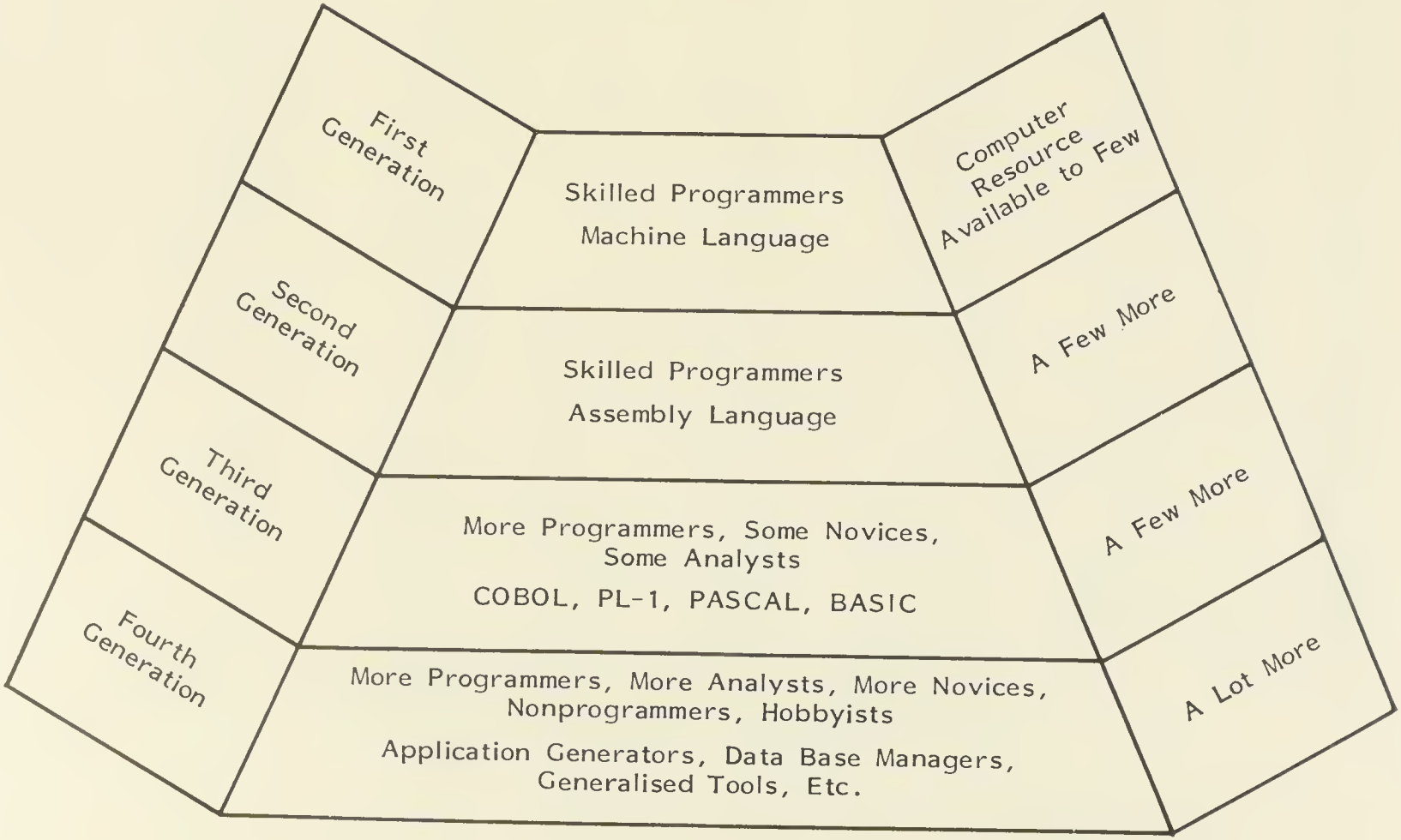
- While many fourth generation languages are designed for programmers, there are many that are targeted for the end user. INPUT's research shows that in 1985, 62% of the users of these products are nonprogrammers. INPUT predicts that this will grow to nearly 70% over the next couple of years.

- INPUT has identified at least four major types of fourth generation languages:

  - Generalised tools, including self-contained proprietary DBMSs.

EXHIBIT III-1

CHARACTERISTICS OF THE LANGUAGE GENERATIONS



- Tools linked to a separate proprietary DBMS.

- Application and program generators that generate higher level language object code.

- Modeling languages that have 'programming' facilities.

- Exhibit III-2 gives some examples of leading products in each of these categories. See Appendices A and B for further information on fourth generation language vendors.

- INPUT's definition allows for including some micro products like Lotus that are questionably called fourth generation languages, but that are of such high interest and referred to so frequently as FGLs that the definition has been loosened to conform to industry usage.

- Exhibit III-2 displays some existing product categories. INPUT believes that new products will emerge that are hybrids of these categories or that will constitute fourth generation environments.

- Exhibit III-3 shows another view of fourth generation languages: who uses them and for what type of activity.

- Exhibit III-3 further demonstrates the degree to which fourth generation languages are making computing resources available to more and more people in the business world.

- Further consideration of Exhibit III-2 and III-3 shows that vendors need to plan to support multiple hardware products, since users will want their applications to migrate to higher capacity machines as they develop larger and more complex systems.

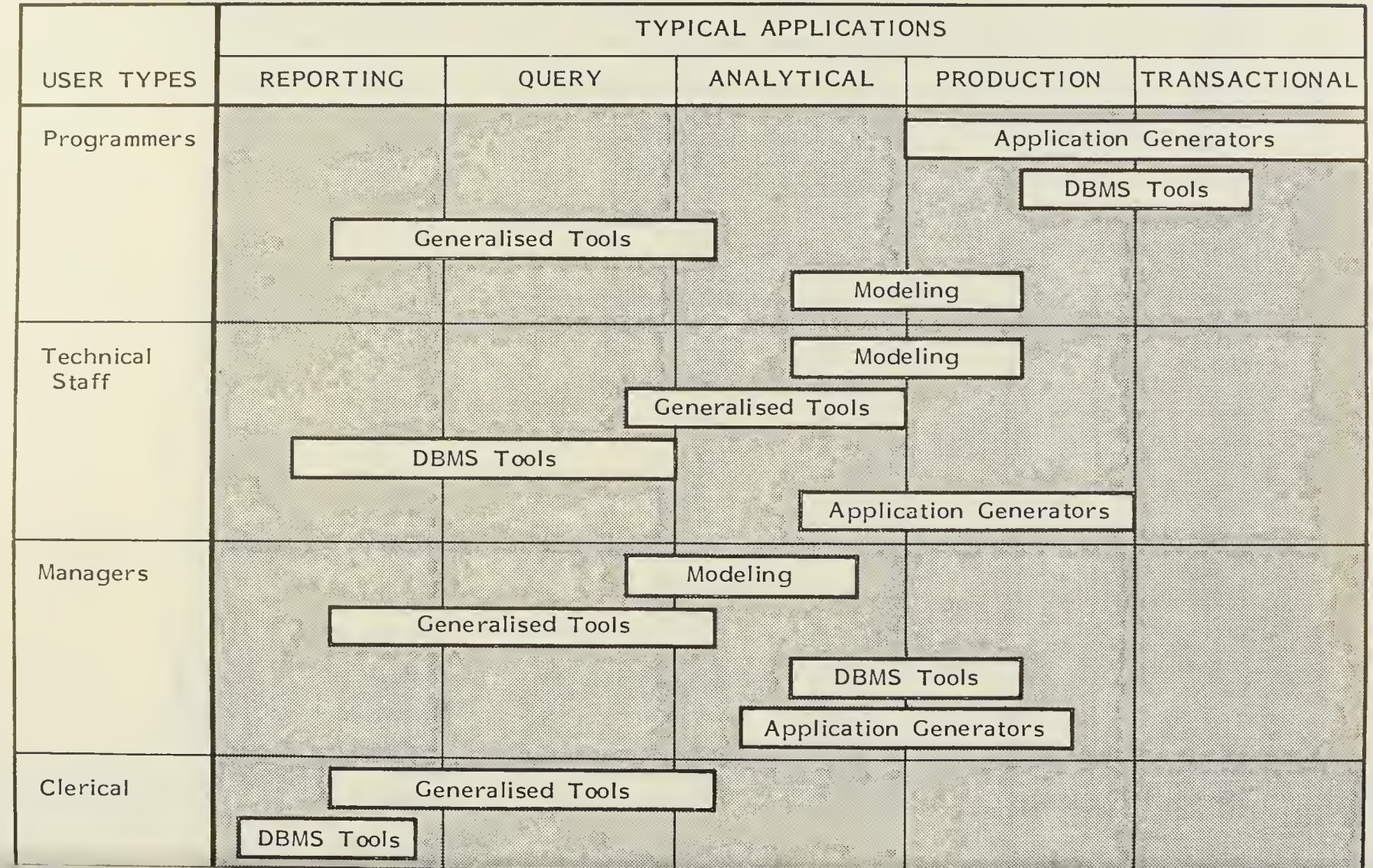
EXHIBIT III-2

EXAMPLES OF FOURTH GENERATION PRODUCTS

MAJOR TYPES	HARDWARE USED		
	MICRO	MINI	MAINFRAME
Generalised Tools	FOCUS PC Ramis II		AS Ramis II Information Expert Millenium
Tools Linked to DBMSs	Informix	Natural Informix	FOCUS Ideal Natural Atos Plus Oracle RDBMS PX Ellysse
Application Generators	All Mapper	All POWERHOUSE Mapper	MARK V ALL Mapper UFO Mantis
Modeling Languages	Wizard Micro FCS	Express	Wizard Express IFPS FCS-EPS

EXHIBIT III-3

TYPICAL USER ACTIVITY



- Users also want product integration or the ability to link the same product to different hardware products and to move back and forth between them.

