

**JUSTIFICATION OF
INSTALLING
4GL IN
HONG KONG
ENVIRONMENT**

by

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RESEARCH REPORT

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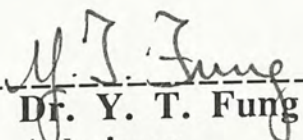
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TABLE OF CONTENTS

ABSTRACT	i
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Part One

CHAPTER

I	INTRODUCTION	
	PROGRAMMING LANGUAGE EVOLUTION	1
	4GL -- ITS DEFINITION	3
	4GL, DBMS and CASE	7
II	POTENTIAL BENEFITS	10
III	4GLs IN THE MARKET	15
IV	4GL OPINION SURVEY IN HONG KONG	19
	FUNCTIONALITIES	22
	SELECTION CRITERIA	23
	DIFFERENCE BETWEEN EAST AND WEST	25

Part Two

CHAPTER

V	CONSIDERATIONS OF INSTALLING 4GL IN HONG KONG ENVIRONMENT	26
	CONSTRAINTS OF INSTALLING 4GL	27
	HONG KONG'S PROBLEM	28
	DP VS USER DEPARTMENT MATURITY	29
VI	PLAN FOR IMPLEMENTATION OF 4GL	32

THE TOOL	3 2
THE PEOPLE	3 4
THE METHOD	3 5
THE ENVIRONMENT	3 5

V II CONCLUSION

CASE STUDY - A REAL LIFE EXAMPLE	3 7
4GL - YES OR NO ?	3 9

APPENDIX	4 1
-----------------	------------

BIBLIOGRAPHY	4 3
---------------------	------------

A B S T R A C T

Fourth Generation Language (4GL) is a hot topic in the year of 1987 among the Electronic Data Processing (EDP) industry. There are many vendors, especially in the West, who claim to supply 4GL tools to help DP shops to release the existing backlogs as well as to face the future requirements. To select the right one or whether to choose one at all will definitely be an on-going concern for EDP managers in the years to come.

To clear the mist, this thesis analyses the justification of installing 4GL in the Hong Kong environment. In Part One, I first try to define 4GL and summarize its potential benefits from Western literature. In Hong Kong, due to the lack of local publications or experience on this subject, two surveys are conducted. Firstly, two available 4GL products in the local market are analyzed in depth to see what they provide and emphasize. Secondly, a questionnaire is sent to companies with established EDP departments aiming to find out the actual need of local DP professionals and their expectations from a 4GL product. The findings from these surveys will be compared with those from the West to see if there is any difference.

After getting an overall view and understanding in the topic, in Part Two, the discussion will be narrowed down to view the subject from an individual company's concern. We will first analyze the constraints that should be considered when evaluating the installation of 4GL in a company. Some concerns in particular to Hong Kong current situation will also be discussed. As successful implementation needs good preparation work, some areas are brought to attention to serve as a reference for those who wish to install 4GL.

Finally, a case study will be conducted to help in visualizing the real life situation and this ends the whole thesis.

Part One**CHAPTER I****INTRODUCTION****PROGRAMMING LANGUAGE EVOLUTION**

The purpose of a language is to communicate. In the case of computer languages, the goal is to communicate between man and computer. Conventionally, programmers were taught to talk to the machines using computer languages. Today, we are starting to teach computers to communicate with us in our own language. However, this did not happen overnight. This was the result of the efforts of countless number of computer professionals who led us through five generations of programming languages, namely machine code, assembler, high-level, non-procedural and knowledge-based.¹ The characteristics of the first four will be discussed in more details. The fifth generation, knowledge-based, will be left out in this discussion since it is still in the experimental stage.

¹Cobb, Richard H. "In Praise of 4GLs". Datamation. July 15, 1985, P. 90

The evolution started with the machine language which was a well-constructed pattern of zeros and ones. As we look back from current standards, it is characterized by low programming productivity and labour intensive. Only technical specialists used the language in those days. Even in today, its usage is limited to specialists working for computer builders.

Assembler emerged in the late 50s. It utilized symbols and mnemonics to represent bit pattern of machine language. Due to its improvement in the communication process with the computer, more people could make use of computer to write their application systems. It is still use in writing system softwares and on-line applications that require the fastest response time.

The first high level language appeared in 1957, not long after assemblers were developed. Well known third generation languages, such as Cobol, Fortran, Basic etc., emerged quickly in subsequent years. These were mostly procedural, structured and used symbols extensively. Significant productivity improvement for society had been achieved through the use of third generation languages in the past thirty years. Nowadays they are still widely used and constitute the majority of language utilization for application development.

Despite the astonishing rate of change of technology and fast evolution of the first three generations. Fourth Generation Language (4GL) takes as long as twenty years to strive for its birth. In late seventies, products such as Logic and Information Network Computer (LINC) from Burroughs Corp. and Powerhouse

from Coznos Corp. started to claim themselves to be 4GL. Until now, 4GL itself has also undergone some transformation which can roughly be divided into 4 stages : ¹

3GL Code --> Productivity --> End User --> Total Solutions
 Generator Tool Product for DP Professionals

4GL - ITS DEFINITION

It is very difficult to define what 4GL is since there is still no universally accepted definition so far. Mr. J. Martin, who first proposed the idea of generation of programming languages, gave some guidelines to 4GL :²

1. The code can be generated such that the number of lines of code should be smaller by an order of magnitude than the number which would be required with COBOL, PL/1, ADA, etc.;
2. A 4GL is a high productivity language which employs mechanisms such as filling in forms or panels, screen interaction and computer-aided graphics for coding;

¹May, Albert. "Defining what a 4GL really should be". Asian Computer Monthly. November 1987, P. 8

²Clubb, O. L. and Zepp, R. A. "The Use of 4GL in Hong Kong" Hong Kong Computer Journal. Vol. 3, No. 4, April 1987, P. 20

3. A 4GL normally does not employ von Neumann-like constructs, i.e. should be non-procedural; (John Von Neumann is a mathematician who proposed the concept of program flow controlling by counter);
4. It may be designed for a specific class or range of applications.

There were more Western literature on this topic in recent years. The essential criteria that a 4GL should possess are generalized as follows:¹²³⁴

1. Complete Brand-new Environment

Many of the so-called 4GLs are nothing more than a 3GL automatic code generator, a screen formatter, a report writer etc. They should be considered only as three plus a fraction generation language. A 4GL should possess a complete brand-new environment with efficient data handling features, working in both on-line and batch modes, providing query, screen formatting and reports writing facilities. It should

¹Clubb, O. L. and Zepp, R. A. "The Use of 4GL in Hong Kong" Hong Kong Computer Journal. Vol. 3, No. 4, April 1987, P. 20

²May, Albert. "Defining what a 4GL really should be". Asian Computer Monthly. November 1987, P. 8

³Newman, Greg. "Benefits for MIS departments". Asian Computer Monthly. November 1987, P. 12

⁴Hurst, Rebecca. "DBMS and 4GLs : Splitting the Difference". Computerworld Focus. January 7, 1987, P. 19

also contain a good security control system on the data and all other resources.

2. Productivity Improvement

There are 5 phases in any project development cycle, namely analysis, design, programming, testing and implementation. 4GL should contribute at as early as the design stage by the ease of developing prototypes and documentations. Programming time reduction is the common area that most 4GL vendors addressed. However, it must be noted that this stage is only one fifth of the whole cycle. Also the existing 4GLs are generally weak in dealing with complicated logic. Finally, testing should be made simple because of the non-procedural language and hence the implementation would be smoothened.

