COURSE TITLE: MSc INFORMATION ENGINEERING

PROJECT TITLE: AN INVESTIGATION ON MODELS AND METHODOLOGIES FOR DEVELOPING AN I.S STRATEGY

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Abstract:

This project intends to examine four different models and methodologies for development of information Systems, and their applications in industry.

These are the work of four prominent Information Systems consultants namely **Richard Hayward**, **Edwin Tozer**, **James Martin** and **Arthur Andersen**.

This is followed by looking at eight major companies in the UK investigating their commitments to **IT** (first four) and the models and methodologies used to develop their **Information systems** (last four).

I felt it was appropriate to squeeze in some findings of **MORI** research in 1989.

Section 1: Preliminary discussions:

1.1: OBJECTIVES:

The main objectives of this project are to establish:

1. How widespread **HAYWARD** and **TOZER** models for Information system plans were among British companies?

2. Were there other models or methodologies used for developing an Information Systems Strategy?

1.2: Background to this project:

During the latter part of 1989 we had a module on project management with lively discussions on development of Information Systems strategy.
It was here that we were introduced to two models under the headings:

"Developing an information systems strategy" By Richard G.Hayward

And

"Developing strategies for management information systems" by Edwin E.Tozer.

Although these two models seemed to have been quite well understood in the academic circle, but the problem was we did not know how popular they were in industry and the pertinent questions to be answered were:

* What would be the rational behind choosing a specific model?
In other words, would the selection of a model be based in accordance to the functionality of the main stream of a business, or would it simply be the taste or style of an individual senior manager?

* Are there other models or methodologies for similar applications?

I undertook the work in order to find some satisfactory answers to these questions. I started off the work by writing to 119 companies in the UK which had **IT** activities (content of my letters in appendix I) and had a good response to my request.

1.3 Introduction

Strategic planning is the latest in the managerial responses made by organizations of all kinds in an effort to cope with the pressure of growing change and complexity in the business environment.

Success in achieving corporate goals is related to an organization ability to exploit the opportunities in the environment and to minimise the effect of damaging threats, and strategic planning has evolved as a way of managing this process.
In the 1980's the business environment for most organizations has been characterised by increasing uncertainty, complexity and volatility.

It is not simply the magnitude of changes in areas like legislation change, technological developments, industry structure and so on, that one causing problems for organizations, but the increasing rate at which these changes are occurring.

Strategic planning as a management function was designed to rationalise and clarify the ways in which particular organizations were most likely to be able successfully to interact with their increasingly hostile business environments. In this sense it

was seen largely panacea to the problems of most business organizations.

The strategic planning function and discipline was heavily imported into the UK companies during the late 1970's and early 1980's as the increasingly hostile European business environments became apparent.

The Pitfalls:

As with all panaceas in management, the strategic planning has not had the dramatic impact that was anticipated in many organizations.

There are two primary reasons for this "failure". First many companies clearly had unrealistic expectations of organised, formal strategic planning departments.

Creating a corporate planning function and giving a team of strategic planner's large budgets and sophisticated computing systems and expecting the problems of the business environments to go away.

This was a classic managerial response of throwing money at the problems and hoping that they will disappear. They rarely do.

Secondly, strategic planning was introduce as a separate and distinct staff management area and was largely isolated from the main stream management of the business.

Recently the planning function in many organizations has been recognised as being too distant from the real business of running a company.

This has resulted in a change in the role of most strategic planners within companies particularly in the USA, from being individuals who "do" the planning for this company to those people who help managers devise and implement their own plans for their part of the business. This changing emphasis is now being reflected in the UK.

Recent work at Cardiff Business School has focused on the problematic issue, looking at way in which strategic planning can be managed in order to create successful implementation.
It suggests that participation in planning from all management functions and at all levels is the only way to gain the ownership and commitments at strategic plans

that is necessary to achieve successful implementation.

The idea of "strategy" and hence strategic planning is ambiguous and unclear to many executives. It is for this reason that many strategic plans are little more than window-dressing. The challenge is to make the strategic plan the blueprint for the long term future and direction of the organization.

If strategic planning is to be effective, the plan produced must be matched both to the company's ability to implement it and, perhaps most particularly, to ability to resource it.
Further more these issues must be incorporated into the planning process not simply produced as a managerial response to a plan produced.

Most importantly, if strategic planning is to be effective, there is a need to **manage Information systems.**

This implies both flexibility and innovation in the way in which information is captured and presented, as new questions are formulated which can not be answered by standard reporting systems.

More fundamentally the management information system is a structure placed on the present and new structures may be needed to deal with the future.

1.4: MORI Research on Information Technology:

It seems appropriate here to investigate Britain's use of and attitudes to information technology before proceeding any further; for this we are going to look at a survey commissioned by Computer Management Group (CMG) which was carried out by Market & Opinion Research International (MORI).

The reason for the commissioning was the CMG's belief that it is vital that views, opinions, and apprehensions of Britain's general public and senior managers are fully appreciated.

"**IT** into the 1990s" shows that there have been significant shifts in the use of information technology since previous surveys conducted in 1982 and 1985.

A general public poll was first undertaken by **MORI** for the **DTI's "IT:'82"**, Information Technology Awareness programme.

Then **IT** was still in its infancy as far as its impact on the public was concerned. Three years later a separate poll was carried out for the technical change centre. That survey revealed that the arrival of the personal computer had indeed started to make an impact on people's lives.

Field work for this survey took place among the general public between 17 August 1989 and 21 August 1989 and among managers in Britain's top 750 companies (and their major subsidiaries) between 10 July 1989 and 4 August 1989.

The responses demonstrate that there is confidence that **IT** will provide new opportunities and new jobs and a positive belief that Britain is in good shape to face the challenges of a single European Market.

General Public; Use of IT:

In 1989, one in four of the general public uses Ceefax, Oracle or Prestel, whereas in 1985 only one in seven did so.

During these four years, use of cordless phone or cell phone has also increased, from one in twenty two in 1985 to almost one in seven in 1989.

Nowadays 11% of the British public use fax or telefax whereas in 1985 use was not sufficiently widespread to be measured.

Personal use of word processors/computers/terminals at work has increased over the four years but, curiously, personal use of these items at home seems to have decreased.

USE

Q.: "What of the following do you personally use or operate nowadays?

	1985	**1989**
Fax/Telex	0%	11%
WP/C at work	13%	19%

Ceefax/Oracle	16%	25%
Cordless phone/ Cell (uler) phone	5%	13%
WP/C at home	13%	18%

Base: All Source: MORI/CMG

Use in the home?

Q.: "You mentioned using a word processor/computer/terminal at home. What do you personally use it for?

Less serious games of 'space invaders' variety	70%
Serious games such as chess	26%
Word processing	26%
Accounting/Finance	13%
Database	11%
Graphics	10%
Spreadsheets	6%
Design 6%	

Base: All Source: MORI/CMG

IT at Work:

In 1982, less than a third of the working public had a computer terminal at their place of work; today, this proportion has risen to over one-half.
The greatest proportional increase has occurred in the incidence of word processors at work.
In 1982 one sixth of the British public had a word processor at their place of work; today this proportion has risen to just under one-half.

In these seven years, the incidence of micros or other computers at the public's place of work has almost doubled.
Use of fax machines at work has greatly increased, by over four and half times in the period being compared. However, the use of electronic systems control and

electronic automated machine tools has remained constant over the period.

Two thirds of working respondents have at least one of the items at work and over half have at least two.

About one in four of the working respondents interviewed have had one or more of the items installed at their place of work during the last year. However, just under half of the working respondents have not had any items installed.

At Work:

Q: "Which of these, if any, do you have at your place of work?

	1982	1989
Computer Terminal	29%	51%
Word Processor	16%	45%
Micro or other computer	24%	42%
Facsimile Transmitter	6%	29%

Base: All working full or part-time Source: MORI/CMG

Attitudes to IT:

The general public takes a more definite stance on their response to IT today than in 1982 with a general increase in the proportion both agreeing and disagreeing with certain statements.

On the whole the attitude shift in the seven years has been in favour of information technology, with a greater proportion of the public in 1989 feeling that information technology is important to people like them, and a smaller proportion being suspicious of information technology.

Attitudes to IT:

Q: "I am going to read out some statements about IT and would like you to tell me how strongly you agree or disagree with each?"

	1982	1989

IT is important to people like me	36%	51%
IT is an area where Britain lags behind	38%	46%
I'm suspicious of **IT**	20%	27%

Base: All Source: MORI/CMG

Views on the effects of IT:

It is clear that there has been a tremendous change in the British public's attitudes toward the likely effect of Information Technology.

In 1982 only a quarter expected information technology to create new businesses and services, now over three times as many do.
Similarly, in 1982 less than four in ten expected IT would create new opportunities for industry whereas in 1989 more than eight out of ten expect this to happen as a result of IT.

Expectations regarding educational benefits have also risen markedly over these seven years. More than twice as many members of the public expect IT will enable people to learn in their home than was the case in 1982.
A significantly higher proportion also expected IT will help children in school.
In 1982, less than a quarter of British public expected information technology to create more leisure time; in 1989 this proportion has trebled.

The public were also pessimistic about the effect of IT on unemployment in 1982 with over one-third expecting IT to increase unemployment. Although this proportion has risen to one-half of the British public in 1989, they are much more positive about its benefits than they were in 1982.

Effects of IT

Q: "Which of the things on this card do you think are likely to happen as a result of IT?"

	1982	**1989**
Help children in schools	46%	85%
Create new opportunities For industry	37%	84%
Enable people to learn in their own homes	39%	84%
Create new business and services	25%	81%
Create more leisure time	28%	72%
Increase unemployment	34%	50%

Base: All Source: MORI/CMG

Computers at school:

Use of computers in British schools has increased enormously since 1982, especially in our primary schools.

In 1982 less than one out of eight of British primary school children used a computer at school but today this proportion has risen to three quarters.

In 1982 half of Britain's secondary school children used a computer at school and today nearly nine out of ten do so.

At school

Q: "Do they use a computer at school?"