B. FOURTH GENERATION LANGUAGES: USES AND ECONOMICS

- Most current fourth generation language products are typically being used for secondary, non-mainline data processing applications.

  - 'Mainline' uses are those that introduce or modify a production system that is usually both large and transaction oriented.

  - Secondary applications are generally using already 'processed' data, at least in the minds of IS management. These are applications like modeling and decision support systems.

  - Another secondary applications that is large but less visible than the normal analytical applications is the development, by users, of their own 'pseudo' production systems. In these, the end users are both programming and operating their own production systems.

- Most of these applications are developed by end users to address the invisible backlog that has built up due to the users' frustration with corporate IS response. However, fourth generation languages are contributing to a shift in these user attitudes. More important, users are developing computer literacy and awareness.

  - The shift in user attitude is one of independence and feeling of control, since they know they can solve their own problem rather than worry about the backlog.

- The application backlog still remains about the same, but the balance has shifted towards more new applications, with users taking on more small tasks and more reporting and query applications.

- The acceptance of fourth generation languages appears to be gaining. Exhibit III-4 shows vendor and user responses to issues or objections they are encountering. The responses reflect whether the user or vendor has a high, medium, or low concern for a particular issue.

- As far as vendors' concerns were expressed, no one issue stood out. Increased hardware resources, lack of a structured methodology, and loss of control over data and systems were rated of medium concern in comparison with other issues such as increased staff and support costs. Interestingly, vendors only rated competitors' product features as an issue of less concern.

- In contrast, users rated the lack of a structured methodology as a high concern, with all other relevant issues rated as medium.

- The use of fourth generation languages has been strongest in analytical or ad hoc applications; this satisfies a current, often short-term, need. With growing acceptance, INPUT believes that vendors will find more users growing into 'pseudo' production applications, resulting in further increases of the demand for these tools.

    - However, some of this growth may be delayed by the lack of hardware resources, since large organisations plan capacity 12 to 18 months in advance, and IS expressed concern about being able to adequately forecast and justify the capacity needed to meet the insatiable demand.

EXHIBIT III-4

STATUS OF COMMON ISSUES

	CONCERN BY:	
	VENDORS	USERS
Increased Hardware Resources	Medium	Medium
Increased Staff and Support Costs	Low	Medium
Programmer Opposition	Low	Medium
Commitment to Traditional Methods	Low	Medium
Lack of Structured Methodology	Medium	High
Loss of Control of Data, Systems, etc.	Medium	Medium
Competitors' Features	Low	N/A

C. IMPACTS OF FOURTH GENERATION LANGUAGES

- Fourth generation languages are beginning to establish a strong presence in most markets. The exception is Italy, where demand does not yet appear to be very strong; interest in fourth generation languages has not yet been translated into action.

- End users are becoming increasingly satisfied with fourth generation language products, and INPUT considers that this will lead to demands for more products, services, and training.

- Fourth generation languages are becoming a major factor in the development of the information centre, and INPUT believes that a similar opportunity exists for the emerging development centre. The development centre is intended to do for programmers what the IC is doing for end users.

- Within the organisation the strength of fourth generation languages depends heavily on how they are used by end users or by the information systems department.

    - When fourth generation languages are used by the end users, the overall result is positive, but there is little perceived impact on the organisation.

        . The exception occurs as these users begin to really understand how to use these tools and extol their virtues to senior management. The more management understands how end users are profiting from these tools, the more management will be encouraged, and the easier it will be to fund projects and services.

. There is a danger of conflict in that the users may then tell the information systems department how to design and implement corporate systems. This can then result in a considerable loss of confidence by end users with IS, as is illustrated graphically in Exhibit III-5.

- The impact of fourth generation languages can be much greater when they are used by information systems for mainline or production systems.

- In the early stages of experience with an FGL, users' satisfaction with IS increases due to more appreciation for data processing, etc. However, as users become highly skilled the satisfaction may go down due to feelings that they know how to solve a problem better and faster.

- Information systems and information centre departments expect to enjoy the benefits of fourth generation languages.

  - Faster systems implementation.

  - Increased productivity in both development and maintenance.

  - Increased system quality.

  - Allow IS to shift costs to the department incurring the cost.

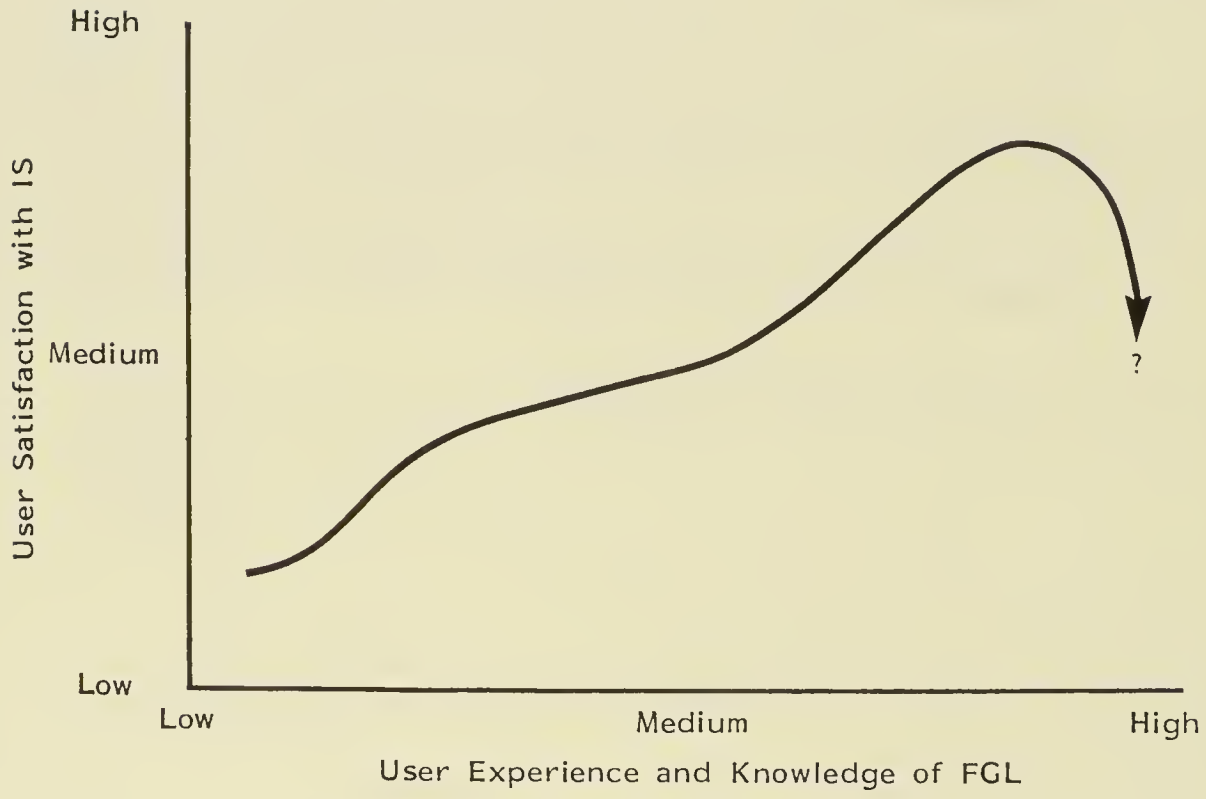
  - Reduction in the visible and invisible backlog.

- Fourth generation languages will have a significant impact on personnel, both IS and non-IS.

  - User skills in computer tools will increase dramatically.

EXHIBIT III-5

FGL USER SATISFACTION WITH INFORMATION SYSTEMS
(WHERE INFORMATION SYSTEMS DO NOT USE FGLs)



- IS skills will change in response to fourth generation languages, since FGLs will obsolete traditional languages.