3. Resource and Run-time Efficiency

It is not worthwhile when a dedicated computer has to be reserved for a 4GL, neither is the case that whenever a 4GL is in use, all other applications are being slowed down significantly. Concerning processing time aspect, speed should be faster, or at least as fast as 3GL. In this respect, an automatic 3GL code generator cannot be regarded as a 4GL since extra time would be elapsed in the conversion process.

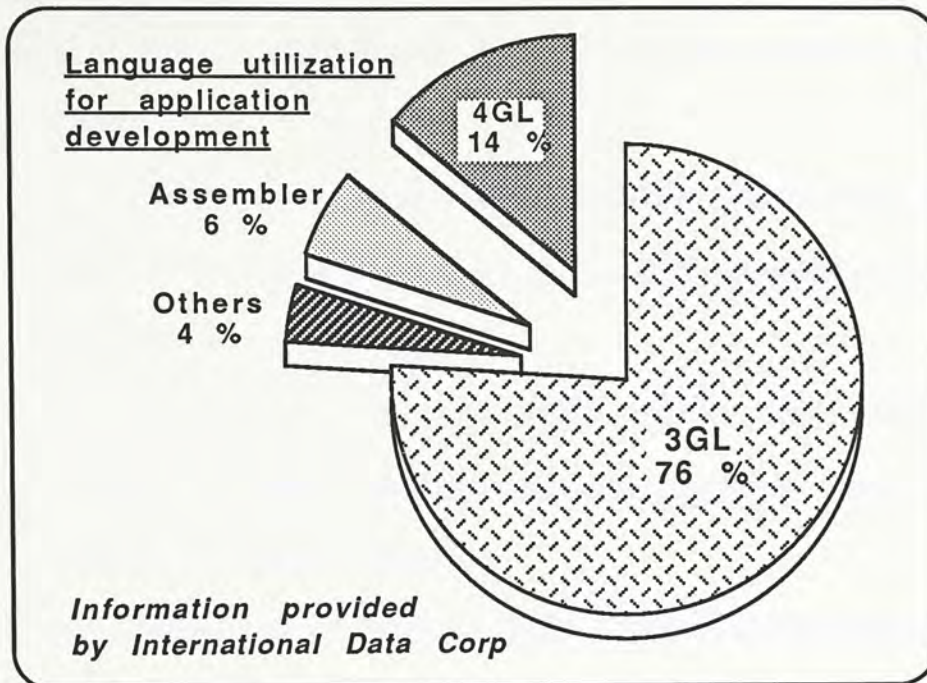
4. Ease to learn and User Friendliness

A 4GL should take less than one week to learn and be able to write applications. Therefore, it must be supported by features such as on-line menu, prompt facilities etc. The commands should be English-like and meaningful such that they are easy to remember. A 4GL should be targeted at DP staff as well as end users. Both parties would be able to use it without any hindrance. That is, DP staff can use it for sophisticated applications on one hand, and users can use it for ad-hoc requests or simple applications on the other.

5. Hardware Independence

A 4GL should be able to be used from mainframe down to PC and across different brand of computers.

Strictly speaking, none of the existing products claiming to be 4GL fulfils the above definitions. However, as the requirement to boost productivity in most DP shops is strong, 4GLs have already eaten up one seventh of the language pie. And, this portion is seen to be expanding in a rapid rate.



Source : Computerworld. February 4, 1988, P. 8

4GL, DBMS and CASE

We have defined 4GL from Western literature. However, in order to avoid confusion with other computer buzzwords, I try to clarify its boundaries with DBMS and CASE, 2 DP productivity tools that also aroused wide interest in the industry.

According to Shaku Atre, president of Atre Consultants in Rye, N.Y., a DBMS product must satisfy all of the following nine points in the checklist below.¹

- ∞ A DBMS must have a data model, which provides the underlying structure of the system.

¹Hurst, Rebecca. "DBMS and 4GLs : Splitting the Difference". Computerworld Focus. January 7, 1987, P. 19

- ∞ A DBMS must have the ability to create physical files.
- ∞ A DBMS must have a data definition language (DDL). The DDL describes the data in a language that the DBMS will understand.
- ∞ A DBMS must have a data manipulation language (DML). A DML manipulates the physical files of data within the data base.
- ∞ A DBMS must have a data control language (DCL). The DCL describes backup and recovery for the DBMS if it should go down during transmission or in the middle of a program.
- ∞ A DBMS must have system installation capabilities, which include recovery, restart, space redundancy and reorganization.
- ∞ A DBMS must have the ability to program in the host language.
- ∞ A DBMS must perform data communications. Data communications is important for data transfer to a DBMS that resides on another computer. One form of communications is CICS, which manages terminal and transmission line access.
- ∞ A DBMS must have a data dictionary.

As 4GL and DBMS introduced in the mid 70s, they emerged as separate products addressing to different requirements. DBMS users soon realized the need for an easier way of creating data base files and 4GL vendors responded by providing DBMS

interfaces. Seeing such success, data base vendors were tempted again to build their own 4GLs. Hence a mix of products, though with different emphasis, appeared in the market. However, if we try to look from a user point of view, it is not difficult to identify what you require. DBMS addresses to high-transaction applications with huge data base. 4GL, on the other hand, is most capable of handling ad-hoc and 'what if' analysis.

CASE stands for Computer-Aided Software Engineering. It aims to "automate" design & programming of applications. Similar to the concept of Computer-Aided Design (CAD), which improved both drafting as well as design work, CASE not only formulates the idea in areas of flowcharting and logic design, but also provides the basic error checking facilities and code generation interface.¹

When CASE emerged recently, it faced the same pressure as DBMS to amalgamate with the 4GL products. That is why some CASE products can automatically generate machine-readable code or even COBOL from the final design elements.

Since these products all aim at improving productivity in the DP shops and just differ in emphasis, we can expect the three will gradually merge together. New products will possess features with 4GL technology, DBMS capability and a system approach to offer software engineering productivity.

¹ Stamps, David. "CASE : Cranking Out Productivity". Datamation. July 1, 1987, P. 55

CHAPTER II

POTENTIAL BENEFITS

After getting some ideas about 4GL, we will look into why it is so fascinating and why it can arouse wide attraction. Nowadays, the backlog of computer applications in most established firms often extends beyond a period of 2 years. Those may only be the visible ones that are equivalent to the tip of the iceberg. The problems are getting more serious in recent years as more people become aware of the power of computers to improve their daily work.

The tool "4GL" seems to appear as the "Saviour" for the heavy-loaded DP staff, i.e. to relieve their burden in the analysis and programming tasks. To analyze how far this "salvation" is being achieved today, we shall first examine the gains to a firm as provided by 4GLs in the current market.

1. Productivity Improvement

The major problem with most third generation languages is that programmers have to instruct the computer the logic flow of a program to achieve a specific result. This also implies that any change in the end result requires the programmers to trace through complicated logics again to find out what is needed to be amended.

4GL is born to tackle these problems. It is results oriented and non-procedural in nature. It transfers the entire concern about program flow from programmers to the computer softwares. Programmers need only to specify the desired result, rather than the actions required to achieve that result.