	1982	1989
Primary school	12%	76%

Secondary school	51%	87%

Base: All with children at primary or secondary school Source: MORI/CMG

Senior management use of IT:

The fax or telefax is the most widely used item among senior managers in all job functions except those involved with finance, who are slightly more likely to use a word processor / computer/ terminals at work.

Personnel managers make the most extensive use of Information Technology which is used by about six out of ten of them, compared with just over half of those involved in other job functions.

Variations in use of these IT items to some extent reflects the nature of varying industries; for instance the percentage of senior managers in the construction industry who use cordless or cell phones is double that of those in the manufacturing industry.

The use of fax and telefax is almost universal in the transport and distribution industry while word processors / computers and terminals are least used at work by those involved in mining or natural resources.

Use in the home?

Q: "You mentioned using a word processor/computer/terminal at home. What do you personally use it for?"

Word processing	41%
Accounting/Finance	26%
Spreadsheets	22%
Less serious games	16%
Database	14%
Serious games	6%
Graphics	4%
Design	3%
Specified others	21%

Base: Senior Managers Source: MORI/CMG

Use at Work?

Q: "Which of the following do you personally use or operate nowadays?"

	Finance %	Sales %	Management %	Personnel %	Other %
Fax/Telefax	88	84	88	96	89
W.processor/ Computer/ Terminal	90	71	82	85	78
Ceefax/ Oracle/ Prestel	35	46	35	54	35
Cordless/ Cell phone	31	41	37	46	31

Approach of companies to information systems:

Senior managers were asked whether or not their company has specific plans or objectives regarding information systems written down in a strategic document. Six out of ten said their company did, while three out of ten said their company did not and one in ten did not know.

This means that approximately one third of the top British companies do not have a strategic document regarding information systems, objectives or plans.

Factors involved in changes:

Senior managers were asked which major factors were likely to be involved in any future changes in their company's information systems.

Senior managers feel that the major factors in the next five years are changing management information needs and the need to reduce costs, each selected by around nine out of ten of senior managers.

Quality assurance was chosen by over three-quarters, improvements of strategic position by nearly three-quarters, changing industry standards by two-thirds and changing organizational structure by just over half.

Approach to IT

Q: "Does your company have specific objectives or plans regarding IS written in a strategic document?"

59% Yes 32% No 10% D/N

Q: "Does your company have a manager or director who is responsible for information management and strategy?"

79% Yes 19% No 2% D/N
Base: Senior Managers Source MORI/CMG

Approach to IT

Q: "Changes in your company's information systems are likely to take place in the next five years, for a number of reasons. I am going to read out a short list, and would like you to tell me whether or not you think each one is likely to be a major factor in future changes in your company's information systems?"

	Yes	No	D/N
Changing management Information needs	90%	9%	1%
The need to reduce costs	88%	10%	2%
Quality assurance	82%	16%	2%
Improvement of Strategic position	73%	20%	7%
Changing industry Standards	66%	28%	6%

Changing organisational Standards	54%	40%	6%

Base: Senior Managers (500) Source: MORI/CMG

Attitudes to IT:

Senior managers were asked whether or not they were satisfied with the following issues:

* Their companies preparation for Europe 1992, in information Technology terms.

* Government legislation on information systems.
* Computer systems security and data protection.

Senior managers are in general satisfied with their companies' preparation for Europe 1992, in IT terms, and Government legislation on information systems is regarded as less favourably overall.

Attitudes towards computer systems security and data protection also vary. Equal numbers of senior managers are satisfied or dissatisfied, with less than one in eight undecided.

Attitudes to IT?

Q.:"I am going to read out few topics or issues and I would like you to tell me how satisfied or dissatisfied, you fell about each?"

Your company's preparation for Europe in IT

Satisfied	Dissatisfied	Neither
58%	21%	21%

Company systems, security and data protection

44%	44%	12%

Government legislation on information systems

34% 29% 37%

Base: Senior Managers Source: MORI/CMG

Senior managers whose companies have specific objectives or plans written down in a strategic document and/or had a manager / director responsible for information management and strategy, are more likely to be satisfied with their company's IT preparation for Europe 1992; they are also relatively more likely to be satisfied with computer system security and data protection.

As with the general public, senior managers were also asked whether they considered that information technology was important to them, whether they believed it an area where Britain lags behind and whether they were suspicious of IT.

Senior managers are much more aware of the importance to them and, correspondingly, less suspicious of IT, compared to the general working public.

The vast majority of senior managers agree (over half of them strongly) that this is important and almost the same majority are not suspicious of IT. However, there is less difference between senior managers and the general working public in their opinions on whether Britain lags behind in the area of IT. Just less than one half of each sample agrees that Britain does lag behind, while a third of senior managers disagree.

Personnel managers register the highest net agreement that IT is important to them, and show net disagreement with the statement that Britain lags behind.

Managers in personnel, sale, marketing and advertising are the least suspicious of IT; those in finance are the most suspicious.

In terms of industry sector, senior managers involved in mining and natural resources react rather differently from senior managers in other sectors. In general, they are relatively less likely to agree that IT is important to them, or to agree that Britain lags behind.

Attitudes to IT?

Q.:"I am going to read out some statements which people have made about IT and I would like you to tell me how strongly you agree or disagree With each?"

	Senior manager	Working public
IT is important to people like me	93%	62%
IT is on area where Britain lags behind	45%	48%
I'm suspicious of IT	14%	23%

Base: Senior managers (500)
Working public (1108)

Source: MORI/CMG

Views on the effects of IT:

Senior manager's impressions of the likely effects of information technology may be divided into four categories.
The most popular predictions include creating new businesses, services and opportunities for industry, which are mentioned by around nine out of ten senior managers.

These are closely followed by effects on education such as enabling people to learn in their homes and helping children at school.

The third category, creating more leisure time, is seen to be less likely, and the fourth, increasing unemployment is expected by about a quarter of senior managers.

The views in the first two categories are echoed by the general working public, but 50% more of the sample believes it will create more leisure time and 78% more fear that it will increase unemployment.

Personnel managers have the highest expectations of the effects of IT, anticipating without exception that it will create new businesses, services and opportunities for industry. Again finance managers hold the lowest expectation on this aspect.

Effects of IT?

Q: "Which of the things on this card do you think are likely to happen as a result of IT?"

	Senior managers	working public
Help children in school	93%	89%
Create new opportunities for industry	87%	89%
Enable people to learn in their own home	86%	89%
Create new businesses and services	92%	86%
Create more leisure time	49%	74%
Increase unemployment	28%	49%

Base: Senior managers (500) Source MORI/CMG
Working public (1108)

Section 2: Discussions on Models and Methodologies:

2.1: INTRODUCTION:

In this chapter we look at four models and methodologies for development of information systems which in one way or another have the intention of solving the traditional problems of Information Systems which have been:

* Excessive development time.
* Ineffective support of business activities.
* Lack of resilience to change.
* Requiring substantial maintenance.
* Requiring high technical skill levels for development.

The four models and methodologies are the work of Richard Hayward, Edwin Tozer, James Martin and Arthur Andersen.

2.2: Developing an Information Strategy by Richard Hayward

This model is meant to be specially structured to ensure that the necessary strategic issues have been examined before drawing up detailed tactical and operational plans.

Introduction:

Information systems are essential to most organizations and a strategy for information systems should be part of corporate
Strategy.

A planning model for information systems should not only include a systematic review of the technology, the applications and the
Management of information systems but should support a mechanism to overcome the communication gap between top management and data processing.

The need for an information systems strategy:

It is well established that long-range planning is part and parcel of business activity and with information systems, the time span of commitment is quite as long as other corporate activities. The use of new technology and the complexity of

new integrated systems, all suggest a planning horizon of 5-10 years.
Today computers can significantly increase productivity, not only in payroll, order entry and inventory control, but in areas as diverse as process control, Computer Aided Design, the Electronic Office and Decision Support.

Three ideas mentioned here: The need for planning, the importance of information, and the importance of computers in information handling lead naturally to the conclusion that a strategy, or plan, for implementing computerized information systems is vital in today's enterprise.

2.2.1 Nolan's Stage Hypothesis:

(Note that both Hayward and Tozer have shown interest in the hypothesis)

This is the result of some research by Nolan which has shed light (in terms of need for improved planning, organization and control) on the impact of computer-based information systems upon the business.

However these hypotheses have been criticized by some but should provide guideline for an organisation to see where it stands and where it may be leading in terms of computerization.
Nolan believes that an organisation typically undergoes six stages growth in the quest for automated solutions to information problems.

These stages of growth are:

Stage 1: **Initiation:**

At this stage the computer is first introduced into the organisation and consequently user's unfamiliarity with the computer means limitations of its usage.

The applications developed at this stage tends to serve the operational needs in the areas such as payroll, accounting, order entry and invoicing with little or no overall control of the computer systems apparent.

Stage 2: **Contagion:**

This is the stage where users are becoming more enthusiastic and demanding new

applications as they overcome their initial apprehension of the computer, hence, there is a sharp rise in computer service expenditure and still the applications development is in isolation.

Stage 3: **Control:**

This is where not only user demands for information are frustrated but also the ever expanding cost of running the computers and marginally increasing benefits draw the attention of the upper management, as a result either the budget for all this is reduced or hold constant.
The focus is now on providing the IS function with the type of professional management found else where in the business.
Emphasis is placed on documenting existing applications and moving them towards middle management probably away from its operational use, causing backlog and possibly higher maintenance cost.

Stage 4: **Integration:**

This is where a significant transition of the use computers takes place within the organisation. This is the transition from management of the computer to management of the data resource.
This shift although hampered by data redundancies and inconsistencies is reflected in attempts to integrate existing systems using data base. This is initially carried out where lack of the organisation-wide information analysis is also apparent.

Stage 5: **Data Administration:**

By now the data base technology is in place and corresponding data administration would plan and control the organisation's use of data moving towards more integrated systems with data been shared among various departments.

Stage 6: **Maturity:**

Only very few organisations have reached this stage where the attainment of maturity reflects on the true integration of the computer systems where the information resource is meshed with the strategic planning of the organisation.
It is clear that an organisation should be able to see where it stands and where it is heading in terms of computerization.