- There will be organisational impacts to deal with as well.

  - For many applications, routine maintenance will be handled by user departments.

  - Information systems will expand their quality assurance activities to include user-developed systems as well as their own.

  - Generally, IS will improve as a corporate resource, becoming more consultative and better able to advise on how to benefit from the corporate information resource. This type of a role will also be more valuable in contributing to the success of the organisation.

IV FOURTH GENERATION LANGUAGE ENVIRONMENTS

IV FOURTH GENERATION LANGUAGE ENVIRONMENTS

A. CURRENT USER ENVIRONMENTS

- One of the most important issues for vendors to understand is the degree to which information systems management is using FGLs and what applications they are addressing.

- Some general observations on the use of FGLs are:

  - Fourth generation languages are less likely to be used when the systems are large or when they are transaction oriented.

  - Although INPUT does not agree that fourth generation languages are limited in this way, it is important in planning sales programmes to realise this is the way IS management is thinking.

  - INPUT believes that the shift to higher level languages will grow and that FGLs will be used increasingly for large applications and transaction-oriented applications. Regardless of what IS is thinking, end users will lead the way.

    . In the case of these larger systems, the end user is much more likely to get IS involved. In either case, vendors will need to have sales programmes directed at IS management.

- As fourth generation languages have found their way into user environments, they have evolved around four primary developments or issues, usually stemming from the involvement of the information systems organisation.

  - Prototyping with FGLs. Users feel that the value of prototyping is very high and that this allows them to improve their ability to respond to changing end-user requirements.

  - FGLs for production systems. Although there has been resistance to FGLs for production systems, resistance will weaken as production and pseudo-production systems evolve.

    . One of the biggest benefits for IS is that with a FGL production system, it becomes feasible for the user to run the system and to maintain it on a decentralised basis.

    . It also becomes possible for FGLs to satisfy changing user needs and to make users feel that the system is their own.

  - Micro-to-Mainframe FGL Links. Users rate the current products as unsatisfactory, regardless of the initiative taken by vendors in this area. While it is not totally clear what the relationships between micro and mainframe links should be, the following points seemed to emerge:

    . A complete or comprehensive subset of the FGL has to be on the micro so that uploading and downloading are transparent to the user.

    . The linking is needed on an application basis, with the micro 'using' the mainframe as a data base 'backend' machine. The implication here is that users don't want to transfer files, they want to access data.

- System Quality and FGLs. IS departments will become increasingly concerned about quality. Quality is the foundation for productivity, for user satisfaction, and for controlling the life cycle costs of application software.

  . IS acknowledgement of this will be a plus for fourth generation languages since the real key to robust growth is FGLs' use in production systems, both for capturing more applications and for significantly enhancing users' ability to access data for Decision Support Systems.

  . The most important attributes of quality systems will be directly addressed by FGLs. FGLs have the potential to improve system robustness, system flexibility, and data integrity.

  . In contrast, IS is concerned that users will get carried away with these new-found tools and fail to manage data and information effectively.

  . Another concern is that of users adding more features and functions and actually increasing development and operating costs.

- The original technical hostility of many IS managers to FGLs is being weakened as organisations are increasingly appointing 'business managers' to oversee IS operations and more focus is placed on business rather than technical goals.

- There are also other factors fueling the acceptance and growth of FGLs in the user community, especially:

  - The development of the information centre around the use of FGLs.

- The explosive growth of microcomputers and FGLs or FGL-like systems.

- Even with the high acceptance of FGLs, users are aware of the need for improved performance by generating higher level code or by other means.

- Continuing improvements in human factors is also very important. Fourth generation languages must be built on DBMS technology to hide the complexity of the data and to present the data the way the user thinks.

- FGL growth is expected to remain strong and to increase at the rate resources are made available, which may be the constraining factor.

  - FGL support and training is expected to lag behind the growth in users.

  - Within organisations that are developing information centres the expectation is that the growth of FGL use by nonprogrammer users will probably be 50% greater than the growth in use by programmers. However, use by programmers will increase dramatically (perhaps by as much as 500%) over the next five years.

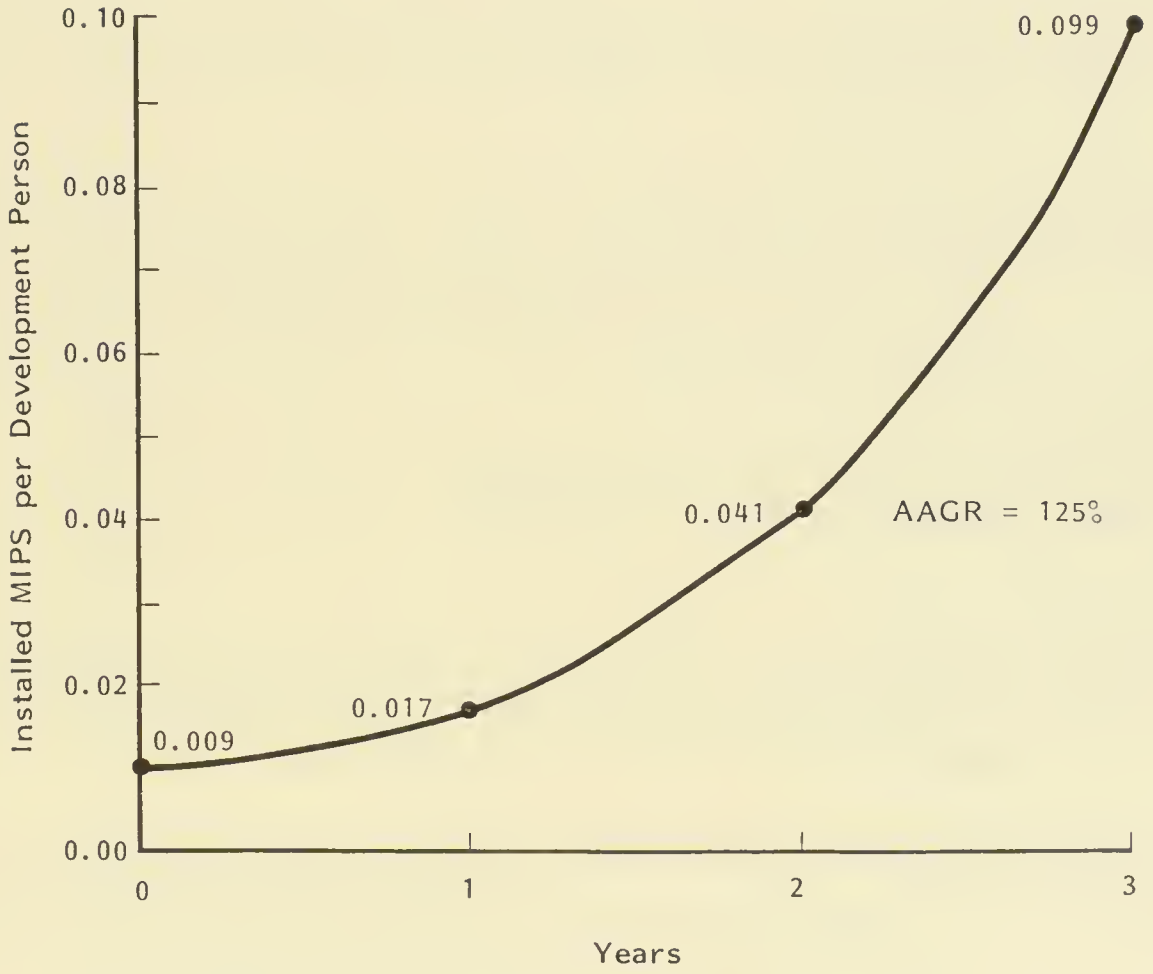
- Although the acceptance of FGLs is currently high, IS is well aware that the FGL environment does require more hardware resources.

  - Exhibit IV-1 shows the need for substantially more horsepower for each development person after the installation of a fourth generation language.

  - As fourth generation languages are installed and really used by programmers, the hardware resource requirement increases at an average of 125% per year.

EXHIBIT IV-1

INSTALLED MIPS PER DEVELOPMENT PERSON
AFTER FOURTH GENERATION LANGUAGE INSTALLATION



- Exhibit IV-1 shows this build-up; it also demonstrates that growth appears to further accelerate with user experience.

- In fairness to vendors of fourth generation language products, it should be noted that these economics are considered at a particular point in time. They should become more favourable to FGLs as vendors plan to provide ongoing enhancements to improve performance.

- Also in favour of FGLs are falling hardware prices and rising personnel costs that translate into IS management having increased interest in improving labour productivity.

- It wasn't too long ago that assembly language was being touted over COBOL; now it is COBOL being touted over FGLs. The significance is that the importance of hardware efficiency is diminishing and is not a deterrent to fourth generation language growth. In fact it is the impetus for continued success.