As a result, application development time as well as maintenance effort are much shortened. Logjam will be diminished and more development can be implemented to support the company business.

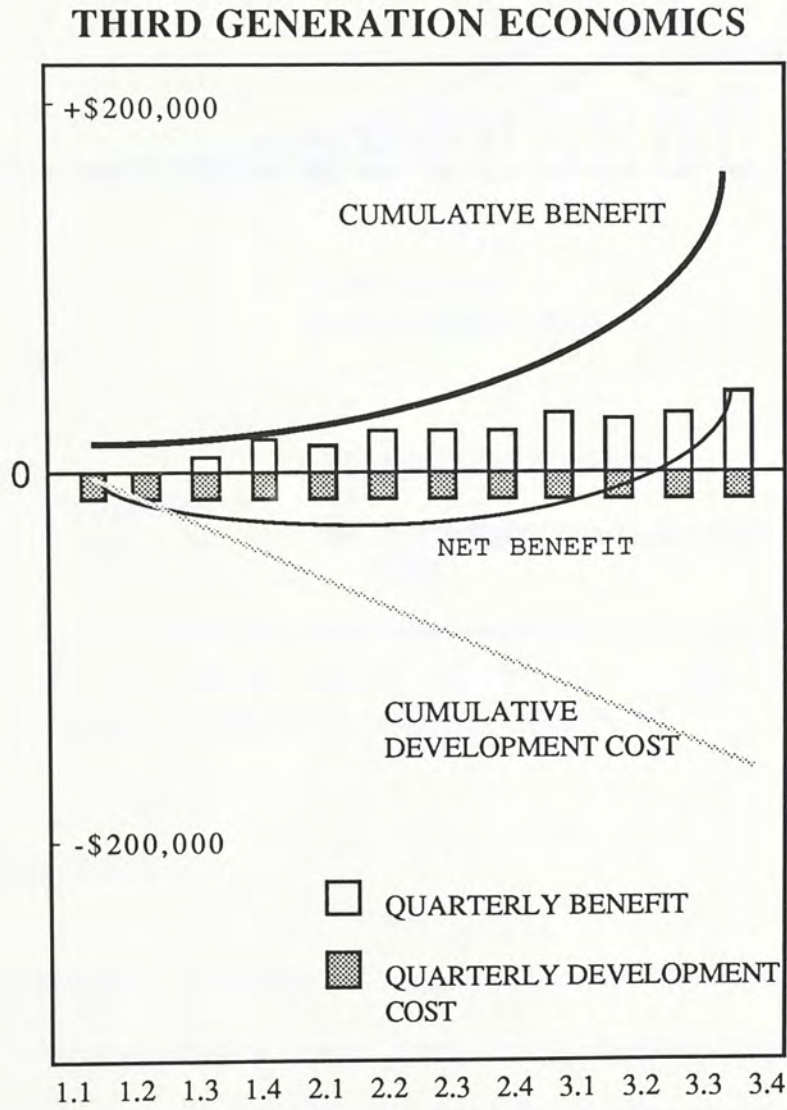
2. Quality Improvement

4GLs make a significant change in the analysis process by employing prototyping. Many 4GL vendors portray the picture that users and DP staff are sitting together in front of the terminals to formulate the requirement. Since the users actually "see" how the system works, the possibility of any misunderstanding will be much reduced. Thus the chance of future maintenance is much reduced as well. Users will also be very happy because they can ensure not only the logic of the requirement, but also the ways the screens or reports appear.

3. Cost Reduction

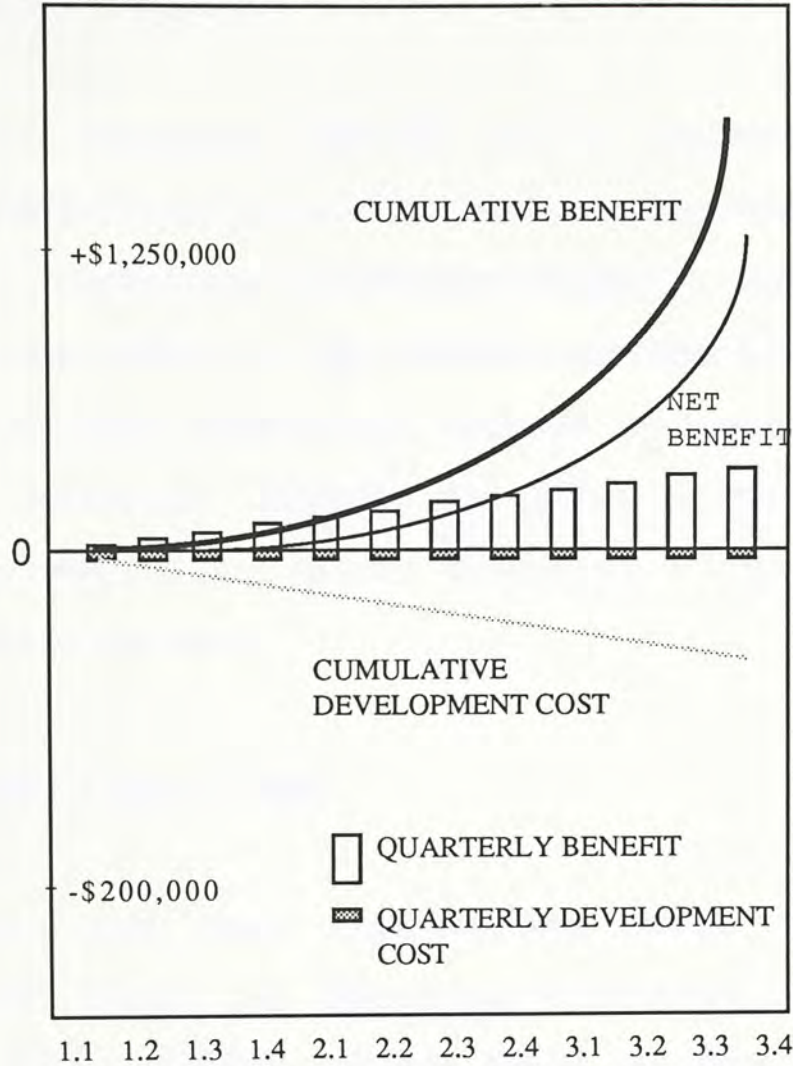
Significant cost saving can be achieved by 4GL according to Cobb, one of the developers of RAMIS II which claimed to be the first 4GL. He showed the difference of the benefits in

monetary term as expected from the third and fourth generation.language as shown in the following graphs.¹



¹Cobb, Richard H. "In Praise of 4GLs". Datamation. July 15, 1985, P. 90

FOURTH GENERATION ECONOMICS



4. Job Improvement

Since 4GL enables a project to be finished in a shorter duration, programmers may find more satisfaction in the job. Moreover, because of lesser coding, programmers may have more chance to handle the whole project instead of coding just part of it (in fact programming in 4GLs is easier to be handled by one person than a group). Also the tedious coding tasks are out while the interesting analysis and design jobs are in. All these will result in better job satisfaction and higher morale.

5. Organizational Benefits

Other intangible benefits to the organization include making the DP shop more stable and less dependent on outside experts. Higher job satisfaction helps to lower the staff turnover rate, which is a big headache for most DP shops in the world. In-house development reduces the need to purchase software packages. Modifying the system to suit the changing business need do not require outside work force and thus is more easy to manage.