The answer is to move the whole business to the latter stages of the Nolan cycle in smooth fashion and hence maximise the efficiency and effectiveness of its investment in computers and avoid to bring an out of control IS into line.

This obviously calls for enlightened and sound planning with top level management support - The Information Strategy.

A planning Model for Information Systems Strategy:

Overview of the planning Model:

This model is based on identifying a number of key areas where senior management needs to take strategic decisions regarding the objectives, management, technology and applications of information systems.

Once these strategic decisions have been made, IS management has a frame work within which information systems can be built.

The model is an evolutionary process starting from simple models for application development, to data modelling, information resource management and information requirements planning to the present.

Further evolution seems inevitable and may lead to the development of expert systems for information system strategies.

The planning model comprises four major activities:

Strategic requirements: planning, a management strategy, an application strategy and A Technology strategy.

Strategic requirement planning links the plans and strategies for information

systems with overall corporate objectives and strategies.

The management of IS activity is vitally important; strategies and policies must be formulated to define the role of people, what they should be doing and where they belong, together with the control structures that are needed.

Application strategy deals with the data and automation of the processes operating on data.

Technology strategy is concerned with the computer equipment, both hardware and software, required to support the applications strategy, given the application's specifications the technology strategy evolves a system architecture that supports the desired applications with provisions for future development.

Although the technology being intimately tied to the applications, there are number of reasons for making a distinction between the two strategies.

In part it is the convenience since the applications strategy is easier to define when the specific characteristics of the computer equipment are ignored.

All the applications strategy formulation can concentrate on the issues of business activities, processes and data.

Another reason for this distinction is to have logical design before physical design, leading to a degree of independence between the application and the technology so changes in either of the two can easier be realized.

It is also true that the application strategy is mainly internally focused when the business needs determine the information architecture, while the technology strategy primarily at least depends on the software-hardware vendors.

This means to have knowledge of things like machine characteristics and compatibility issues.

Strategic requirement planning:

These then are the fundamental components of IS strategy, strategic requirements planning is carried out first, followed by the concurrent planning of

management (management strategy, information (application strategy) and systems (technology strategy) architectures.

The strategic Requirements Plan:

It is critical that the IS strategy receives the support top

Management right from start and should reflect the overall long-term objectives and strategies of the organisation with **SRP** at the heart of it. To accomplish **SRP**, the organisation must assess its objectives and strategies, define IS mission, assess the current environment and set IS policies, objectives and strategies.

In addition there are various techniques used in formulating corporate planning.
1 - Critical success factor which we will deal with in details later.
2 - Strategy set transformation which aims to transform the overall corporate requirements or strategies into a MIS strategy set consisting of MIS system objectives and associated instructions and design approaches.

3 - Result of an assessment of the current state of information systems development in terms of Nolan cycle.

The key issue is to realise the purpose of and need for strategic requirements planning and relate information systems strategy to the new external and internal environments.

The management strategy:

People are the most important ingredient in the development implementation and maintenance of any strategy. So the policies objectives and strategies for the organisation of people within the IS function must be defined; this is to say at what level the IS manager should be reporting to, what the policies of recruitment personnel should be, should the control of IS be centralised etc.
Reporting structure. In the past DP have reported to a functional executive,

typically an accounting executive with little relationship between the two functions. The scope of the IS department needs to be defined with reference to the rapid growth of user computing.

The need for an information centre should also be examined with reference to its reporting structure.
The viability of a steering committee should also be examined both in regard to the ongoing development of information systems and the development and review of an information systems strategy.

Education : Another aspect that deserves special mention is education since the staff involved in the IS area will be dealing with new concepts much of the time and the learning curve is broken if the Nolan cycle is replaced with another cycle. Education should not only apply to the IS department but also it should to the users organisation.

The application strategy:

There are three fundamental problems arising when considering the application strategy: the identification of data and process need for the enterprise, the priority applied to the application and resource allocation and the actual development of applications on schedule. In order to deal with these problems in detail we look at information requirement analysis, resource allocation and project planning.

1 - Information requirements Analysis:

This first step is necessary because the information requirements of the enterprise must be understood before any decisions are made on computerization. The analysis of information requirements revolves around data analysis and distribution analysis.

Data analysis involves analysis of data entities and relationships might be achieved using the entity-relationships approach developed by Chen Martin enterprise

modelling techniques are useful in functional analysis, where business processes and activities are analyzed in terms of data usage and timing distribution analysis for which no formal techniques are popular, is concerned with the use of data across spatial dimensions specific techniques such as IBM's business system planning whether be and Davis Ends/Means Analysis, and Rockart's critical success factors may be appropriate.

2 - Resource Allocation:

The allocation should be considered at two levels: corporate and application.

At the corporate level an organisation has to allocate scarce resources to competing claims.
At the application level however the problem seems to be simpler by intangible associated with various categories of information and decision support system make the task difficult.

At its simplest form it is to allocate the limited resources to that system with the highest priorities. Important point here is the systematic sequencing of project development on the success of much information system depends on the full functioning of other systems as prerequisite.

Resource allocation then involves the information subsystems priorities, taking into account subsystem interdependencies as well as resources.

A further consideration is the proper mix of projects.

3 -Project Planning:

A successful application strategy ultimately depends on the implementation of the designated information subsystems without time or cost over runs. To ensure this detailed planning for each application must be undertaken.

Project planning typically involves managing the schedules of activities and specific resources. Techniques that might be used include milestone, together with PERT, critical path analysis or Gantt charts.

The Technology Strategy:

An overall view of what hardware and software is needed for an organisation to reconcile the differing needs of many applications bearing in mind the time span of the IS strategy effected among other things by the rapidly changing technology. What brands of computers will be used?

What communication standards will be popular over the next 5-10 years?

Which data management system would be more suitable for our operational area? In what way will computing power be distributed? These are examples of technology strategy issues which give rise to a need for some generic and useful model.

It is suggested that the distinctly separate and key issues of the technology strategy are data, communications, distribution and software and that strategies are required for each of them.

1 - Data Strategy:

Data should be central to the IS Strategy and its administration needs to be supported by software such as modelling systems, data dictionaries and data base management systems, with provisions for migration retrieval, manipulation and output of the data.
In terms of a specific DBMS, speed, simplicity, facility, compatibility and cost must all be suggested to arrive at the best answer to an organisation's requirements.

2 - Communication Strategy:

This is to distribute computer power from A to B. Regrettably there is no proper standard, as a result communications cannot be guaranteed across a manufacturer's product line, let alone between different manufacturers.

It is therefore vital that an organisation wide prospective be maintained, one that taken compatibility issues, both present and projected into account.

3 - Distribution Strategy:

In most cases a totally centralised computer system is infeasible and some kind of decentralising the information system architecture is needed.

There are two aspects of distributed computing: functional and geographical distribution. Functional distribution involves the dedication of computing power to a specific function.
Functional distribution: this is to dedicate computing power to a specific function.

This is the result of fall in the cost of hardware and the end result usually is more flexible system.

4 - Software Strategy:

This work should be carried out along side with the application strategy dealing with the problem of system implementation.
Resource allocation in particular, requires some estimate of cost and time required to computerise a particular application.

Also of course an organisation wide view of the processes is needed for a rational and consistent development.

A process strategy then is needed at the overall level to establish guidelines for implementing applications.

A recent survey of Australian companies suggests that the documentation backlog for computer applications was typically in excess of three years.

It seems that the major problems are being experienced by companies in their quest for computerised information system.
Clearly a rational and comprehensive attack on the problems of software development productivity is required.

One possible solution combines three broad approaches:

- The enhanced conventional Approach-Software Engineering:
This is where application development tools (ADT) and prototyping present two opportunities for enhancing productivity in the conventional environment.

Among the function of ADT, one may find test data generation, logic testing, prototype execution harness, and operational execution harness and documentation generation.

The main benefit of prototyping is achieving better quality in terms of meeting user requirements.

- The fourth generation environment:

This is where the active involvement of user for developing their applications is possible. There are number of 4 GLs capable of being understood by the business user after a day's training this first application development should cover some of the problems of backlog mentioned earlier.

- Application packages:

These are the off the shell packages which are growing in popularity and can go long way for solving software problems.

5 - Suppliers:

It is important to take suppliers into account at a strategic level.

However there is little regards in the academic literature for this topic but organisation's commitment to a supplier through the purchase of hardware and/or software has major implications.

2.3 Developing Strategy for Management Information Systems by Edwin Tozer

The key features of this model:

1-Starts with business planning process dealing with logical links and dependencies on corporate and divisional plans.

2-Is pragmatic and hence practical.

3-Combines formality and business expediency.

4-Takes account of trends in business and information planning.

5-Encourages the active use of up to date approach in the development if information systems utilising the fourth generation language by the user.

6-Follows through into the development of a complete, practical, business-orientated information system dealing with what must be done, how long it takes, and how much it is going to cost.

7-Is open with regard to extension and enhancement.

8-Has been used successfully in major corporations, continues to be used and hence is continuing to develop further.
The result of business plan are documented in the form of working model, logical derivations of which is based on the business needs and clear priorities. Once the approach has been conducted for the first time within an organisation, it can be used in subsequent cycles.

A minimum level of business direction is also an essential prerequisite to the approach to information system.

Analysis of business plans:

In order to carry out the analysis, some degree of broad acceptance of the concepts of management by objectives is expected. In the absence of this management should be encouraged to formulate business directions and goal statements. Should this approach be in line with Rockart, then the start up task is considerably simplified.

The degree of formality to carry out this process varies from organisations to organisations but the key to success in information systems is that the real business plans, priorities and information needs must be identified and understood by the information systems planners.

Impact of Competition Pressures:

The increasing rate of change in business climate and competition combined with reduced margins has meant that corporate planning has had to become far more tuned and responsive. Usually response time needed to react to market changes or competition pressures is very short, sometimes less than the time it takes to develop new support systems. So the pressure grows for better planning and decision making.

Traditionally good managers have always been able to respond to market pressures working mostly by "feel" and limited information but if using more formal and complete information leads to better decisions then the evolutionary process will favour those companies who have more complete and looked after information services.