B. CURRENT VENDOR ENVIRONMENTS

- FGL vendors are very active in product development and promotion. The last year has seen more developments in FGL products than the previous five years combined. INPUT attributes this to several factors:

  - As stated in the previous section, user acceptance has been very high and most FGL vendors have had strong performances, allowing them to put more resources into research and development.

  - Competition within their own markets and the market opportunities resulting from the personal computer explosion have put pressure on FGL vendors to assure their participation in broader markets in the future.

- From the user point of view this activity has produced mixed results. For example, while many micro-to-mainframe links have been introduced, the users have been generally unimpressed.

- However, this does not mean that vendors should be discouraged, since users are generally pleased to see competition and keen interest from vendors which are interpreted as signs that products meeting their expectations will emerge.

- Exhibit IV-2 shows the balance between the product advantages perceived by vendors and those perceived by end users.

- This type of analysis can be very important in deriving strategy, since it highlights where vendors are tending to miss the mark by not taking advantage of their products' perceived strengths.

- Interestingly, most vendors rated all items as having high importance, but greater productivity was singled out for the highest rating. In contrast, users rated reduced cost and micro-to-mainframe links as being of only medium importance.

- Another perceived advantage cited by users is the use of FGLs as a tool for the information centre. INPUT feels this is a real advantage for vendors and one they should aggresively promote.

- Vendors are tending to place their highest development priority on improved product performance, either by developing post processors that generate more efficient run-time modules, or by generating higher level code that is similar to the application generator products.

  - Also, micro-to-mainframe links are relatively high in development priority but are only rated at medium importance by the users.

EXHIBIT IV-2

FGL ADVANTAGES: PROMOTED AND PERCEIVED

ADVANTAGE	USER	VENDOR
Improved Development Capability	High	High
Prototyping	High	High
Reduced Cost	Medium	High
Greater Productivity	High	Very High
Better End-User Participation	High	High
Micro-to-Mainframe Links	Medium	High

- Exhibit IV-3 summarises the users' requirements contrasted with the vendors' market perceptions and development plans.

- Vendors and users alike had mixed views on the need for analytical tools to be integrated into the FGL offering. The capability of 'connectivity' to other tools may be satisfactory.

- It can also be seen from Exhibit IV-3 that 'improved human factors' appeared to be at the lowest level of priority for vendors in terms of their development plans.

- Users ranked this item as medium in relation to their needs but, interestingly, better end-user participation was rated of high importance as a perceived user advantage of FGLs. This tends to indicate that vendors should pay more attention to this aspect of FGL products.

  - An important issue in the users' mind is that the syntax offered by the personal computer software vendors is superior and that vendors should create products equal to or better than their current fourth generation language products.

  - Other issues such as documentation and user interfaces appear to be secondary. However, INPUT believes these issues will begin to surface as more new users are introduced to FGL products.

- On the training issue all mainframe FGL vendors consider training to be critical to success. In contrast, micro vendors don't consider training a high priority (other than training for their dealer and distributor organisations).

  - IS and end users also consider training to be a issue. Although many users currently do their own training, INPUT believes that there are further opportunities for vendors to offer more services in this area.

EXHIBIT IV-3

PRODUCT REQUIREMENTS:
USER NEEDS AND VENDOR PLANS

REQUIREMENT	USER NEEDS	VENDOR PLANS (Year)
Performance	High	1985-1986
Micro-to-Mainframe Application Linkage	Medium	1985-1986
Transportability	Medium	1985-1986
Enhanced Data Structures	High	1985-1986
Enhanced I/O Support	High	1985-1986
Analytical Tools	Medium	1985-1986
Improved Human Factors	Medium	1986
Security	High	1985-1986

- The training issue points out only one of the many contrasts between mainframe and micro software vendors. INPUT considers that from the users' point of view, the lines between these vendor classes will blur and the huge current disparity in price and capability will also blur.

  - The above is important because it will make the selling job more complex and will open questions about alternate forms of product distribution.

  - Vendors that offer versions running on both micro and mainframe will benefit in all respects. Reduced training costs will be one more sales advantage.

C. STRATEGIC AND TACTICAL ISSUES

- One of the big tasks for vendors will be tracking technology as it changes at ever-increasing rates. Tracking changes will be important because it will affect product differentiation more than it has in the past. For example, the blurring of product lines referred to in Section B is probably favouring the mainframe vendor, especially after recent announcements of larger microcomputers.

  - For example the IBM PC AT, with three million bytes of main memory and full 16-bit data transfer, is a reasonable target machine for vendors to move full mainframe FGL implementations.

  - In fact, one of the toughest product decisions for vendors may be choosing which new architecture makes sense. It may make sense to rethink whole product lines from a standpoint of distributing more to the micro.

- FGL vendors will also face the issue of where to keep the data. Already 40-to-160-megabyte disk systems are available on micros; developments like optical storage will follow.

- Alongside these technology issues is the issue of pricing. INPUT believes a hybrid of the current mainframe software and services industry pricing is needed--i.e., an upfront license fee plus an incremental amount per work-station.

- Vendors and users believe that software technology is at hand to develop a fourth generation environment; i.e., a fully self-contained application environment that is its own operating system, application generator, and transaction processor.

  - However, vendors and users also agree that such a system would be very difficult to get accepted.

  - From the user point of view the system would be highly desirable in that it would be operating system independent. The objections--too much hardware resource, lack of transportability, etc.--are similar to those raised about fourth generation languages a few years ago.

  - INPUT believes this technology will emerge within the next two to three years and will be targeted toward smaller companies by vertical-industry integrated system vendors as they move to microcomputer-based solutions.

- Given FGLs' importance in the information center, vendors should closely track the emergence of the development centre (DC) concept. Although the development centre is modeled after the IC, the audience for DC tools and services is professional programmers.

- However, INPUT expects that the higher level of sophistication means that FGLs will compete with many good development tools and that the penetration of the DC will not be easy.

- Another question affecting the further development of FGLs within organisations is the ability to get sufficient budgets to meet end-user demand for FGLs and to provide other end-user computing support.

  - Since the end users themselves feel these tools are valuable, end users should be the source for budgets, either through charge-back schemes to the IC or through direct purchases of services like training.

  - Vendors should find opportunities by looking to the end users, identifying product and service needs, and proposing product and service solutions to IC management.

  - However, vendors should still nurture their relationship with IS departments since INPUT believes that most IS departments see FGLs as an opportunity to improve their image and get closer to the mainstream organisation.

- Another organisational impact that INPUT feels FGL vendors should track is the increase in mobility between IS and user departments. As end users become proficient in FGL technology, they will become more mobile and can move between IS and other operational functions of the company.

  - This also implies another possible scenario--that is, a potential shift of information power from IS to the user. INPUT believes this is a concen of IS and one that vendors need to watch for.

- Product differentiation will be increasingly difficult to achieve, not only between established large-scale products, but also between those products and micro-based ones. This will occur for two reasons: most current products are

already feature rich, and the performance differential between micros and mainframes will diminish.

- There are several major vendors with well over 1,000 installations of their product worldwide. In order to be successful, smaller vendors need to find ways to differentiate their products and services from those of other, established vendors.

- Conversely, the established vendors are expected to aggressively support their account base through service and product enhancement.

- The key product issues appear to be in communications, both micro-to-mainframe and micro-to-micro. INPUT believes vendors can find in these product trade-offs differentiation that users will perceive as real and important.

  - The IS department and end users believe that the personal computer is very beneficial in the progress of the information resource. They are also very anxious to see more and better micro-to-mainframe links.

  - The need for micro-to-micro links is driven by the number of workstations and by the growth of the available data residing on them.

    . Although the need for these micro-to-micro linkages has not surfaced in a big way, INPUT believes that it will be a major need within the next few years and that vendors should begin planning for product offerings now.

- The next major market opportunity will be driven by the development of micro-to-micro and micro-to-mainframe networks. The most visible potential is for office automation systems.

  - Combined with the power of the 16- and 32-bit microcomputers, these office networks will evolve, as will a new architecture to support them.

. On the hardware side the mainframe will become even more powerful, however, and the layers of smaller mainframes will vanish from these systems.

. The software layers will include FGL-like products and much more highly developed applications links. Some of these links will be hardware assisted, both by firmware and, in some instances, by special dedicated processors.

- One of the keys to the successful development of office systems is simplicity to the end user--that is, simple and intuitive responses to system actions.

V MARKET TRENDS, DEVELOPMENTS, AND FORECASTS

V MARKET TRENDS, DEVELOPMENTS, AND FORECASTS

A. USER EXPECTATIONS

- In large organisations there are two distinct sets of 'users': the end users and the information systems organisation. It is important that vendors:

  - Understand the needs of both groups in planning products and product enhancements.