6. In line with Future Trend

More and more organizations adopt the ideas of Information Centre and Distributed Information System, which aim to provide flexibility on the hands of users to cope with the ever changing business world. 4GLs pass the programming tasks to the users so that they can manage the priority of the application development and manipulate the system according to their own wish.

No one will deny that every DP shop wish to enjoy all of the above benefits from 4GLs. However, as the viewpoints gathered so far are coming from the West, to what extent are these ideas applicable to the local environment ? The following two chapters will describe the findings from two surveys conducted aiming to explore the Hong Kong situation.

CHAPTER III

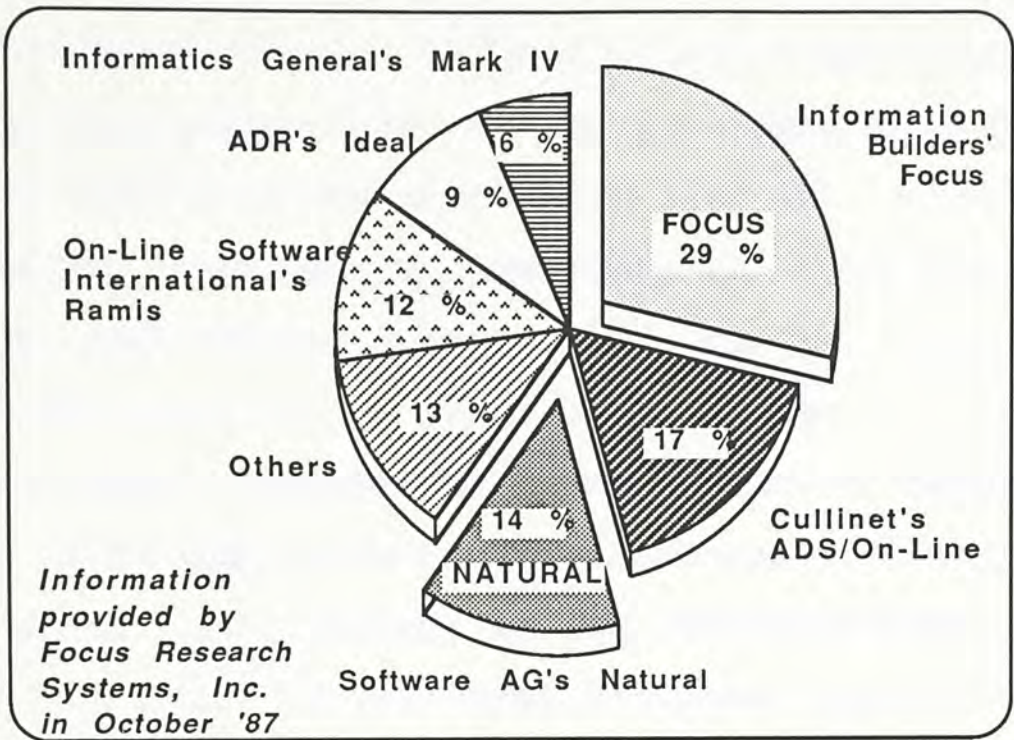
4GLs IN THE MARKET

As I mentioned in Chapter I, there is still no commonly accepted definition on 4GLs. I share the view that perhaps too early a clearly defined one will limit further innovative development on the products. Anyway the market is flooded with the so-called "4GL vendors". The products vary from simple report generators to integrated programming softwares including their own database management systems. Among the popular ones, each emphasizes differently in terms of functions, efficiency, flexibility, compatibility with other software products as well as portability among the existing hardwares.

In order to look at what features are provided by the 4GL products in the market, and whether the products fit the needs of local DP professionals, we try to analyze two of the most popular ones, FOCUS from Information Builders, and NATURAL From Software AG.

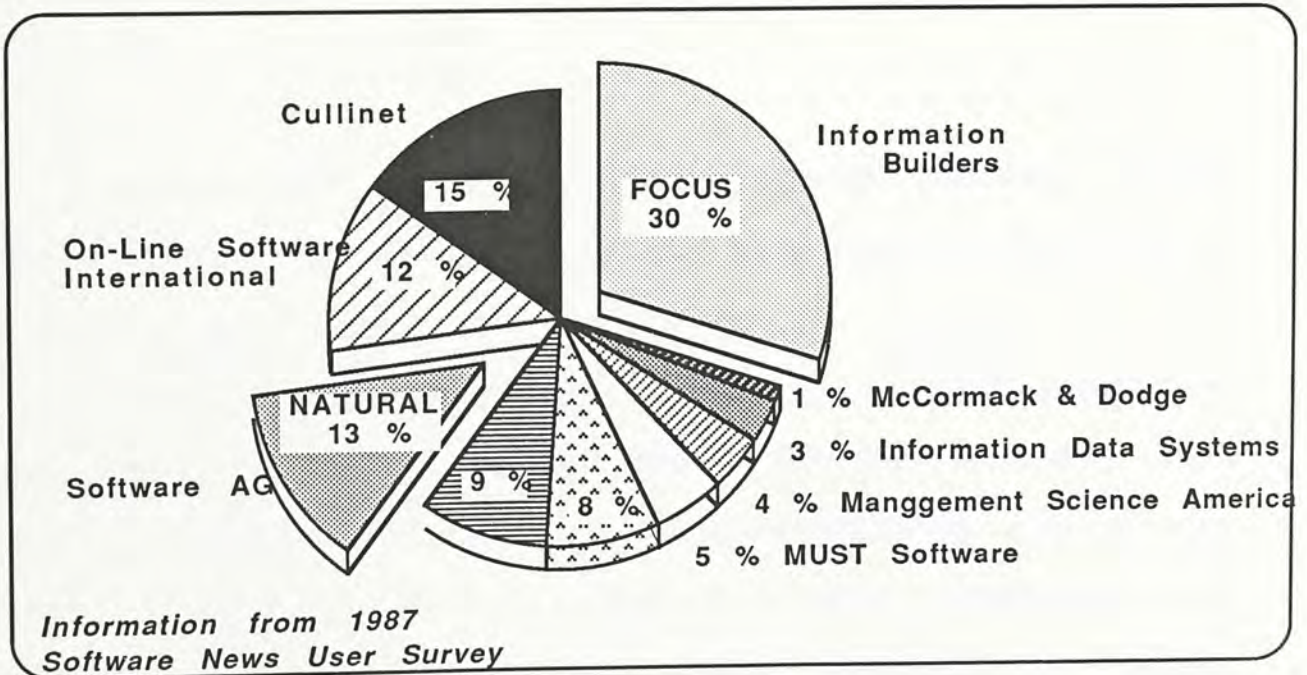
A survey conducted by Focus Research Systems, Inc. showed that FOCUS occupied about 30% market share of the 4GL products on mainframe in October, 1987.¹

¹Computerworld. November 30, 1987, P. 87



Source : Computerworld. November 30, 1987, P. 87

The statistics collected by Software News User Survey gave similar results.¹



Source : Software News. December 1987, P. 38

¹Weitz, Lori with Ambrosio, Johanna. "On a Converging Path". Software News. December 1987, P. 38

Focus claims to have interfaces to most major database systems in the market. It has also its own integrated database manager to serve as another alternative to work with. It provides screen painting, report writing, prototyping and query language capabilities. With 12 year of experience in the 4GL market and over 300,000 users, Focus claims to work under all popular operating systems in environments varying from PC to mainframe. According to the analysts in the computer industry, "Information Builders ported Focus, originally an IBM mainframe product, to Microsoft Corp.'s MS-DOS and Digital Equipment Corp.'s VMS in 1982 and 1985 respectively, years before those operating systems became hotbeds of software development. It is that type of foresight that has contributed to its success in maintaining the largest market share"¹. Moreover, Focus also advertises their large user group, good local technical support and training facilities.