Information systems contributing to company objectives and goals:

A common response to change in market conditions is to launch a new product. This means the need for rapidly developed service and support systems for it. If the new product is to be successful, the support system needs to become as efficient as possible.

During the life of a product the emphasis on operational systems support changes from rapid introduction to efficient low cost running.

A valuable way of classifying information systems is on the basis of the nature of

the contribution made to the business. At the least ambitious level, service and support systems contribute to efficiency resulting to conduct business at lower cost, thus offering the choice of greater profitability or increased competitiveness in pricing.

At the next level the contribution: The way for effectiveness to do things better e.g. giving a better, faster service to customers thus improving the business.

The third level in this contribution-based classification is where the information systems are able to make a proactive contribution to business development for competitive advantage.
These "Decision Support" systems are discussed below.

Lastly we are seeing growing number cases where the very products or delivery channels for the business are wholly dependent on innovative use of information technology.

For the reasons discussed before it is so important that approach to the information systems development is geared to the business and priorities. Without this there is no basis for determining what systems should be developed or how fast as a result of which significant opportunities may be lost.

The past failure of information development:

In spite of the fact that many organisations have had successful information systems developed the track record in systems development has created credibility. Problems and management are entitled to ask frequently "why should we think we can get it right this time?"

Some examples of common problems are:
-Despite growing lost of IS development some senior managers are disillusioned with quality, time lines and accuracy of system delivered.

- It takes too long to develop a system making it out of date often when they are delivered and hence fail to meet the end users real need when they are installed.
- Buying more technology without paying enough attention to the key prerequisites. This is more apparent with lack of ability to utilise the fourth generation languages developing inappropriate applications.

- Desperate end users can "Strike Lucky" and find the developed
System is exactly what they want without being selective in their approach but this may be followed by doomed attempts to use the same approach for developing larger, inappropriate projects.

The role of decision support system:

Decision support systems are those applications which provide basis for improved management decision making.
Objective is to improve the speed and quality of senior and middle management decision making, through provision of better information up-to-date, at the right time, in the right format.

Approach: to have provisions of more interactive, more flexible planning and analysis facilities, this provides access to:

* Up-to-date, integrated operational database.
* External information sources.
* The result of previous actions by the user.

Characteristics: Ability to formulate new requests in response to results of previous query and ability to handle less structured problems.

Overview of the practical approach:

Business needs should be specified by businessmen so must business solutions to business problems. Management should specify their information needs and priorities. This should get the information systems division out of the firing lines for business case development and prioritization. It avoids many of the problems made in the past, where the DP department having devised solutions to apparent problem, then attempt to sell them to unreceptive and uncommitted users.

Links to the business planning cycle:

A good information system plan is essentially linked to the business planning cycle. This is a two way link in that changes in business direction or priority must be reflected quickly to review the existing information system, but also new decision

support systems may provide valuable planning assistance for future business cycles.

In the extreme, we may see "technology push" from information systems, e.g. electronic fund transfers influencing the choice of new product or new market directions.

The information system plan must be practical and feasible with evolving nature moving the business from its current status to the desired goals.

The feasibility and costs of information systems development will depend on specific technical developments and therefore should be supported by a fully worked out technology plan. Planning is not a one off process and should be basis of future actions and plans so the system should be maintainable.

Lack of formal techniques for analysis business plans:

Approaches at the business level sometimes lack in rigour giving way to excessive subjectivity usually associated with the so called business judgement in setting information objectives and priorities.

Excessive detail in analysis:

It is common fault that approaches based on structured analysis/design techniques have little or no guidelines as to where to stop. The techniques can lead to endless analysis with little sense of direction. The techniques may be of an immense value when used with judgement.

Limited applicability due to dependence/insistence upon specific techniques: whenever approaches are based on highly specific techniques, the result may just be right for those companies where the techniques are in favour. In most other cases they disqualify themselves.

Key features of this approach:
Objectives: to produce information systems plan which reflects the business information needs and priorities and which form a basis for future evolution.

Scope:

The approach starts with the business planning process, and makes clear the logical links with the dependencies on corporate and divisional business plans. It covers all aspects of business information, service and support needs.

It sets applications development priorities, and develops technical, skills and organizational strategies needed to support the information systems development and operation. All classes of application are covered, including office automation and voice and data communications.

It follows through into the development of a complete, practical, business-orientated information systems plan encompassing a definition of what must be done, along with estimates of costs, time scales, organisation needs and skill/resource requirements.

Style:

The approach is pragmatic, in recognizing great variation in the level of detail and formality normally found in corporate plans, and also in being oriented to delivering a practical, approximate plan within a reasonably short time scale.

It tempers formality with business expediency, in that it is recognized that there is a level of planning, varying by industry and management style, beyond which it is not worthwhile to proceed.

Because of the concentration of priorities and critical success factors, it is possible to conduct the study within a limited time scale, and also to select an appropriate trade-off between precision/detail and business expediency/urgency, according to prevailing need.

Techniques:

The method recognizes and takes practical account of contemporary planning (for example the work of Alloway, and of Rockart at the Sloan School of Management). It positively encourages the active use of up to date approaches to information

systems development, typified by the terms "end-user computing, "fourth-generation language" and "rapid development".

It is "open" with regard to extension/enhancement of the techniques embodied, and specifically avoids taking a doctrinaire stance over details of the methodology to be followed.

Time scale and resource needs:

The approach is economical in its use of management resources, and can lead to a reasonably short development time scale, because of the "rifle bullet" approach to business priorities. The planners are strongly encouraged to keep their eye on the strategic priorities, and to ignore detail which is not material at the strategic level.

Proven ness:

It has been used successfully in major corporations over a period of 5 years. It continues to be used, and in consequence is continuing to develop.

Visibility and reproducibility:

The results of the planning cycle are documented in the form of a working model, in which the logical derivations of the planning outputs based on stated business needs and priorities are clear.
This facilitates communication with the senior management control group during the study helping, to foster and maintain confidence.

It also permits subsequent review in the light of changed business plans or priorities, enabling it to be determined whether the plan needs to be revised on an exception basis.

The four main phases are:

Phase 1: Determine business information needs:

This analysis usually takes place in series of senior management interviews which are conducted according to a predefined format and goes through the stages of

functional objectives, critical success factors, control information and other quantities means for determining the successful critical success factors leading to a definition of specific information needs.

The product of this phase is a statement of the business requirements and priorities which will form the rational for the information systems needs and a clear functional definition of the business structure.

Phase 2: Development of conceptual architecture for systems and data:

Here the result of analysis of the business information needs from the first phase is used to produce clear architectural statements for application systems and associated conceptual databases.

Information architecture:

This is the information view of a business which is independent of any computing, data handling, any procedures or systems. This should represent the type of things which the business might keep data about (entity classes) and the inherent business processes in which the entity classes are involved and hence which may use Data.

The information architecture is the foundation upon which all the more detailed analysis and eventual construction must be based, if information systems are really to model the business and respond readily to changes requirements.

Business systems architecture:

This outlines the future computer and clerical systems needed to support the business and the dependencies between these systems.
This also outlines the subject data bases that will be maintained by, and shared between these business systems. Each entity class in the information architecture is represented in some database and each business function may be supported by one or more systems.

The difference between business architecture and information architecture is that with business architecture the emphasis is on what the systems will do and how the data will be organised, rather than on what the business is about and what data is used.

The resulting product is a re-statement of the information architecture of the business showing the data and the processes involved in more detail.

Phase 3: Determine key priorities and systems grouping:

Products of this plan are:

1 To define urgent actions required for example to stop a particular project or to start a project with higher priority.

2 To prioritize the information needs and application processes identified in phase 2

3 To draw up a statement of direction and the technical architecture for computer hardware and software, communications, management support work stations and other IT items.

4. Technical Architecture:

In this phase with the third architecture we consider hardware software and other technological issues.

This architecture should also address the issues such as the degree of data distribution and business system, the role of automation and data processing facilities etc.

Phase 4 - Migration Strategy:

The final detail deliverables are the plans for achieving systems outlined with architectures.

The plans outline the sequence of development of business systems and subject data basis. Some attention should be also given to the acquisition of the components of the technical architecture.

The migration Strategy Product includes:

1. Overall business system development plan:

How the applications plans should be grouped into systems projects and the implementation sequence and resourcing.

2. Technical plan:

Precisely what technical developments should be carried out and in what sequence with definition of the factors affecting the plan.

3. Organizational plan:

What are the functional requirements to support the system and indication of how these functions should be grouped organizationally?

Accompanying these products there should be a cost benefit analysis of the overall plan showing the resource profile and how the benefits are to be achieved.

2.4 System Development Methodology by JAMES MARTIN

Under the leadership of its Chairman, James Martin, James Martin Associates (JMA) is developing and deploying leading edge technology in the field edge technology in the field of systems development methodology.

The JMA methodology has been structured by considering the parallel world of engineering disciplines where major projects are undertaken, designed by a small group of specialists and users, and given pictorial presentation in order that anyone

with a basic, but generally semi-skilled, ability can take part in the construction techniques.

To reflect this approach the methodology has been named "Information Engineering".

The major benefit to an enterprise of Information Engineering is that it views the main problem to be the provision of information, rather than the construction of computer software.
To the businessman it means Data processing people will be addressing the business problem in a way that is intelligible and can be monitored from a business perspective.

Fourth Generation Systems:

The New Revolution:

Horizons in technology continue to recede rapidly before us.

The revolution is thrust upon us by the market place. The enormous computing capacity available, both processing power and storage, is being taken up because of changing patterns of cost and style in the information systems environment.

The cost of technology is declining rapidly in all key areas. On the other hand, people and paper are becoming more expensive. The key to maintaining a balance is to replace the paper and make the people more effective.

This is being done by harnessing the vast new technical capacity; using it both to support new business areas and to bring together others that previously were limited by their systems being designed individually. The result is the fourth generation.

The fourth generation style is to organize data such that information is available and shareable throughout the organization. Many technologies may be used to provide this capability wherever it is needed - relational databases, distributed data, text handling systems, and data communications networks to name but four.

The New Orientation:

The fourth generation provides a new orientation in information systems. Now the emphasis is genuinely on the business and the user, rather than on technical details.