  - Develop selling strategies for both groups. The success of FGLs is based on two steps: getting in the door, generally through IS, and being utilised by end users in a way they perceive as productive and in a way that contributes to the accomplishment of their objectives.

  - Understand each individual company and plan the support strategy on a 'tailored' basis.

- The IS and IC organisations view their role as the 'information consultant' as one that is critically important, enhancing their image and value to the corporation. This presents two opportunities for vendors:

  - To serve the need for training and hand holding and, thus, strengthen their relationship with IS and IC groups, as well as to establish a new revenue stream.

- To further strengthen account presence by promoting the success of the IS and IC groups in improving end-user computing through the use of powerful tools like FGLs.

- For FGLs to make real inroads into production applications, IS believes that more structured methodologies need to be made available. For the smaller applications, these are not required; however, for large applications, more structure is needed.

- The highest priority requirements expressed by IS and IC management were:

  - Improved human factors, primarily in simplifying the syntax and 'protecting' the end user from complexities of the data or data organisation.

  - Better micro-mainframe application linkage. INPUT believes this is a very high priority because the IS organisation wants linked personal computers in order to increase user dependency on their organisations.

- Exhibit V-1 summarises IS views on FGL use.

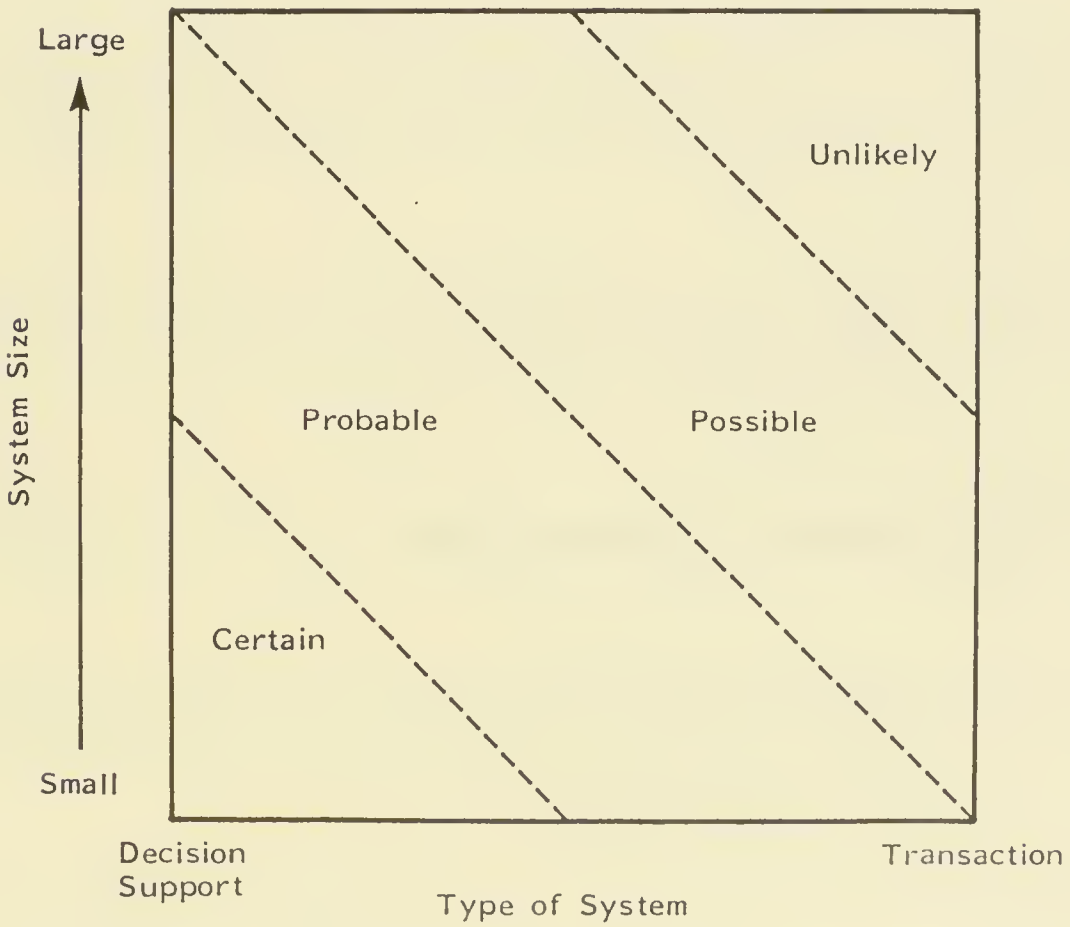
- The user departments believe that the vendor community will respond to these and other market requirements.

- One of the major concerns often mentioned in connection with fourth generation languages and personal computers is the potential shift of information processing power from IS to the end user. However, no hard evidence to support this view emerged from this particular research. In fact, loss of control and loss of data were rated as issues of low concern in general.

- There is also some concern that personal computer software firms and their selling approaches (primarily their overselling of the capabilities of some

EXHIBIT V-1

I.S. VIEWS ON THE USE OF FOURTH GENERATION LANGUAGES



products) are creating potential conflict within organisations through the raising of end-user expectations.

  - INPUT believes this conflict could provide opportunities for information services firms to use their selling and support skills to penetrate the market, either through acquisition or through distribution agreements.

  - Not only is there a competitive advantage resulting from service orientation, there is also a real advantage from experience in end-user computing and the resulting knowledge of support, pricing, and training.

- Users expect to benefit from the highly competitve market, the quality products already available, and products anticipated over the next several years.

B. PROJECTED VENDOR ACTIVITIES

- Although vendors are generally placing relatively high priority on micro-mainframe products, they do not perceive a high need for improving human factors in their products.

  - INPUT considers that a higher priority should be given to human factors in order to compete with personal computer products whose strength (or perceived strength) is the user interface.

- Some vendors reported that they were working on producing transportable systems, both for new target mainframes and for microcomputers.

- Although it was not high on the list of how vendors promoted their products, INPUT found prototyping was a hot button with users. Users extolled the virtues of prototyping in improving development and in contributing to overall system quality.

- Many vendors have targeted a potential user base already experienced in data base or decision support type systems. These more sophisticated FGL users have been dubbed the 'power users'.

- Vendors should bear in mind that these users may not necessarily represent the best market opportunity, given the tendency of the IS department to satisfy the first-time user.

- For vendors who have been concentrating on programmer targets, this is reasonable since there are many more potential users. However, there are also a number of entrenched vendors with quality products.

- One of the reasons for improving user interfaces is to address a wider market than the 'power user'. The largest target market is neither the programmer nor the power user, but the novice or first-time user.

- One of the major trends identified is that vendors of FGLs are expanding their products in many directions in an apparent attempt to be everything to everyone. INPUT believes that this is a poor product strategy.

  - From all indications there is plenty of room for products in this marketplace and vendors have little to gain by providing the ultimate all-encompassing product. Instead, what is called for is searching out a niche and developing an overall strategy to serve and build that market.

  - In the 'power-user' market, for example, many users are already dedicated to a particular product and would be very reluctant to change

anyway. They may, however, be very open to a new product that would complement their existing products.

- While nearly all FGL mainframe product vendors are releasing or planning micro-based products, INPUT knows of no micro-based products now being transported up to the mainframe environment.

C. MARKET FORECASTS

- INPUT's forecast for the fourth generation language market in Europe is shown in Exhibit V-2. Forecasts for the four major country markets of France, Italy, the United Kingdom, and Germany are shown.

- These markets are forecast to be fast growing over the period up to 1990, ranging between 26% for the U.K. and 30% for Italy.

- The U.K. is currently the most developed market for FGLs, resulting, not surprisingly, from a greater readiness to accept English language-based products from U.S. vendors.

- As 'other language' versions have been brought to market by vendors, so has increased penetration of continental European countries developed.

- The Italian market stands out as being relatively underdeveloped in comparison to other markets. Although interest in FGLs has been relatively high, much of this interest has not translated across into purchase decisions.

- Nevertheless, it is expected that growth in the Italian market will accelerate during the forecast period.

EXHIBIT V-2

EUROPEAN FOURTH GENERATION LANGUAGE MARKETS, 1985-1990
(Local Currency)

COUNTRY		1985	AAGR	1990
France	MFF	300	30%	1,100
	Conversion Rate*	9.4		11.4
	$ Millions	32		96
Italy	Billions £	32	30%	120
	Conversion Rate	1,923		2,446
	$ Millions	17		49
United Kingdom	£ Millions	35	26%	110
	Conversion Rate	0.79		0.79
	$ Millions	44		139
West Germany	MDM	110	29%	400
	Conversion Rate	2.9		2.6
	$ Millions	38		135

* Conversion rate is estimated on basis of prevailing exchange rates. It is used simply as an index to eradicate distortions that would arise as a result of the use of different inflation assumptions for different countries.