Another 4GL products that have recently aroused attention in Hong Kong is NATURAL or the new release NATURAL 2. Software AG claims its product to be targeted for both application developers and end users. Its heuristic prototyping and interactive testing facilities enable DP staff and end users working together to minimize misunderstanding and ensure smooth implementation. Integration with Software AG's relational data base management system, ADABAS, is a "perfect match" to provide optimum performance. However, interfaces to other popular data bases such as IMS and file structures such as

¹Computerworld. November 30, 1987, P. 87

VSAM are available. They also emphasize on portability, on-line and batch support as well as its own security system.

From this survey results alone, it is difficult to draw any conclusion, especially we cannot test out how far the products can perform as they are advertised. However, it does serve as a guideline for drawing up a list of functionalities & capabilities to be used in the questionnaire sent to the local DP professionals.

CHAPTER IV

4GL OPINION SURVEY IN HONG KONG

All of the 4GL vendors in the market come from the West and naturally their products are designed to fit the requirements of their surroundings. It is generally admitted that the Information Technology in Hong Kong, or even in Asia except Japan, is somewhat lagging behind developed countries such as USA or UK. Are the DP managers in Hong Kong expecting the same functionalities and benefits from the 4GL products in the West as those described in Chapter I and II ?

Since there are few publications in Hong Kong to address these queries, a questionnaire was mailed to 56 major Hong Kong companies to collect some field information. In order to avoid overlapping with previous studies¹, the purpose of this survey is intended to dig out the real needs of 4GL from the eyes of local DP professionals. The results will be compared with the opinions from the West to see if there is any difference.

¹Clubb, O. L. and Zepp, R. A. "The Use of 4GL in Hong Kong" Hong Kong Computer Journal. Vol. 3, No. 4, April 1987, P. 20

A survey on "the Use of 4GL in Hong Kong" was conducted in 1987 by two Associate Professors of Management Science at the University of East Asia, Macau. Questions included the naming of 4GLs, usage, application effect on machine loading, training and software benefits. The result findings stated that "use of 4GL in Hong Kong is already substantial (26 out of the 66 respondents are 4GL users)". "Users seemed to be pleased with the use of 4GLs, particularly in prototyping and overall success of implementation".

The setup of the questionnaire is based on 3 simple questions. Question 1 tries to find out which group in the company will use 4GL, DP staff or users. This will influence the rating on the criteria in Questions 2 and 3. Questions 2 and 3 try to dig out the expectations from local DP professionals from 4GLs in areas of functionalities & capabilities. One is requested to mark on a 5 point scale for each of the criteria. The questions are deliberately designed to be simple, precise and clear in order to attract more responses.

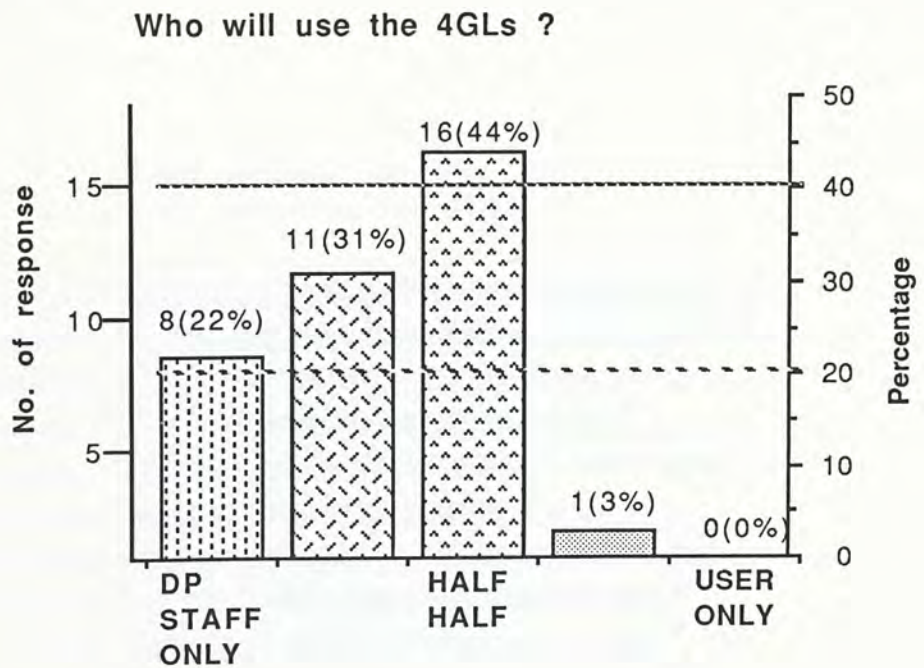
In our samples, all companies have established EDP departments and use IBM mainframe computers. They are chosen because, firstly, they will have more mature ideas towards 4GL and, secondly, the mailing list is handy since all companies belong to an IBM User Group and my company is one of the members. Out of the selected samples, the distribution in trade or industry is as follows:

Banking and Finance	18
Trading	10
Transportation	6
Government and Education	5
Software Firms	5
Public Services	3
Insurance	2
Others	7

TOTAL	56

As seen from the table, the spread is quite even and the samples cover all the trades that require substantial amount of computerization in Hong Kong.

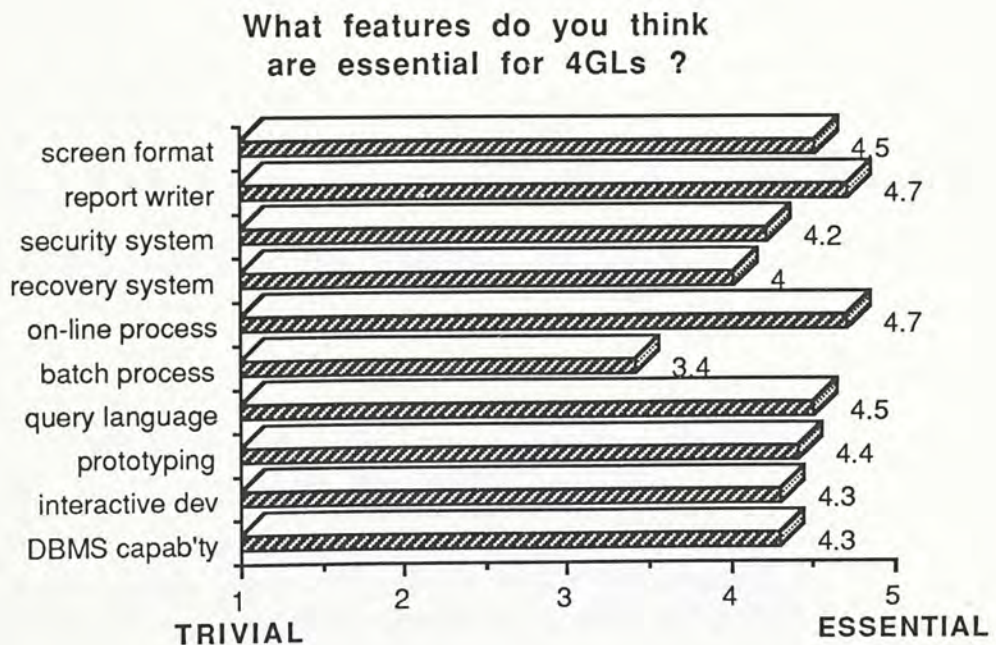
The results of the first question clearly reflected the difference from the West. While many of the 4GL products in the West emphasize that the target group is the end users, the data in the survey showed a deviation towards being using by DP staff rather than end users.