Business orientation is possible because of new approaches to system development. These emphasize the need to have systems which model the business and support its overall objectives.
They concentrate first on understanding the business, by analyzing the inherent business processes and types of things with which they are involved.

Then the user's immediate requirements are expressed in business terms. Progressively, these users may build their own systems. This revolution in computer usage is essential to the fourth generation.

The vast production of micro-processors can only be sold if they can be put to work without professional programmers.

The major features of fourth generation systems environment may be summarized as follows:

1 - **Features of the Fourth Generation:**

* Convergence of Technology:

The integration of voice and data communications, data processing, office automation, records management, robotics and process control; in fact all technologies based on electronics and digitisation.

* Data Sharing:

The availability of a pool of common data which can be used for operational and information purposes for all functions of the enterprise.

* Business Systems:

Systems that model the business closely, rather than constraining their users.

* Distribution:

The placing of data and processing capacity it is required.

*** Interaction:**

The ability of people and machines to communicate freely throughout the enterprise.

* Automation:

Automation of the design and construction of systems through prototyping and code generation.

* User construction:

End Users building their own systems.

The New Tools:

Software tools are beginning to appear which directly support the concepts and objectives of James Martin Associates. Using fourth generation technology, systems can be built which model the business, and as such are responsive to changes in the business.
These tools correctly applied, can make a great contribution to systems quality and development productivity.

User orientation is emphasized in the new system development approaches. The users can take responsibility for the nature of their systems by making direct use of the power of the new technology. They can be directly involved with fourth generation software - end user languages, system generators and prototyping tools.

For a language to warrant the term "Fourth Generation" it should have the following characteristics:

2 - Characteristics of a Fourth Generation Language:

* Coding and testing can be completed in very much less time than with COBOL or PL/1.

* It avoids the needs to code technical details of no relevance to the user.

* A non-professional programmer can obtain results with it.

* Non-procedural code is used where possible.

* It makes intelligent default assumptions about what the user wants, where possible.

* It is designed for on-line operations.

* It employs a database management system directly.

* It enforces or encourages structured code.

* It is easy to understand and maintain another person's code.

End User Languages were created for two main reasons:

* So that non-programmers could obtain results from computers.

* To speed up the programming process greatly.

System Generators, in skilled hands, can be used to create complex systems based on business analysis and straightforward design without explicit program coding.

Prototyping Tools are a further aid to productivity. They speed up the design process by allowing poorly defined or dynamic business processes to be understood, and by ensuring that the end user has a clear understanding of the systems being developed.

The essential feature of all these tools is productivity. They alter the nature of the development process and allow systems to be produced more accurately and more rapidly, both for stand alone applications and within a shared data

environment.

The Fifth Generation:

The fourth generation is not just a concept; its technology, tools and effects on our way of working are here today. It is also well accepted that a clear vision already exists of the fifth generation.

Japanese plans for this new, knowledge-based architecture are defined and its development has started.

The fifth generation is directed towards inference and problem solving. Thus, while fourth generation tools and techniques are allowing the problems of operational and tactical systems to be dealt with today, future generations of engineered information systems will revolutionize strategic and decision support functions by including "intelligent" database capabilities.

INFORMATION ENGINEERING:

The Challenge:

The challenge is to tap the potential of fourth generation technology rapidly and effectively. A full contribution to corporate success must be squeezed from the data resources by making them available to all entitled to extract information from them.

In responding to this challenge, key questions must be answered:
How can you plan an effective information systems strategy which is linked to your business planning cycle?

* How can you ensure that the implementation of the strategy will produce the required benefits?

* How can you surmount the difficulties currently experienced in adapting existing systems to changing environments and in overcoming the crippling maintenance backlog?

* How can you assess the technologies, products and tools that will lead to successful introduction of integrated systems within you overall strategy?

Failure to obtain maximum benefits by harnessing the new technology will seriously affect the ability of any enterprise to maintain its edge - or even to survive - in today's increasingly competitive market place.

The Answer:

Information Engineering is the term used to describe the set of inter-related disciplines which are needed to build effective business systems.

Information Engineering takes as its basic premise the fact that it is data that lies at the centre of information processing. It has often been demonstrated that the inherent data structure of any business is relatively stable, whereas its procedures tend to change.

Therefore, with correctly supplied data-oriented development techniques, we can succeed where the procedure-oriented techniques of the past have failed.

Many of the procedure-oriented techniques have resulted in systems which have been slow to implement and difficult to change. Information Engineering seeks to provide the means to rapidly fulfil management's changing needs for information.

It establishes the necessary infrastructure which can provide results quickly and it enables the creation of effective systems which are resilient to change.

Moreover, because it provides a complete framework for managing the development effort, costs are firmly controlled.

The Reasons for Success:

Information Engineering succeeds for four mains reasons:
* Systems stem from the strategies or business plan of the enterprise.

* It is highly user oriented, initially involving senior management and other end

users at more detailed stages in the development process. It relies on clear diagrammatic techniques to provide easy communication of business analysis and systems design.

* It consists of a comprehensive series of stages each serving a clearly defined purpose and each serving the needs of subsequent stages. The stages have well specified tasks allowing systems development to be readily managed and controlled.

* It uses the most advanced and proven techniques for analysis and design and supports them with software aids to ensure that systems development proceeds rapidly and accurately.

Information Engineering has evolved through practical use in a wide variety of business and technical environments over the past ten years. It remains pre-eminent as the Fourth Generation Methodology.

3 Criteria for a Fourth Generation Methodology:

* Clear delineation between application oriented tasks, data oriented tasks, and those viewing data and applications together.

* Separation of design from analysis, to provide flexibility for business and technological changes.

* Emphasis on a development strategy rather than on ad-hoc problem solving.

* Based on a development plan which allows for both user priorities and logical constraints.

* As great an effort is put into analysis of the business, as into the design and construction of computer systems.
* A clear distinction is made between user-oriented tasks, when full user involvement is expected, and technical tasks, when little user involvement is expected.

* Tasks at each stage progress from the general to the
Particular - it is largely top down.

* Each stage in the systems life cycle provides a firm and complete foundation for the next stage, while permitting iterations within each stage.

* Provision of tool kit from which to select the most suitable techniques.

* Reliance on diagrammatic technique and standard forms, rather than on narrative specifications.

* Automated support of routine tasks, including documentation, diagram drawing and program coding.

* Complete independence from any particular software, hardware or systems considerations.

SYSTEMS DEVELOPMENT BY INFORMATION ENGINEERING:

Key Features:

Successful development of enterprise-wide systems by capitalizing on fourth generation capabilities depends on clarity of purpose and execution. It thus requires a coherent methodology to give a complete framework for the development effort.

Information Engineering uses formal disciplines with precise, well thought-out techniques to provide this framework, and focuses on:

* Planning
- To ensure that the enterprise gets the systems it needs to satisfy its business priorities.

* Data-centred Development
- For shareable business information systems, eliminating duplication of effort in collecting and maintaining data.

* Techniques

- To provide a disciplined means for carrying out the analysis and design tasks.

* User involvement

- To guarantee usable systems and allow users to construct their own systems where appropriate.

* Automation of the Methodology

- To improve productivity in systems development.

The Stages for Project Management:

Information Engineering works by separating the development cycle into carefully defined, practical stages. Each stage consists of a number of cohesive tasks, each serving a single purpose and delivering clearly defined products.

The result is a de-mystified approach where all activities are visible. A consequence is that it is easy to identify points where systems development can be improved, be given automated support, or make use of the best productivity aids.

The stages of Information Engineering:

Information strategy planning:

Information Strategy Planning results in the underlying rationale for information systems needs and from them, aspects of three architectures are derived:

1 The information architecture of the business, expresses as subject areas, business functions and their interactions.

2 A business systems architecture proposed to meet the information needs.

3 A statement of direction for the technical architecture in terms of computer hardware, software and communications.

The strategy includes an outline benefit analysis and specific plans for the transition from the existing systems. A plan for systems development is prepared, including work programmes for high-priority projects.

Once the plan is complete, remaining issues should not be material to the strategic direction, i.e. are unlikely to change the strategic plans. The results should therefore be reasonably insensitive to the perceivable range of changes in business and technical plans, volumes and costs.

Business Area Analysis:

For an identified business area within the scope of the information systems development strategy, a detailed study is carried out of its data, its business functions and the information required fulfilling those functions.

This leads to identification of entity types and of the specific business processes and their information inputs and outputs.

These are analysed in detail and their names, interactions, meanings, quantities, rules and business algorithms documented. An important feature is the maximum involvement of end users in the specifications of requirements, priorities ad facilities.
From this information, a detailed statement of the business requirement for information systems in the business area is produced.

By the end of business area analysis a business area description has been prepared, showing the processes performed in the area and the entity types, relationships and attributes found in the area, together with their usage patterns in the business processes.

The properties of all these objects are documented. They provide greater detail for the information architecture and indicate information needs and priorities within the business area.
From these details it is possible to identify the broad nature of likely computer support required for business processes; to define the scope of one or more design areas within which business systems can be designed; to prepare a work program and resource estimates for the design areas.

All the information is present about the business and its users' requirements, which is necessary to select particular business processes for computer support and to design the computer systems and the data structures needed to give that support. The only discussions with users in the subsequent stage should concern the design of user interfaces.

Business System Design:

For the whole or a major part of the business area analysed, the facts gathered during analysis are used to design a system to meet the identified business requirements. The design includes all those parts of the system directly relevant to its users including transactions, dialogues and controls.

It is kept as independent as possible of the technology to be employed in implementation. Prototyping techniques, using fourth generation languages, may be used to replace many of the tasks traditionally gone through in this stage.

An important objective of this stage is that it should complete the system design to the extent possible without pre-judging technical issues. It is heavily user oriented and requires agreement of the users on the ways in which they will interact with the system.

The final product from business system is a business system specification showing, for each business process, the consolidated documentation of information flows and user procedures and for each computer processes, the dialogue design. screens, reports and other user interfaces and adjustments to the data usage patterns.

From this, a detailed scoping of the intended computer systems is prepared together with a work programme and resource estimates for the next stage.