- In the other country markets there may be some slowing of growth towards the end of the forecast period. This will result from the emergence of products in the area of expert systems and artificial intelligence.

- Within the overall market for FGLs, the highest rates of growth are likely to be in the areas of generalised tools and application generators.

VI CONCLUSIONS AND RECOMMENDATIONS

VI CONCLUSIONS AND RECOMMENDATIONS

A. MARKET SUMMARY

- FGL products will continue to be built predominantly around proprietary data base systems, with more availability of application tools and application templates.

- INPUT also expects to see diminished product differentiation between products and between micro products and mainframe products.

- INPUT expects fourth generation languages to continue to evolve and for product hybrids or 'fourth generation environments' to become available.

  - Like the current fourth generation languages, INPUT expects these to be built around proprietary data base systems.

  - However, this does not mean vendors will curtail product enhancement activity. On the contrary, INPUT expects even more aggressive enhancement programs.

- The market for FGLs will continue to be strong and new competitors should be anticipated.

- FGLs should be important participants in the automation of the office, which will in turn attracts major vendors to participate with their own products. INPUT expects the majority of these participants to enter by way of acquisition.

- While the office automation market will attract the industry giants, there will be room for information services industry vendors to carve out significant niches.

- The proliferation of personal computers as management workstations will continue, further fueling the need for more and more software and specifically for fourth generation languages and tools.

- Between the hardware and software developments and the sheer number of new users, there will be new problems to solve. One of those will surely concern how organisations manage and control all the data and educate users to respect the data as a corporate resource.

  - FGLs can add to this confusion since their ease of use can lead to more end users getting at corporate data. While this is desirable if it leads to increased overall productivity, it can be disastrous if, for example, these users start tying up mainframes with data base queries.

- IS management is generally aware of these types of issues and will be looking to vendors for support and solutions.

- INPUT recommends that vendors track expert system and artificial intelligence activities. Much investment in R&D is taking place in this area, particularly amongst large U.S. firms. The resulting products are likely to become competitive with developments in fourth generation languages.

B. RECOMMENDATIONS

- Vendors are urged to develop full-function micro-mainframe linkages, as these will be important in the traditional markets and critical in the office automation markets.

- INPUT believes that the information network systems of the future will consist of large-scale mainframes and microcomputers. Therefore vendors will need products that span these hardware classes.

  - Mainframe FGL vendors will see increasing competitive pressure from the micro software vendors and should have competitive plans and products to counter this threat.

  - Mainframe FGL vendors should increase their emphasis on human factors to counter the micro competitors and to meet what seems to be a current user requirement.

    . These human factors or user interfaces will increase in importance and vendors should plan to be better than today's 'best' user interfaces.

    . The emphasis in human factors should reflect an attitude that the user interface should work the way the user works. In other words, the interface should be as intuitive as possible.

- The use of fourth generation languages in production applications will be one of the key factors for sustained growth. Vendors will need the support of IS management to ensure this growth.

  - Vendors, therefore, should develop long-range sales strategies to sell to IS management and to solidify relationships.

- One of the elements that could help this objective is promoting the concept of IS and IC organisations in supporting end-user computing. Another is aligning promotional efforts with a perception of the power of FGLs for prototyping.

- In product promotion plans vendors will increasingly need to be aware of the need to approach the end user and the IS audiences with appropriate messages.

  - For example, reduced maintenance costs may be important to the IS group, whereas to the end user the only thing that is important might be improved customer service.

  - Both groups should be responsive to promotional plans that emphasize FGLs as tools for the IC and as prototyping tools to develop quality applications rapidly.

- INPUT recommends that vendors develop strategies devoted to the areas of training and support. These will serve two purposes: 1) training and support appear to be business opportunities, and 2) the leverage for vendors in getting new business and maintaining existing accounts.

- Given the success of fourth generation languages in the information centre, INPUT believes vendors should plan sales programmes targeted at the development centre. Specifically, these programmes should be targeted at the features used by programmers.

  - Contrary to what is being published today, INPUT believes that professional programmers will support advanced tools like fourth generation languages and that programmers represent an opportunity and a potential ally within the organisation.

- As FGL vendors continue to enhance system performance and as the use of FGLs for production systems increases, there are additional opportunities:

  - INPUT believes well-tuned FGLs are excellent development tools for the thousands of independent applications software companies. This is because of FGLs' inherent power as a development tool and their low cost due to ease of maintenance through the applications life cycle.

  - Opportunities will also exist for the large OEMs, which will need to become more vertical market-oriented and will need to get more and more into the applications software business to maintain and enlarge their customer bases.

- INPUT believes the rapid-growth stage of end-user computing will be hastened to maturity by problems of managing corporate data and mainframe capacity.

  - Vendors need to develop strategies to address the major emerging issues of data control, security, and data administration.

  - By being proactive, vendors will avoid becoming 'part of the problem'. Another benefit to a proactive strategy is that vendors will learn the full details of the problem, thereby getting a head start on software solutions (another market opportunity).

  - INPUT anticipates that all this emerging power in the hands of end users will surely result in at least a few potential catastrophies. Therefore, planning for disaster should give vendors the ability to be proactive.

  - INPUT also recommends that vendors work as closely as possible with IS and have the objective of being an insider, both to provide solutions and to strengthen the vendor's relationship with the organisation.

APPENDIX A: SELECTED FOURTH GENERATION LANGUAGE CHARACTERISTICS

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- To provide readers with further background to the fourth generation language market, sketch descriptions of some selected FGL products are included in this appendix.

- Appendix B contains a more comprehensive list of FGL products and vendor names and addresses for both European- and U.S.-based vendors.

A. FOCUS

- FOCUS is a highly integrated, general purpose FGL whose characteristics include:

  - Information retrieval and reporting.

  - Transaction processing in a multiuser environment.

  - Direct interfacing to procedural languages and the most common DBMSs and operating systems.

  - Statistical analysis.

- Financial modeling.

- Graphics.

- Fully compatible PC version now available.

- FOCUS is a highly modularized system. The basic reporting module costs $70,000. FOCUS on the PC, PC/FOCUS, costs $7,600.

  - The mainframe version runs on IBM 4300, 370, and 30XX; DEC/VAX; and Wang/VS.

- The PC strategy is to offer all the functionality of the mainframe version, subject only to size constraints in capacity on the smaller computer.

  - The PC version requires 256K or RAM, PC-DOS 2.0, at least one dual-sided, double-density floppy, a hard disk, and an accelerator board. It can use additional features if installed, such as more memory, a colour monitor, or the 8087 math chip.

  - The system also provides distributed processing capability and can function as an application prototyping and/or transaction processing workstation, as well as a training machine.

  - It runs on IBM PC/XT, PC/AT, and XT 3270; Wang PC; TI PC; and Olivetti ITT-Xtra.

- FOCUS is highly user-oriented, but has been used successfully by some organisations as their exclusive programming and development language.

  - Operating performance ranges from 10% less to perhaps double that of a COBOL or PL/I program, but normally equivalent or 10% more if properly designed and tuned.

- It may not be suitable for highly complex batch environments, but this would need to be determined on an individual basis.

- FOCUS offers extensive training and support in a variety of modes, including self-study, live instruction, computer-aided instruction (CAI) on the mainframe, and video-assisted instruction (VAI) from third parties.

B. APPLICATION LANGUAGE LIBERATOR (ALL)

- Application Language Liberator (ALL) is a fourth generation tool designed for the development and execution of business applications by nonprogramming staff.

- ALL consists of two main components: the generator which generates ALL functions, and the executive which is the run-time system.

- The applications are built from a sequence of simple steps. ALL generates applications by leading the user through a sequence of menus and screen prompts. This allows the application to be specified by a series of parameters using a minimum of input. The parameters, entered by the user, control the sequencing of standard software routines from the ALL executive. The tasks which comprise the application are generated together with the required routines, ready for execution.

- ALL comes from Microdata, the U.S.-based Pick systems supplier, and runs on all current Microdata computers. The price for ALL is from about $6,000 for micros to about $25,000 for an M9000 system.

- Microdata Information Systems, known until 1983 in the U.K. as CMC (Computer Machinery Company), was formed in 1969 and in 1978 became a wholly owned subsidiary of the Microdata Corporation.

C. APPLICATION SYSTEM (AS)

- IBM's Application System (AS) is a decision support and departmental computing tool with comprehensive support functions.

- The main functions of the system are:

  - Data analysis with full reporting and graphics.

  - Special purpose integrated packages, such as Project Management, Business Planning, Statistics, and Forecasting.

  - Application development tools and a data dictionary.

  - Facilities for document creation and distribution.

- AS provides extensive facilities for the collection, management, and retrieval of information, and offers a wide range of data presentation methods, including formal reports, tabulations, and graphical displays. AS also incorporates more sophisticated techniques for complex analysis, business planning, and various management science applications.