An average score of 3.7 is obtained, from a scale that 5 represents 4GL used only by DP staff and 1 represents 4GL used only by end user. This shows that application development is still mostly handled by DP staff and the degree of user involvement in programming is not as common in Hong Kong as in the West.

FUNCTIONALITIES

Using also a 1 to 5 point scale, companies were asked to consider what features were essential for 4GLs among a list of 10. "Report Writer" and "On-line Processing" scored the highest followed by "Screen Formatter" and "Query Language:". Most of the ratings fall in the score range of 4.0 to 4.7 except that "Batch Processing" received a distinct low score of 3.4 .



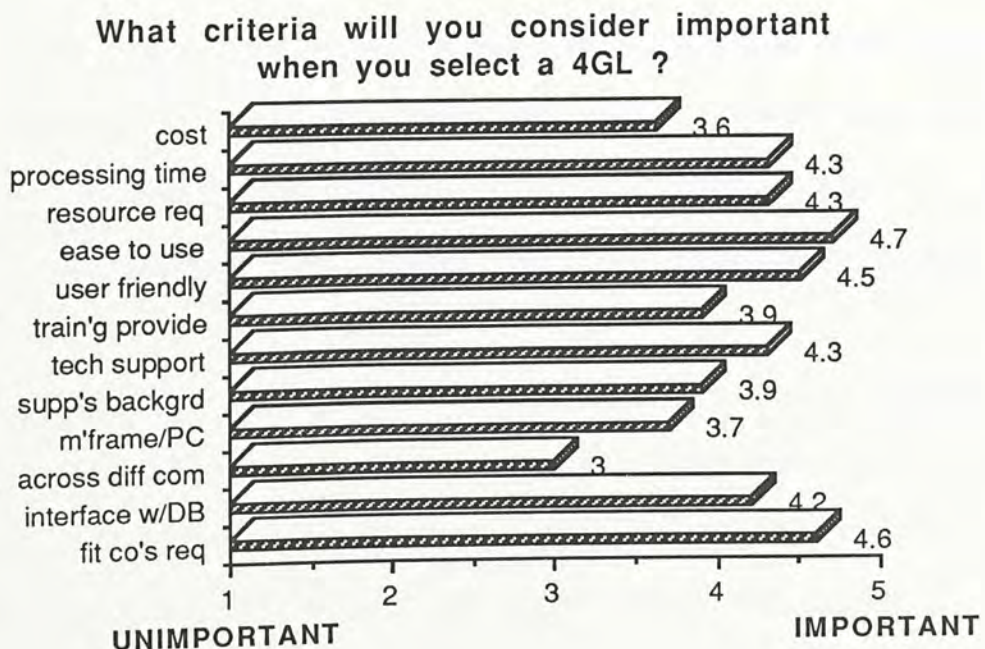
Some generalization can be made from such findings. Companies in Hong Kong need badly a tool to clear the backlogs of producing reports and preparing screens for on-line enquiry etc. Among those needs, it is quite predictable that "Report Writer"

scored highest because managers in Hong Kong are still more comfortable to have a hard-copy of their information rather than to scan through the screens. Maybe a few years later "Screen Formatting" and "Query Language" may overtake when terminal become more "friendly" to the business executives.

On-line response during processing is certainly essential for some ad-hoc requests to meet the current business demand. The low score of "Batch Processing" is of no surprise since such requirements are adequately handled by the traditional 3GLs.

SELECTION CRITERIA

Finally, companies were requested to fill in the importance of each criterion when they selected a 4GL.



Explaining from the those criteria receiving highest scores, "Ease to Use" and "User Friendliness" are the most concerned. That should certainly be the case since productivity improvement can only be achieved through such features. Moreover, it is quite impractical to further burden the programmers by long learning period on one hand, or to send the end users to take a B.Sc. degree in Computer Science on the other, in order to learn the language.

"Processing Time", "Computer Resource Required" and "Technical Support" followed with a consensus that most DP managers worried about the performance of the 4GL as well as the technical aspect. That would have severe impact on their current system if it is not addressed properly.

Usability horizontally across different brand of computers and vertically from mainframe to PC scored low may be due to the fact that in Hong Kong, there are not so many sophisticated system with many different brands of computers and databases linking together as compared with the West. "Cost" also appeared as a low concern for most companies, which may be biased because the response is collected from big mainframe users.

Last criterion, "Fitting to Your Company's Requirement", is a little bit tricky where over 75 per cent scored the "right" answer. However, at least it reflects that 4GL is not treated as a gimmick, but a serious consideration for local DP professionals to

solve the existing problems and to meet the future demand of their business.

DIFFERENCE BETWEEN THE EAST AND WEST

There is no similar survey in the West available to compare our findings. However, generalization can be made from the materials in the journals. The analysis above clearly reflects that there is significant difference between Hong Kong and the West in areas of usage, expectation and requirement. In Part Two, we will focus our attention to an individual firm's consideration. A case study will be conducted in a typical DP environment as a real-life example.

*Part Two***CHAPTER V****CONSIDERATIONS OF INSTALLING 4GL
IN HONG KONG ENVIRONMENT**

The main theme of Part Two will be centred around the topic of this thesis -- "Justification of Installing 4GLs in Hong Kong Environment". Firstly, in contrast with the benefits mentioned in Chapter II, the limitations as observed from the 4GL products in the market are explained. Then we will analyze the considerations in particular to Hong Kong environment and to an individual organization . For those who have signalled green light for 4GL installation, we will look into the selection and evaluation criteria as well as the preparation work for implementation. Finally, a case study is performed to see how the whole analogy fits into a typical Hong Kong DP environment and this ends the whole essay.

CONSTRAINTS OF INSTALLING 4GL

In Chapter IV, we found out that "Processing Time" and "Computer Resource Required" ranked second when companies considered to purchase a 4GL. These are also the areas where most 4GL vendors deliberately skipped in their advertisement. No one would deny that 4GL has substantial productivity improvement over second and third generation especially in coding. However, if a 4GL product reduces the coding time by a few times, but utilizes double or treble CPU and disk resources, is this really an increase in productivity?

One "solution" to this problem is to dedicate some computer resources to cater for the requirement. However, in the real DP world, every shop always have tight budget on computer resources and this would rarely be possible.

Another concern that most DP managers hesitate to install 4GL is the interface with the existing system. Most established companies are currently having a very complicated and integrated computer system as well as sophisticated databases. To maintain these systems, it is sometimes more efficient to use traditional method than to insert some 4GL codes to the 3GL programs. In addition, if we divide the DP programming tasks into development and maintenance nature, the latter constitutes a majority of up to 80%. Hence, 4GL will not be much helpful unless the whole system is rewritten.