A key technique in this stage involves representing the logic and data usage of procedures in the form of structured action diagrams. These can be translated directly into fourth generation language statements.

Once this is done, all aspects of the system which relate directly to the user should be defined and stable, and sufficient information should exist to finalise

estimates for, and to complete, technical design.

Technical Design:

For the computerised aspects of the business systems specified, the facts gathered during analysis are used to design those parts of the system which are dependent upon the computer technical environment.

This is carried out in sufficient detail for construction and operation to be adequately costed. This design includes data storage structures, computer programs, operational procedures and interfaces.

The level of detail in the design is dependent upon the selection of implementation vehicle, e.g. system generators have much of the technical structure predefined.

The aims during this stage are to define effective computer systems to support the selected business processes and to develop good (+20%) estimates of costs and timescales for construction and transition in terms of manpower and computer equipment.

The end result of technical design is a technical specification containing database designs, procedure designs in the form of action diagrams, and the technology dependent details of the system design.

These include batch runs, finalised conversation flows and definition of programming work units.

The specification also includes the technical architecture and standards employed by the system - the hardware and software environment selected its mode of use and specific standards and conventions proposed.

Finally it identifies the content of the construction and transition stages and gives a work programme and resource estimates for these stages.

This technical specification provides a stable design which meets the functional and performance objectives and is insensitive to likely business and technical changes.

Construction:

For each phase identified during design, a system is put together. This includes installation of equipment, establishing files, setting up procedures and specifying, coding and testing programs.

The aim in the construction stage is to develop a system, as defined in the technical specification, which meets the targets of timescale and budget, is of an acceptable quality, and which contains all necessary operating and user procedures.

This stage can be regarded as complete once the defined acceptance criteria for the application are met satisfactorily.

Transition:

Transition is the phased replacement of existing procedures and files with the new system and data structures.

It is governed by the transition plan, including a work programme and resource estimates, which is normally finalised in parallel within the construction phase, although it is not really dependent on the outcome.

Transition can be regarded as successful when the system operates for a specified period within defined tolerances as regards performance, error rate and usability, and passes its post-implementation review.

Production:

Production is the successful operation of the system, with tuning and modification as necessary, until eventually the transition stage in some other project replaces the systems built in this project.

The main objectives during production are to maintain service levels and functional performance during the lifetime of the system and to respond promptly and effectively to changes in business requirement

Alternative Staging:

Not all systems require such a rigorous development path.
Systems built by users to meet their personal needs; systems to support decision making where the accent is on flexibility; systems geared to ad-hoc retrievals from available databases; these need not be of the quality expected of high volume, fast response or widely shared systems.

Although key aspects of all Information Engineering stages apply to the development of all systems, short cuts may be taken and the stages may not always be so clearly delineated.

Thus Information Engineering can well be regarded as a collection of building blocks, some of which have more stable foundations than others, but all of which are built from the architectures established during Information Strategy Planning.

Techniques:

Information Engineering provides far more than merely checklists of tasks and deliverables. The emphasis is very much on the "how" of developing systems rather than the "what has to be done".

Information Engineering is in effect a tool kit from which appropriate techniques can be selected by the analyst and designer.

The most widely used techniques rely heavily on diagrams. The Information Engineering conventions enable diagrams to provide a far more rigorous specification of both the business and its systems than any prose description.

They provide a sound means of system verification and of communication between the project team members and the users.

THE AUTOMATION OF SYSTEMS DEVELOPMENT:

The Information Engineering:

Information Engineering is already supported by a variety of software aids automating specific tasks and techniques.
Eventually analysts and designers will use an automated facility to support the full development cycle. The Information Engineer capabilities will include:

* Information Strategy Planning

- By recording the results of investigations;

- Displaying matrices to illustrate and compare current and possible scenarios;

- Computing suggestions as to areas for automation.

* Business Area Analysis

- By handling graphical input and ensuring that it follows guidelines and is consistent with other encyclopaedia contents;

- Providing views of data and business processes consistent with user's views;

- Validating and recording observations on the interactions between the information systems' components;

- Identifying logical groupings of components and boundaries for systems.

* Business Systems Design and Technical Design

- Adding the user's needs and work patterns to the analysis;

- Incorporating technological requirements, such as dialogue design;

- Designing likely database structures.

* Construction

- Supporting prototyping tools or feeding system generators.

* Project Management

- Confirming task status;

- Verifying the completeness of results;

- Estimating and measuring progress.

The Encyclopaedia:

At the heart of any automation of systems development there lays a source of information. This is the reference point for all decisions; the baseline for progress and change control; the basis for all documentation.

This is the function of the Encyclopaedia, the database to support Information Engineering. It is used to record results from planning, details from analysis, and decisions from design. It provides the input needed to drive the systems generators.
The information it contains covers the interest of every person involved in the development cycle.

Prototyping:

Prototyping tools are used primarily to supplement Business System Design by supporting direct interaction with the user. A usable version of the system is produced very rapidly and can be modified on-line during discussion with the user.

These tools may also be used to investigate "fuzzy"; business processes which are very dynamic or informal. Instead of analyzing them, the prototype simulates them. The analyst can then check what the prototype does with the user.

System Generation:

System generators replace the construction stage of development by generating complete systems composed of well-structured, executable code. They are usually

driven by the products of technical design.

Current development efforts are producing more sophisticated tools capable of taking the results of business system design and inferring a reasonable system design.

A systems generator should be driven by the contents of the Encyclopaedia, built up by other components in what JMA has called the Information Engineer.

Application System Packages:

Often the most productive way to implement a new system is to use an off-the-shelf package. The decision to use an application system package may well be taken as a result of information strategy planning.

More often, the decision is made following business area analysis when it is possible to specify the requirement precisely.
Knowing the nature of the data and processes which need to be supported, a package can be selected which matches the requirement accurately.

Many packages require tailoring, especially of the user interface. In these instances a certain amount of business system design is required before they can be used. In extreme cases a choice may be made which requires that portions of the package be restyled or rewritten to suit the technical environment: however, this not recommended.

BENEFITS:

The case for Information Engineering differs from organisation to organisation. Clearly no business can continue to build its systems solely with the methods of the past. The problems of the maintenance of obsolete systems and the failure to keep up with the business needs can only worsen.

Reasons companies have cited for adopting Information Engineering include:

Productivity:

Automation is the outstanding of fourth generation systems development. It applies to the construction of systems, but also to the earlier stages in the development cycle. This emphasis on automation, using the most up-to-date tools, brings major benefits in productivity through both acceleration of the development cycle and more applicable systems.

Real Business Systems:

Planning, based on business objectives and user priorities, followed by analysis, carried out comprehensively in defined business areas, given an accurate view of everything that matters to the company.

From this the core elements can be separated out from local elements. Investment decisions can then be based on this separation.

This approach leads to clear identification of infrastructure systems crucial to the whole business.

It also shows users where they can build their own systems to improve local effectiveness, without conflicting with corporate aims.

User Responsibility:

Information Engineering subdivides the development cycle in a practical fashion. It shows exactly where the users should become involved to be most effective and what the objectives are for their involvement.

It emphasizes business modelling and the use of clear graphical techniques, so allowing users to specify the nature of their views precisely.

They can then assume responsibility for making sure that the systems produced do match their views. They can also make sound decisions on when to build systems themselves.

Control:

The structure of the Information Engineering development cycle ensures that project progress can readily be monitored and controlled. Information Strategy Planning and Business Area Analysis do much more.

The Information systems strategy guarantees the relevance of the whole development programme to the business and ensures that the strategy will persist.

The analysis leads to a full information architecture which serves as the framework to control the integration of systems and ensure the shareability of information.

Quality :

The planning and analysis techniques allow an unprecedented amount of completeness and consistency checking. They also extend to cover future requirements through stability and extensibility checking.

The staged Information Engineering specifications lead to correct systems which will incur a very low level of maintenance overhead. Combined with system generators, the resulting system is of a very high level of quality.

Personal Development:

Information Engineering represents a unique opportunity to participate in using a leading-edge methodology. Skills can be developed in many areas:

* planning an information strategy

* Rigorous analysis and sound data modelling

* Communication and understanding users' problems

* Prototyping for good human-factoring of systems

* using fourth generation languages for creative system building

* Rigorous specification to produce bug-free systems

* Administration of the information, business systems and technical architectures

* Support of analysis, design and construction by advanced software aids.

THE WAY AHEAD:

Users want more systems than today's information systems specialists can deliver. The backlog is often blamed on a shortage of trained staff. This paints a wholly false picture based on an assumption that computer systems can be programmed only by unusually skilled staff. The boom in home-micro sales gives the lie to this assumption.

The missing elements are the tools to bring development into the hands of the users, and the methodology to establish architectures which show these users where to direct their efforts.

Tools are being brought rapidly to the market and information engineering provides the methodology. Together these bring about changes to the character, appearance and image of data processing in an enterprise.

The new image is one in which the information systems organisation has carried out Information Strategy planning and detailed entity and function analysis to give information and system architectures for the enterprises. It has also made the key infrastructural components for use in building new systems.

The Advanced Development Centre:

Many enterprises are establishing Advanced Development Centres to evaluate the products of the new technology and guide Information Systems Departments in introducing them.

They try out the Information Engineering methodology, prototyping tools, system

generators and other software on pilot projects. They are then able to provide guidance, training and reference materials to all system developers.

A team of specialists with a wealth of successful Information Engineering experience is then on hand to help the remainder of the enterprise succeed in introducing the new technologies.

The Information Centre:

Many Information Systems organisations operate an information centre designed to give users the maximum help in finding the information they need, processing it or reformatting it to their requirements and generating procedures and reports. It handles many kinds of short-term user requirements.

With the power of its end user languages and personal computing facilities, it can produce solutions to information problems very quickly. If the data exist and is well organised, it can be tapped by the Information Centre.

Training:

The Information Engineering programme puts a special emphasis on training, so that users and system development staff can quickly become fully familiarized with the concepts and techniques.

Three levels of training are advisable and can be provided by James Martin Associates.

* Seminars

Short duration to introduce users and the support staff to the central ideas of the methodology and its main stages.