- The system has the ability to perform many tasks on a single piece of data, making it a useful product for the information centre.

- AS has been available on a bureau service via IBM Information Network Services (INS) since 1975, and as a VM licensed product and a packaged product, AS Information Centre (ASIC), since 1983.

- AS is available worldwide in 14 different languages.

1. ASIC

- Application System Information Center (ASIC) is a prepackaged information centre providing an application system service on user site hardware.

- ASIC runs on a specified configuration of a 4331 Model Group 2 or 4361 Model Group 4 or 5.

2. VM/AS

- VM/AS is a program that provides the functions of application system (AS) on an in-house DP computing facility.

- VM/AS comes complete with a set of end-user documentation which is designed to enable the end user, without DP expertise, to become self-sufficient very quickly. AS itself provides a level of security and password protection that allows different users to have appropriate levels of access to information.

- VM/AS is designed to run under VM/SP Release 2, the minimum configuration being an IBM 4331 Model Group 2.

3. MVS/AS

- Application System is now also available as an IBM program in the MVS environment, to be known as MVS/AS (Multiple Virtual Storage/Application System).

- MVS/AS provides interactive computing to non-DP-trained business professionals.

- MVS/AS accesses data through a new file server technique, which uses VTAM to find the data on any MVS/AS machine connected to the SNA network.

Further data access is via RACF (Resource Access Control Facility). This enforces the authorisation rules set up by the DP administrator.

D. RAMIS II

- RAMIS was the original FGL, even before anyone thought of the term 'fourth generation language'. It spawned, directly or indirectly, a number of the other leading FGLs, including its own successor, RAMIS II; further improvements are in store.

  - RAMIS II now offers the user-friendly front-end, Intellect, from Artificial Intelligence (also offered by IBM). RAMIS II calls it 'English', and provides some unique features not offered by Intellect's other implementors.

    . A preloaded general lexicon that defines processing synonyms.

    . The ability to switch back and forth between 'English' and native RAMIS II terminology.

  - Processing inefficiencies associated with the original RAMIS have been significantly improved, and RAMIS II now claims to be the most efficient of the FGLs.

  - A PC version is now available on the IBM PC, XT, and AT machines.

- RAMIS II is a general purpose FGL that is intended as an information management product, but also offers interfaces to SAS for statistical analysis and graphing, as well as to the other common DBMSs, such as IDMS, TOTAL, ADABAS and, of course, PL/I and IMS.

- RAMIS II is priced on a different structure than most of the other FGLs, and depends on the level of mainframe on which it is to operate. The prices range from $33,500 for the 4331 level, up to $67,000 for the 3084 level, for the basic system. Transaction processing and other modules are additional.

- The PC version of RAMIS II costs $1,500.

- RAMIS II has been used for some very large databases, including a million record market research application. However, Mathematica, its vendor, does not sell prewritten applications.

- Extensive training options either exist or are being developed for RAMIS II.

1. ENGLISH-SPEAKING USER

- With RAMIS II English, the user can obtain information from computer files simply by posing a question or request in everyday English.

- The user does not have to learn how to use the computer through learning a programming language; the computer, or RAMIS II English, learns through dialogue, becoming more fluent as the user defines new words and concepts.

2. FRENCH-SPEAKING USER

- RAMIS II is now available also in French.

- The product will be known as RAMIS II Francais. It was jointly developed by Mathematica and ERLI (the Societe d'Etudes et de Recherche Linguistique et Informatique), a Paris-based artificial intelligence developer.

- French is a front-end to the RAMIS II Francais. But the system follows the same principle as its predecessor, RAMIS II English. It answers any question it is programmed for and if uncertain will interrogate the user until it understands what is required.

- RAMIS II Francais will be sold through MFSA, Mathematica's French affiliate firm, and through Mathematica's office in Canada.

- The system will also allow the user to access data in other IBM mainframe databases such as IMS, DL/I, Software AG's Adabas, Cincom's Total, and Cullinet's IDMS, as well as IBM sequential, VSAM, and ISAM files.

3. USERS IN OTHER EUROPEAN COUNTRIES

- Mathematica is working on the development of Portuguese, Spanish, and Italian RAMIS II versions.

E. IDEAL

- ADR/IDEAL (Interactive Development Environment for an Application's Life Cycle) is an on-line applications design, development, maintenance, and execution facility that was especially designed for database-oriented on-line and batch applications.

- The system offers complete integration of data dictionary, library, programming, database, communications, reporting, editing, and utility services.

- ADR/IDEAL operates in conjunction with ADR/DATADICTIONARY, ADR/DATACOM/DB, and other ADR products, and is an integral part of ADR's integrated network of system software products.

- Applied Data Research (ADR), founded in 1959, is a leading supplier of utility and database management systems software products.

F. MAPPER

- MAPPER is a proprietary product of the Sperry Corporation. It can be described as a user-driven application generator, being much more flexible than a report generator, providing more facilities, and allowing programmers to create data structures.

- Sperry claims that end users with no previous DP experience can use MAPPER to write applications. Initially, general business users with the knowledge of their own particular application can 'sketch' out a system in order to give themselves a general idea of how it will work. Subsequently, refinements can be built in as their experience with the system develops. Generally, MAPPER experts will be used to help the user and participate in the development process as necessary.

- Originally only available on Sperry's 1100 Series mainframe computers, MAPPER has now become available on standalone superminicomputer systems--the models MAPPER 5 and MAPPER 10. Sperry claims an entry level price for a MAPPER 5 system from about $20,000. Sperry has now announced a PC-based system of MAPPER.

G. ADABAS/NATURAL

- A number of the 'classical' DBMSs have extended their facilities with powerful data manipulation commands and/or intelligent front ends so that they are very similar to the general purpose FGLs.

  - One difference is the narrower breadth of functions supported.

  - Another is the smaller range of file interfaces offered.

- Among the leading representatives of the 'extended DBMS' category is ADABAS with NATURAL. ADABAS is an inverted file DBMS, and NATURAL is Software AG's version of Intellect from Artificial Intelligence Corporation.

  - Like other representatives of this category, ADABAS provides ease of retrieving and manipulating information, but does not provide modeling or analytical functions.

  - There is a third-party interface to SAS for statistical analysis.

  - ADABAS/NATURAL provides graphic display facilities in conjunction with IBM's graphics package GDDM.

- ADABAS is expensive. The DOS/VSE version costs $63,000 and the MVS version DBMS costs $95,000, plus $22,000 to $30,000 for NATURAL, and an additional $7,500 for NATURAL/GRAPHICS.

- ADABAS is for programmers. It requires 10% of the coding effort of COBOL systems and 40% of the total development time, but furnishes operational performance at least as efficient as those same COBOL systems.

  - The DEC VAX/VMS version costs $38,000 for ADABAS and $19,000 for NATURAL.

- NATURAL provides programmers and some end users a friendly, English language interface for information retrieval that is still under the control of the data base administrator as to integrity, security, auditability, and performance. The relational nature of the underlying database provides flexibility without impeding performance.

- SUPER/NATURAL extends and simplifies the end-user interface even more via a menu and QBE (Query by Example) approach.

- SUPER/NATURAL enables secondary indices to be developed on-line, if not previously defined.

- Little or no training is required to get at least some immediately usable results.

- Software AG offers NATURAL/CONNECTION, the micro-to-main-frame link for the IBM PC, PC/XT, PC 3270, and XT 370.

- NATURAL/CONNECTION allows data to be passed to and from a PC in forms suitable for use with PC software of the users' choice.

H. MARK V

- Informatics General has updated its line of information handling products with Mark V, a generator for producing on-line application programs, similar to what Mark IV has been doing for batch programs for over 15 years.

  - To the users of Mark IV, the new product will seem very familiar in concept. It fits naturally into an IMS environment and, in fact, uses native IMS facilities for READS and WRITES, as well as security, integrity, and auditability.

  - A CICS version for DL/I and VSAM files has also been made available so that the user will have complete portability between the two systems by simply checking a single box on one of the application development screens.

- Informatics General intends this product for programmers, rather than end users.

- The Mark V product handles high volume transaction processing applications with at least the performance efficiency of COBOL, but at a development effort only one-fourth to one-half that of the COBOL effort.

I. POWERHOUSE

- POWERHOUSE is the Cognos fourth generation language for minicomputers.

- The product was developed in 1979 on the HP 3000 and expanded to include the Digital Equipment (DEC) VAX in May 1984. POWERHOUSE has now become available in Europe for Data General's Eclipse MV minicomputers.

- POWERHOUSE features 'high-level statements' which means the user can speak to it in English-like sentences. The language is 'dictionary driven'. A data dictionary which recognises, defines, and consistently modifies incoming data underpins the possibility of talking 'English' to the system.