Misuse of 4GL will likely happen if the usage is not under proper control. If 4GL product is actually easy to use as expected by the respondents in the survey, a large number of users would be attracted. The more the 4GL users, the more CPU and disk resources required and the longer the response time. Even worse, jobs are duplicated, data seemingly belong to everyone but are controlled by no one.

HONG KONG's PROBLEM

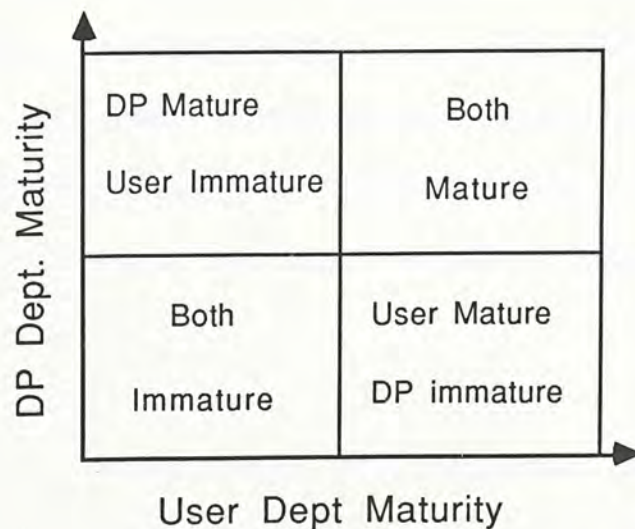
The year of 1987 was characterized by a lot of turnover problem as experienced by most DP shops in Hong Kong. Due to the emigration wavefront of professionals (especially DP and finance) as time is approaching 1997, as well as rapid growth in business transactions both in quantity and quality that require a lot of computerization development work, the demand of DP staff is greatly exceeding the supply. The chain reaction follows that as many of the experienced DP staff leave Hong Kong or new posts are added, companies have to offer high salary in recruitment due to tight demand. This subsequently attracts more DP professionals to change their jobs because of higher pay or better prospect. And the vicious circle continues.

Many DP shops are flooded with programmers with only 2 or 3 year experience on the average. Programmers have to maintain system that they do not have much knowledge in. Poor documentation usually makes the situation even worse.

As we have mentioned earlier, 4GL may help to some extent stabilize the manpower by providing more job satisfaction. On the other hand, since 4GLs have lesser number of lines of code, they are more easy to maintain. Also due to its non-structured nature and results oriented, programmers are no longer necessary to trace through the complicated logic and subroutines. Any change means only to redefine the desired results. Hence the maintenance effort is much reduced.

DP vs USER DEPARTMENT MATURITY

We now narrow down the scope from Hong Kong as a whole to the situation inside a company. The simple diagram below depicts four combinations of DP and User Department Maturity status. This would have a determining factor on the success of implementing 4GL.



The left lower quadrant refers to a situation that no one in the company knows about the right way of using computer. It is represented by a large population of small to medium size firms,

mostly manufacturing in nature, in Hong Kong. It is quite logical to infer that no one will ever think of some advance tools like 4GLs to improve productivity.

The right lower quadrant describes a situation that is most dangerous to install 4GL products. End users have a strong desire to improve their business practice through the use of computer and urge DP department to look for better tools. Under pressure, DP department may arbitrarily select a 4GL without much knowledge nor awareness of its impact on the existing environment. What may happen? Computer slowed down, information disclosed to inappropriate parties, data security system broken down, users claimed for more disk storage, no one managed to control the whole situation. Sometimes, even the 4GL did not work at all.

The upper quadrants provide a favorable environment for the implementation of 4GLs. In Hong Kong, it is quite difficult to find some really "mature" end users who can understand the effective use of computerization to assist in their business operations. Hence most established firms will have situation located at the top left.

With a mature DP environment, the corporate data can be distributed properly to appropriate users with good data management control. Resources will be allocated according to necessity. Standards will be established to maintain good programming and documentation practice. On the whole, complicated application system will be handled through the joint

effort of DP staff and users, leaving the ad-hoc or "what if" requests being performed by the users alone.

PLAN FOR IMPLEMENTATION OF JCL

Implementation of a JCL system is not an simple as it may appear. It requires a thorough understanding of the system's architecture and requirements. The JCL system must be designed to be portable, maintainable, and easy to use. The implementation process should be carefully planned and executed.

CONCLUSION

Choosing the right JCL and implementing it is the right way to go. It is a good investment for the long term. The JCL system should be designed to be portable, maintainable, and easy to use. The implementation process should be carefully planned and executed. The JCL system should be designed to be portable, maintainable, and easy to use. The implementation process should be carefully planned and executed.

In conclusion, the JCL system is a good investment for the long term. It is a good investment for the long term. It is a good investment for the long term. It is a good investment for the long term.

CHAPTER VI

PLAN FOR IMPLEMENTATION OF 4GL

The implementation of a 4GL product is not as simple as bringing in an ordinary application or system software. Apart from understanding the company's status and requirement, the changes from 3GL to 4GL technology must be properly understood and addressed.

THE TOOL

"Selecting the right tool and implementing it at the right time" is too vague and over simplified especially when we do want to implement a 4GL product. One has to know the goods and bads of a 4GL, more importantly what the impact to one's environment is. There are usually cases that features emphasized by the vendors, though fascinating, never fit into one's requirement. On the other hand, some weak points of the product sometimes may not affect a particular environment. Therefore, the matching of tool to one's environment should be considered seriously.

In terms of functionality, most developing DP shops will only require tools for report writing and screen painting at start. Query language and prototyping will deem necessary at a later stage. It may be followed by adding DBMS and other features that

make the 4GL environment more complete. Hence present and future needs of the organization have to be grasped when making the decision.

From the survey, ease to use and user friendliness receive the highest rating. Certainly that is the first area that can be easily "felt", and cannot be neglected during selection. Performance and resource utilization are the trap that most DP shops fall into. It is difficult to simulate the actual working environment. User references are also sometimes misleading since software suppliers will only introduce those user references who are most satisfied with their products. To tackle these problems, it is advisable to dig deeply into the 4GL architectures and designs and to make comparison among vendors as far as possible. And if this cannot be performed due to limited manpower or knowledge, it is more preferable to install the product to test for one to two months. Through such practice, an understanding of its functionality and capability can be established. Also, the shortcomings of the product can be identified and their impact to the company can be estimated.

The technical support and training provided are also the areas that cannot be neglected. A 4GL product will sooner or later be left idle if some technical problems are not solved and training for new staff is not provided. And since 4GL is still a rapidly changing field, one will expect a lot of upgrade in terms of capability and performance in the near future. Hence the continuity of the supplier should also be taken into account.

THE PEOPLE

Although over 75% of the respondents considered "Fitting to Your Companies' Requirement" to be very important when selecting a 4GL product, I wonder how many DP professionals can actually perceive the current and future needs of the company. As DP staff are trained to be analytical or technical minded, few have really a business perspective to think in terms of the users' need or the company as a whole. 4GLs are mostly results oriented and the language itself is unstructured. New attitudes and new ways of approach must be adopted and well accepted before the implementation.