* Orientations

To provide a factual foundation for those about to move through the detailed training and for managers responsible for projects where the methodology will be used.

* Workshops

Giving practical experience of using the techniques and demonstrating how they inter-relate: workshops are for analysts and designers who will use the techniques.

They are structured in terms of the stages in the development cycle and by principal tasks within stages. Training can therefore be given exactly when it is needed and to whom can best profit.

All training is backed up by supporting manuals detailing the major messages and filing in background.

The New Role for the DP Professional:

Many DP representatives have become consultants, helpers and instructors to the end users. Systems analysts work interactively with the end users to create their applications; almost all data is on-line; almost all users who need computing have access to terminals.

The systems analysts create prototypes of applications interactively, charting complex procedures with action diagrams which they can convert directly into code with fourth generation languages.

DP creates the databases, networks and the infrastructure systems necessary to support this activity.

End users of many types throughout the corporation are inventing ways of using computers to improve their own productivity and are constantly adjusting their own applications.

This is the ideal image of computing. It uses support facilities created by DP which enable everything to happen within a managed framework; it uses today's software, which makes it practical for many end users to do their own application generation.

The resulting improvements on relevance and productivity are what engineering is

all about.

2.5 FOUNDATION; A Productivity Tool by Arthur Andersen

This method comes in form a of comprehensive, well tested productivity tool from a well established business consultant.

Arthur Andersen's reputation as a trusted business advisor led them naturally into automated business systems. They pioneered in the use of information systems with the first business application installation for General Electric in 1954. And their development work led to the release of the first commercial data dictionary and code generator in 1972.

Today, Arthur Andersen's consulting practice is one of the largest of its kind in the world.

For more than a decade, they have been building custom integrated environments for their clients. The advanced testing facilities, structured architecture and standards they developed for their client work created the base for FOUNDATION.

They believe when you invest in FOUNDATION, you get more than just another productivity tool. You get the testing, the training, and the personnel of the Arthur Andersen Worldwide Organization.

Their ongoing research and development will provide the new functions or advanced features you need to keep on enhancing productivity.

WHY IS INTEGRATION IMPORTANT?

When your business is information services, you rely on the most comprehensive software and the latest hardware available to meet your business needs.

But when it comes to systems development, the multitude of single-function productivity tools available to you may provide short-term solutions, but often at the expense of creating even greater problems down the road. Redundancies,

incompatible functions, and multiple languages.

How can you increase productivity if the tools you have to work with are incompatible?

The answer is: you can't. Not without an integrated environment for software engineering, the kind of environment you find using FOUNDATION.

FOUNDATION covers the entire systems development process. With it, you eliminate the redundancies, the incompatible functions, and the multiple languages that are unavoidable with single-function tools.

FOUNDATION offers you the consistency you cannot achieve with a disparate collection of development tools. And greater consistency means greater control. Developers are free to spend more time working on creative solutions to business problems because they need to spend less time on the mundane problems associated with making unlike components together.

WHAT is FOUNDATION?

The FOUNDATION environment was developed to work as a single unit composed of three components: METHOD/ for project management, DESIGN/ for planning and design, and INSTALL/ for implementation and support. While each component can stand alone, the highest productivity is achieved when all three components are used in concert.

Every systems developer faces a unique set of challenges. But, for those who tackle the project equipped with integrated software engineering systems from Arthur Andersen, they believe the results can be dramatic. The improved productivity delivered by truly integrated systems makes the difference.

For example, one of their clients from the government sector set out to totally replace all business applications for a large pension system. The project called for replacing an outdated information system including more than 21,000
Programs, many of them in obsolete languages.

How did integrated software engineering systems from Arthur Andersen boost productivity for this client? By using a predecessor in INSTALL/1, programmers

and analysts with no previous CICS or DB2 experience were able to perform most development activities.

The system they produced supports more than 400 on-line users with a standardized, consistent approach to user interface across functional areas of the system. But, just as important, the entire project required an average of only 20 hours per module to complete. And that translates to enhanced productivity in terms of time, cost and efficiency...not to mention a system that performs for all 400 users.

Another example of how they go about enhancing their clients' productivity involved a large public refrigeration company.
Their project called for designing and completing software development for order processing, inventory control and warehouse operations.

By approaching the project using components of FOUNDATION, the coding and testing phases were completed in 30% less time than originally anticipated. The entire project involved more than 7,000 workdays and was completed in one year, start to finish.

BUILDING ON FOUNDATION:

The information executives who look beyond quick-fix solutions to systems development are those who are making major contributions to their organizations' productivity and to the productivity of their departments. And, by using integrated software technology to its fullest advantage, those goals of enhanced productivity in systems design are easier to reach.

If you see a place for increased productivity in your systems development program, and integrated environment for software engineering is a step in the right direction.

FOUNDATION can help you take those steps the right way:

FOUNDATION can give you the features you need to increase systems development productivity to new levels. These include:

Full life cycle methodology:

Based on 30 years of systems development experience, this methodology provides a framework for developing complete systems.

Project management:

FOUNDATION gives you the tools for effective management of you systems development effort.

Diagramming tools:

These are the workhorses used by systems analysts to enhance the conceptual integrity of the systems design. They also improve the communication of the design concept among the users and the team.

Screen and report painters:

These components help the developer define layouts, validation and editing requirements.

Prototyping:

This feature will help you demonstrate proposed screen layouts and dialogs for end-uses.

Checking and analysis:

This feature checks design information as it is entered and analyzes the finished design for consistency and completeness.

Dictionary and reports:

The FOUNDATION dictionary contains information about the system's entities, including screens, programs, etc. It was built using relational technology with a strong, flexible reporting facility. Once information is entered, it is made available

to all FOUNDATION users and consistently used by all FOUNDATION components.

Code generation:

Screen handling and dialog control logic are generated from dictionary resident, high-level, non-procedural specifications. Other features facilitate program generation. A complete file maintenance conversation may be generated from screen and database definitions.

Test data management:

FOUNDATION lets you manage test data as an asset by providing symbolic entry and maintenance, version control and isolation of versions by programmer or team.

Productions systems support/configuration management:

Their dictionary provides the mechanism to analyze the impact of proposed maintenance changes and to control the movement of programs, etc., between productions and development environments.

METHOD/1
METHOD/1: THE PROJECT MANAGER'S AUTOMATED ASSISTANT:

METHOD/1 is Arthur Andersen's structured, highly automated systems development methodology, offering an approach to building quality systems that meet you business strategies.

METHOD/1 has brought improved productivity, communication, and information control to hundreds of information executives around the world. Beyond that, METHOD/1 provides the framework upon which Arthur Andersen's DESIGN/1 and INSTALL/1 are built, thus forming FOUNDATION, the only computer integrated systems development environment designed especially for DB2 users.

With METHOD/1, your approach to systems development begins by focusing on the overall business objectives.
You are not presented with a generic methodology that is too broad to address your specific problems. Nor are you limited by a rigid methodology. Instead,

METHOD/1 encompasses solutions to all your information problems and extends to the support of production systems.

METHOD/1 IS VERSATILE:

By design, METHOD/1 can change as information processing technology changes. The methodology is not locked into a particular development path of confined by structured techniques. Instead, it helps you build on previous successes, while taking full advantage of new approaches.

METHOD/1 will continue to evolve with new development methods and technologies by adopting and implementing improved techniques and adjusting them to the standards of your organization.

METHOD/1 PUTS YOU IN CONTROL:

With METHOD/1, you can achieve the most visible measure of successful systems development project-satisfied users.

The methodology's proven approach helps you plan, schedule and scope projects accurately. Well-defined user requirements and deliverables, active management involvement, and predetermined checkpoints allow the project's scope to be properly controlled-so you can complete the work on time, within budget, and in accordance with user requirements.

METHOD/1 COMMUNICATES:

METHOD/1's success relies on clear channels of communication. The methodology, therefore, defines specific roles and responsibilities to encourage meaningful interaction among project team members.

FUNCTIONS AND FEATURES:

METHOD/1 work plan facility only extracts those activities that are relevant to a project.
This information is stored as a new work plan data base, including all related documents, supplementary information, and management guidance.

Managers can use this information to develop project schedules by skill class or individual team member, then measure progress by team member, project, or deliverable. The work plan can be updated easily at any time.

The inquiry facility locates information within METHOD/1. Because the entire methodology is available online, rather than in manuals, users can read only the information they need and bypass everything else.

Users who are not familiar with METHOD/1 can use menus to locate the information they want, while experienced users can retrieve specific information simply by entering the appropriate index numbers. In either case, the level of detail is specified by the user, not the system.

The project estimating facility runs from a series of electronic spreadsheets that are directly tied to the project's work plans. This facility can generate workday estimates for each task, based on standard estimating factors. Users can easily modify these estimates to reflect factors or tasks unique to their projects, as well as estimate project personnel costs or perform cost/benefit analysis.

The project control facility helps project managers monitor and control work programs for complex projects that involve large staffs.

This facility interfaces with the Work Plan facility to create two useful reports:

-Personal task assignments that provide a formal document and procedure for time reporting.

-Status reports that can be generated by project members and multiple levels of detail per report (such as work segment, task, and step) to permit managers to monitor progress and anticipate potential scheduling conflicts.

The change management facility monitors and processes change requests

efficiently and effectively.

It tracks a change request from the time the request is identified until the appropriate action is complete and can be used at any time in the systems development life cycle and in any area of an information systems organization. By encouraging prompt and efficient capture, tracking, analysis, and response to requests for changes, this tool helps assure that systems will continue to satisfy user's needs, as well as the needs of an organization.

USING METHOD 1: The work planning facility:

The project manager uses method/1's work planning facility to create a project-specific data base. The manager can browse through each METHOD/1 phase and indicate which tasks should be included in the new data base. Additions, changes, and deletions can be made iteratively until all selections are finalized. The extraction includes text, tables of contents, development steps, cross-references, and the initial work plan.

The project estimating facility:

Using the Project Estimating facility, the manager applies completion estimates to the tasks identified in the initial work plan. This facility generates two documents: and Estimating Guidelines Worksheet (based on the manager's parameters), and a report that identifies full-time equivalent requirements by skill level and time period. Adjustments can be made to the time frame, resources, and project scope.