- The product claims to replace COBOL and other third generation languages. Because it is dictionary driven, all data definition is placed outside of the application program. And high level, non-procedural statements perform standard functions previously requiring many lines of code. It is estimated that an average programmer can accomplish 10 times more with POWERHOUSE than with third generation languages.

- The current price of the product is $13,000. It runs on HP 3000, DEC VAX, and Data General MV series.

- Cognos is a Canadian-based software company that achieved revenues of over $26 million in 1984 and employs more than 400 people worldwide.

J. WIZARD

- WIZARD is Comshare's financial modeling package knows as System W in the U.S.

- In January 1983, Comshare was the first vendor to offer a distributed version of such a product on the PC.

- WIZARD is not a general purpose FGL, but given that many users limit their decision support activity to financial data, System W furnishes them with extensive, easy-to-use facilities.

  - The system provides from four to nine 'viewpoints', or dimensions, of data that can be manipulated and reported in any manner or sequence the user desires. But the system incorporates enough intelligence to understand, for example, the valid sequences of consolidation and choose the correct one, even if the user entered something out of sequence.

  - The system operates on a set of rules for variables and time periods that are defined by the user in standard English syntax.

- System W has a large library of routines to handle forecasting, financial functions, goal-seeking (backward integration), sensitivity analysis, simultaneous equation resolution, and some graphics capability (using IBM's GDDM).

  - It operates on data that has been extracted from production files and/or data bases, and can produce journal files for updating back to those files, if desired.

- The micro product is 100% syntactically upward-compatible. The product is a subset of the System W mainframe version.

- It is distributed, not standalone, and depends on the security features of the IBM mainframe operating system at sign-on time.

- It operates under either CP/M-86 or PC-DOS 2.0, and requires at least 256K of memory and four dual-sided, double-density floppies or a hard disk to run.

- It is more limited than the mainframe product, however, in that it can only handle two views of data at a time.

- Comshare, as a computer services company, offers a wide variety of training and support facilities, including live instruction and videos, as well as a two-day CAI course on an Apple or IBM PC. The latter has a one-time charge of $2,600 for the software.

- WIZARD as a software product costs from $38,000 for a four-view capability, and up to $190,000 for the nine-view version. Additional micro copies are $1,900 each.

K. FCS-EPS/FCS-MULTI

- FCS-EPS, a product of EPS Consultants Ltd. (part of the THORN EMI Computer Software Group), is a decision support system addressing the five basic business planning techniques of:

  - Spreadsheet.

  - Modeling.

  - Analysis.

- Consolidation.

- Data management.

- Tools are included with all these systems to enable decision support systems to be built using business graphics, screen management, menus, and report writing.

- EPS launched its first product in 1973. In 1979 a completely new system known as FCS-EPS was launched, aimed initially at the IBM in-house market.

- EPS Consultants claim that it was the first system to combine a non-procedural language with three-dimensional hierarchical consolidation and reporting.

- EPS Consultants then adopted the strategy of developing a fully integrated decision support and information centre environment for the business planner. This resulted in the release of FCS-MULTI.

- FCS-MULTI is a fully screen-driven, multidimensional management information system.

- EPS Consultants was originally formed in the U.K. in 1973 to develop and market a business planning system.

- In January 1985, EPS Consultants was acquired by THORN EMI Computer Software, one of Europe's largest independent software companies.

- THORN EMI Computer Software has annualised revenues of some $38 million worldwide. The organisation employs a staff of over 500 and has its world headquarters in Farnborough, England.

APPENDIX B: VENDOR NAMES AND ADDRESSES

APPENDIX B: VENDOR NAMES AND ADDRESSES

- ADS and ON-LINE ENGLISH.

  - Cullinet Software Ltd., Cullinet House, The Broadway, Middlesex HA7 4DU, U.K. (01) 954-7333

  - Cullinet France S.A., 9 rue de l'ancienne Mairie, 92100-Boulogne, France. (1) 604.81.35

  - ADV/ORGA F.A. MEYER GmbH, Kurt-Schumacher-Strasse 241, 2940 Wilhelmshaven, West Germany. (4421) 8021

  - PRAXIS CALCOLO, 20122 Milan, via Visconti di Modrone 32, Italy. (2) 799601

- ALL.

  - Microdata Information Systems Ltd., Maylands House, Maylands Avenue, Hemel Hempstead, Hertfordshire HP2 4RL, U.K. (0442) 61266

  - Microdata GmbH, Hahnstrasse 70, Lyoner Stern, 6000 Frankfurt-am-Main 71, West Germany. (611) 66 41 60

- AS.

  - IBM Europe, Tour Pascal Cedex 40, 92075 Paris La Defense, France. (1) 767.60.00

  - IBM, Information Network Services-Europe, Avenue Louise 523, 1050 Brussels, Belgium. 32-2-214-31-92

- ATOS PLUS.

  - SLIGOS, 91 rue Jean Jaures, 92807 Puteaux Cedex, France. (1) 776.42.42

- EASYTRIEVE.

  - Pansophic Systems (UK) Ltd., Bakers Court, Bakers Road, Uxbridge, Middlesex UB8 1YB, U.K. (0895) 72501

- ELLYSSE.

  - STERIA, 26 avenue de l'Europe, 78140 Velizy, France. (3) 946.97.97

- FCS.

  - EPS Consultants Ltd. (THORN EMI Computer Software), Boundary House, Boston Road, London W7 2QE, U.K. (01) 579-6931

- FOCUS.

  - Information Builders (UK) Ltd., Station House, Harrow Road, Wembley HA9 6DE, U.K. (01) 903 6111

- IDEAL.

  - ADR Europe, Portmill House, 37-40 Portmill Lane, Hitchin, Herts SG5 IDJ, U.K. (0462) 55353

- INFORMATION EXPERT.

  - MSA Ltd., MSA House, Cedars Road, Maidenhead, Berkshire SL6 ISA, U.K. (0628) 39242

- INFORMIX.

  - Logica Plc, 64 Newman Street, London WIA 4SE, U.K. (01) 637 9111

  - Logica Gmbh, Bleichstr. 2, 6100 Darmstadt, West Germany. (6151) 26718

- MANTIS.

  - Cincom Systems, St. Ives House, St. Ives Road, Maidenhead, Berkshire SL6 IQS, U.K. (0628) 72731

- MAPPER.

  - Sperry Limited, Information Systems Group, Sperry Centre, Stonebridge Park, London NW10 8LS, U.K. (01) 965 0511

- MILLENNIUM.

  - McCormack & Dodge Ltd., I Redcliffe Street, Bristol BS99 7AO, U.K. (0272) 276866

- MIMER.

  - Savant Enterprises, 2 New Street, Carnforth, Lancashire LA5 9BX, U.K. (0524) 734505

- NATURAL.

  - Software AG, Dehmelstrasse 3, 6100 Darmstadt 13, West Germany. (6151) 5040

  - Software AG of the United Kingdom, Laurie House, Colyear Street, Derby DE1 1LA, U.K. (0332) 372535

- NOMAD 2.

  - Dun & Bradstreet Computing Services (UK) Ltd., 242 Vauxhall Bridge Road, London SW1V 1AU, U.K. (01) 834 2223

- ORACLE RDBMS.

  - Oracle Corporation UK, Thames Link House, 1 Church Road, Richmond, Surrey TW9 2QE, U.K. (01) 948 6911

- PACBASE.

  - CGI, 84 Rue de Guenelle, 75007 Paris, France. (1) 544.39.21

- POWERHOUSE.

  - Cognos Ltd., Coworth Park House, Coworth Park, Ascot, Berkshire SL5 7SF, U.K. (0990) 27244

- PX.

  - SOPRA, 90 Rue de Flandre, 75019 Paris, France. (1) 203.23.32

- RAMIS II.

  - Mathematica Products Group, 79-83 Great Portland Street, London WIN 5RA, U.K. (01) 631 3696

- RAPPORT.

  - Logica, 64 Newman Street, London W1A 4SE, U.K. (01) 637 9111

- SDT.

  - Package Programs (PPL), 91 Blackfriars Road, London SE1 8HW, U.K. (01) 633 0121

- STYLE.

  - Leasco Software, Reliance House 150-152 Bath Road, Maidenhead, Berks SL6 4LD, U.K. (0628) 23391

- SYSTEME D'INTEGRATION.

  - SPI, 98 Boulevard Victor Hugo, 92115 Clichy, France. (1) 731.11.91

- TOPTOOL.

  - MBP, Semerteichstrasse 47, 4600 Dortmund, West Germany. (231) 43480.

- UNIVERSE + ADL.

  - Computer Associates, Edinburgh House, 43-51 Windsor Road, Slough, Berks SL1 1EQ, U.K. (0753) 77733

- WIZARD/SYSTEM W.

  - Comshare Ltd., 32-34 Great Peter Street, London J1P 2DB, U.K. (01) 222 5665