On the user side, they will have more involvement in the application development. I have personally experienced some users who were really escaping from anything related with what they thought of as "DP tasks". As a result, many of the strategic development systems turn out to be merely a replication of the manual methods without any improvement. Obviously, initial design work has been overlooked and the user management's interest and involvement have been insufficient. This phenomenon is quite typical in Hong Kong. To tackle this, information technology education to the users especially to management is essential. However, it is also expected to be extremely difficult and requires continual attention over a long period of time using a number of education techniques.

THE METHOD

As 4GLs shorten the time of programming, the development cycle will focus on the analysis and design. With the use of prototyping, users will be much more involved in the development stage. And with such joint effort between users and DP staff, the actual requirement can be figured out and the chance of future amendment will be reduced.

Large development project team will be dissolved and being replaced by a group of 1 to 4 DP staff plus the user involvement. It is preferable to centralize the control in DP department with their usual expertise in project management. Related issues such as methods of rewards, motivation and career development are expected to be changed as well.

THE ENVIRONMENT

A supportive environment is vital to the success of the implementation. Adequate computer resources must be noted in the first place since most existing 4GLs are resource hogs. A more mature and stable environment both in DP and user side will facilitate and ensure the appropriate use of the 4GL products. Last but not least, as people are those who will ultimately determine the success, the organization should compose of business minded DP professionals, analytical minded users and the most important understandable and supportive top management working hand-in-hand together. Then, this is the

right time when we should implement the 4GL technology into our company and its best benefits are anticipated to be enjoyed.

CONCLUSION

CASE STUDY - A REAL LIFE EXAMPLE

In this final chapter I would like to take the company I am working for as a case study to see whether it is justified to use 4GL.

I am working in the EDP department of a Japanese owned company. There are totally 10 staff in the department including 5 application programmers, 2 operators, 1 system programmer and 2 maintenance staff. We have installed the Japanese version of IBM and are using an Information Management System (IMS) to process our daily transactions. The main purpose of the system is to manage our inventory. The application system is basically divided into three sections, which are: inventory management, sales processing, and purchase processing. The system is developed using a group project in 1981 and has been in operation since then. The system is now a very important part of our business and is widely used by our customers. The system is also used by our management to monitor our business performance.

CHAPTER VII

CONCLUSION

CASE STUDY - A REAL LIFE EXAMPLE

In this final chapter, I would like to take the company I am working with as a case study to see whether it is justifiable to install 4GL.

I am working in an EDP department in a Japanese owned trading firm. There are totally 10 staff in the department, including 5 application programmers/analysts, 2 operators, 1 system programmer and 2 managerial staff. We have installed IBM mainframe computer and are using an Information Management System (IMS) to process our daily transactions which are mostly on-line real-time updating in nature. The application systems are basically related to our trading business, which include sales and purchase order processing, accounting, inventory and demand forecasting. The current system was developed under a global project in 1984 with joint effort from colleagues in U.S., U.K. and West Germany. It was then transferred to us for our use and subsequently maintained by our staff. The major language used is COBOL.

Our programmers are relatively green and have an average of only 2 to 3 years of experience. The staff turnover problem is always a big headache for us. The limited documentation of our current system makes the situation even worse. Due to the lack of understanding on the system, our programmers are often forced to scan through the programs to find out the logic and then to perform maintenance.

On the business side, our sales has been growing rapidly in recent years. This results in higher transaction volume and larger demand for improvement of our existing computerized application system. We badly need some tools to improve productivity of system development and maintenance, especially in areas of report writing and screen formatting.

Under such conditions, we have started to investigate the possibility of installing 4GL to alleviate our burden since late 1987. After some preliminary study, we decide not to use 4GL at the present moment. While cost of the software is not our major concern, we have the following hesitations for installation :

1. Our computer resources in CPU and disk storage is just sufficient. Since all 4GLs in the market today require large resources, it is not worthwhile to upgrade our computer hardware to give room for it.
2. Our bottleneck in the backlog is mostly the maintenance jobs. These can be readily handled by our existing 3GL. All

we need are tools to speed up the preparation of reports and screens only.

3. The users are quite traditionally-minded, in a sense that they still rely mostly on reports, not much ad-hoc requests, and being afraid of performing any "EDP" tasks. Hence potential benefits from 4GLs are limited.

Our conclusion on the study is that it is not justifiable to install 4GL, at least at the present moment. We project that at the time we need a major improvement or rewritten of the whole application system, we will install 4GL so that maximum benefits gained from such tools can be achieved.

4GL - YES or NO ?

A major bank in Hong Kong has employed a team of system programmers to investigate 4GLs in the market for one whole year. Finally they suggested to the top management that 4GLs are still "immature". However, they believed that development on the products had been rapid. They expected products with adequate functions and capabilities would emerge within one to two years and at that time they would install 4GL into their shop.

To conclude, every company has entirely different environment and hence different considerations. 4GL is not a must that every DP shop have to install immediately. However, it

is a wavefront that a DP manager cannot resist to seriously consider. The question here is what the appropriate time is. Immature implementation will not only result in wasting the resource employed in the project, but also endanger the stability of the DP activities in the company. On the other hand, too late an implementation will hinder a DP shop from further growth and is not desirable either.

QUESTIONNAIRE ON FOURTH GENERATION LANGUAGE

	DP STAFF ONLY		HALF HALF		USER ONLY
A. Who will use the 4GLs ?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B. What features do you think are essential for 4GLs ?	ESSENTIAL		TRIVIAL		
1. Screen Formatter	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Report Writer	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Security Control System	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Recovery System	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. On-line Processing	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. Batch Processing	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. Query Language	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. Prototyping	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. Interactive Application Development	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. Data Base Management System (DBMS) Capability	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

(P.T.O.)

C. What criteria will you consider important when you select a 4GL ?

	IMPORTANT			UNIMPORTANT	
1. Cost	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Processing Time	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Computer Resource Required	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Ease To Use	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. User Friendliness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. Training Provided	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. Technical Support	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. Supplier's Background	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. Useability from Mainframe to PC	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. Useability across Different Brand of Computers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11. Interface with Your Own Database	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12. Fitting to Your Company's Requirement	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

-- THANK YOU --

RESULTS ON 4GL OPINION SURVEY

QUESTION	5 PT	4 PT	3 PT	2 PT	1 PT	TOTAL PTS	TOTAL RESP	AVE
A	8	11	16	1	0	134	36	3.7
B1	24	9	2	0	1	163	36	4.5
B2	27	7	1	1	0	168	36	4.7
B3	16	15	3	1	1	152	36	4.2
B4	14	12	7	2	1	144	36	4.0
B5	27	7	1	1	0	168	36	4.7
B6	10	7	8	11	0	124	36	3.4
B7	24	6	6	0	0	162	36	4.5
B8	19	13	3	1	0	158	36	4.4
B9	19	10	6	1	0	155	36	4.3
B10	19	9	8	0	0	155	36	4.3
C1	9	11	9	5	1	127	35	3.6
C2	18	12	4	0	1	151	35	4.3
C3	19	10	4	1	1	150	35	4.3
C4	27	6	2	0	0	165	35	4.7
C5	21	12	1	1	0	158	35	4.5
C6	11	14	7	3	0	138	35	3.9
C7	18	11	5	1	0	151	35	4.3
C8	11	13	7	4	0	136	35	3.9
C9	4	17	12	2	0	128	35	3.7
C10	4	7	14	4	6	104	35	3.0
C11	16	10	8	1	0	146	35	4.2
C12	26	4	4	0	0	158	34	4.6

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