The manager then determines the availability of each project team member and uses the Scheduling facility to assign people to specific tasks.

This facility generates reports that show each team member's assignments. Project team members record their time and the number of hours or days estimated to complete each activity. The manager then uses this information to schedule activities for the next time period.

The system uses the data submitted by each team member to generate reports comparing current project status to the work plan. These reports also show variances between original and current estimates of time required to complete the

work.

The change management facility:

After the project is completed, the manager can use the Change Management facility to maintain up-to-date information on system change requests.

Systems maintenance team members enter such information as the request's priority, the name of the person submitting the request, and the date the change must be completed. The system creates a detailed report.

The manager reviews this report and makes changes, if desired. The systems maintenance team addresses change requests according to their priority.

DESIGN 1: THE SYSTEMS DEVELOPMENT METHODOLOGY AND TOOLSET:

DESIGN/1 is an integrated set of software facilities that automates systems design tasks and techniques to improve productivity and the quality of design.

Systems developers the worlds over who look for quick, cost-effective ways to develop information systems have found it with DESIGN/1.

Along with Arthur Andersen's METHOD/1 and INSTALL/1, DESIGN/1 completes the FOUNDATION package to bring you a computer integrated environment for software engineering designed especially for DB2 users.

DESIGN/1 minimizes paperwork by creating, modifying, and maintaining standard design documentation.

This automated approach improves project team communication and, ultimately, the quality of the design. Furthermore, system design changes can be made online quickly and easily.

DESIGN/1 uses rapid prototyping to support many different types of systems development projects, such as application software packages, custom-developed systems, and methodologies.

DESIGN 1 IS USER-FRIENDLY:

Because of its menu-driven structure and optional mouse support, DESIGN 1 reduces the earning curve and simplifies data entry. In addition, it prompts the user with next-step instructions, including valid options, required field entries, and warning messages.

FUNCTIONS AND FEATURES:

DESIGN 1 allows systems designers to both create and maintain relationships between customized design object types and design objects. With it, you can process text and graphics together in a single object and move or copy blocks of text and graphics from one object to another. The system also maintains where-used and cross-reference indexes on the Design Dictionary.

Conversation prototyping enables the user to simulate an online conversation, including actual data entry, by using a predetermined screen flow and sample screens from the proposed system. The user can control the flow through the function keys and data values on screens.

For users with little or no experience, DESIGN 1 has a screen painting facility (Screen Design Aid) that can help you create and modify screens.

DESIGN 1's local area network effectively supports many workstations, thus promoting sharing and enhancing control of design documentation.

DESIGN 1 interfaces with several mainframe dictionaries (including IBM's DB2 catalogue and Arthur Andersen's INSTALL 1), enabling designers to quickly translate the design into a working system.

The DESIGN 1 structure chart editor with zoom graphics allows the analyst to create, maintain, and print both large and small structure charts quickly and easily. The DESIGN 1 data flow diagram editor (available in version 4.0.) allows the analyst to create, maintain, and print data flow diagrams quickly and easily.

USING DESIGN 1:

DESIGN 1 lets you store your design on a microcomputer, so the computer can do these things for you:

- Provide cross-reference reports.
- Store element definitions.
- Paint screens.
- Model data.
- Check the design for redundancy.
- Simulate conversation flow and data entry.
- Obtain various object inventories.

At the beginning of the project, the project manager or the systems development manager establishes project standards by creating (or modifying) the object types that will be used by project analysts.

Project analysts then establish their working environment by determining installation parameters, screen colours, printer types, and print heading information, style of graphics, and other user-specific variables.

INSTALL 1:

INSTALL 1: IMPLEMENTATION AND SUPPORT FOR YOUR SYSTEMS DEVELOPMENT EFFORT:

INSTALL 1 is Arthur Andersen's integrated software package for the implementation and support phases of the software development life cycle. It works in concert with our other systems development components to complete the FOUNDATION environment for fully integrated software engineering.

Along with METHOD 1, the automated systems development methodology, and DESIGN 1, the integrated set of software facilities to automate systems design, INSTALL 1 completes the FOUNDATION family to provide the only computer integrated environment for software engineering that is designed especially for DB2 users.

INSTALL 1 IS DB2-BASED:

INSTALL 1 was built especially for DB2 to exploit its powerful relational capabilities. DB2 based dictionary gives INSTALL 1 a great deal of flexibility and power.

INSTALL 1 IS INTEGRATED:

Since the system is based on a DB2 data dictionary, Design data is entered only once, is maintained in a consistent format, and is available to all the facilities of INSTALL 1.

INSTALL 1 SUPPORTS THE SYSTEMS LIFE CYCLE:

INSTALL 1 offers more than code generation. It supports detailed design, streamlines testing, and enhances maintenance. Since INSTALL 1 is an integral part of the FOUNDATION system, all phases of the systems life cycle are addressed.

FUNCTIONS AND FEATURES:

INSTALL/1 is engineered so all members of the project benefit from it. From systems developer end-user, INSTALL/1 has many functions and features to

enhance systems development productivity.

For the system developer:

- INSTALL 1 allows developers to focus creativity on business applications. Common and reusable systems tasks are pre-coded and tested so that systems developers can focus full attention on solving the business problem instead of re-implementing systems tasks.

- INSTALL 1's code generation facility can generate data structures, screens, records, file maintenance applications, SQL statements, conversation flows, validation logic, copy-books, and I/O modules. This facility actively accesses the DB2-based data dictionary to obtain any information needed by systems developers and their programs. It supports both COBOL II and OS/VS COBOL.

- INSTALL 1 manages valuable test data as an asset by allowing ease of entry of test data and allowing each programmer to maintain private copies of test data bases.

For the end-user, the resulting application offers many advanced functions. Standardized screens and consistent formats make INSTALL 1 functions like these easy to learn:

_ Online Help facility at the conversation, screen, and field level.

- Consistent, PF-driven dialog characteristics.

- Suspend/resume function.

- Fast-path function, which allows experienced users to bypass unnecessary information, such as prompts and menus.
- Table management.
- Screen support for multiple national languages, with a user parameter to define the language of the screen literals.

For the data administrator, INSTALL 1 provides a full-function DB2-based data dictionary - the key to integration - with these features:

- The INSTALL 1 dictionary is active, not passive. Development tools work interactively with the dictionary.

- The INSTALL 1 dictionary is extensible. It contains standard definitions for screens, tables, and allows the user to add new entities, attributes, and relationships.

- The INSTALL 1 dictionary maintains referential integrity among specific occurrences of entities and relationships that are documented in the dictionary.

2.6 SUMMARY:

Let's look at these four models and examine similarities and contrasts.

(i) The essence of **Richard Hayward**'s model is in four major activities:

1. **Strategic requirements planning** which links the plans and strategies for information systems with overall corporate objectives and strategies.

2. **Management strategy** which covers the strategies and policies that should be formulated to define among other things, the role of people, what their strengths, and where they belong with the control structures that are needed.

3. **Application strategy** which deals with the enterprise's data and the automation of the processes operating on that data.

4. **Technology strategy** which is concerned with the computer equipment, both hardware and software, required to support the application strategy.

However Hayward admits that there are intimate ties between application and technology strategies but he has the following reasons for making a distinction between them.

He believes that it is much easier to define the Application strategy when the specific characteristics of the computer equipment is ignored and all that needs to be considered, in terms of computer software/hardware are the general capabilities of computer systems. Therefore the Application strategy formulation can concentrate on the issues of business activities and processes and business

data and its interrelationships.

Similarly, the development of the Technology strategy is helped if the factors closely tied up with Application strategy are ignored.

The other reason for this distinction is to be able to make conceptual-implementation distinction which would enforce logical design before physical design leading to a degree of independence between the Application and Technology which should benefit the system and its future changes.

(ii) Edvin Tozer's model consists of four phases:

Phase 1: Determine business information needs.

This results from the analysis of a series of senior management interviews which are conducted according to a pre-defined format.

The analysis goes through the stages of functional objectives, critical success factors, control information and other quantitive means for determining the successful achievement of critical success factors, leading to a definition of specific information needs.

Phase 2: Development of conceptual architecture for systems and data:

This phase produces clear architecture statements for application systems and associated conceptual database. These constructs are developed from integration and prioritization of the results of the analysis of the business information needs from the first phase.

Phase 3: Determine key priorities and system groupings:

Product of this phase is:

1. A definition of specific urgent actions required, for example, stopping certain projects and starting other higher priority or more relevant projects;

2. A prioritization of the information needs and application processes identified in phase 2;

3. A statement of direction and the technical architecture for computer hardware, software, communications, and management support workstations and other information technology items.

Phase 4: Migration plane.

The final sets of deliverables are the plans for achieving the business and technical systems as outlined in these architectures.

These plans are expressed first in terms of business areas and the priorities to be given to their further detailed analysis. The plans outline also the sequence of development of the business systems and subject databases as expressed in the business system architecture.

(iii) James Martin's model consists of the following stages:

Information strategy planning:

Information Strategy Planning results in the underlying rationale for information systems needs and from them, aspects of three architectures are derived:

1 The information architecture of the business, expresses as subject areas, business functions and their interactions.

2 A business systems architecture proposed to meet the information needs.

3 A statement of direction for the technical architecture in terms of computer hardware, software and communications.

Business Area Analysis:

For an identified business area within the scope of the information systems development strategy, a detailed study is carried out of its data, its business functions and the information required fulfilling those functions.

This leads to identification of entity types and of the specific business processes and their information inputs and outputs.

These are analysed in detail and their names, interactions, meanings, quantities, rules and business algorithms documented. An important feature is the maximum involvement of end users in the specifications of requirements, priorities ad facilities.

Business System Design:

For the whole or a major part of the business area analysed, the facts gathered during analysis are used to design a system to meet the identified business requirements.

The design includes all those parts of the system directly relevant to its users including transactions, dialogues and controls. It is kept as independent as possible of the technology to be employed in implementation.

Prototyping techniques, using fourth generation languages, may be used to replace many of the tasks traditionally gone through in this stage.

Technical Design:

For the computerised aspects of the business systems specified, the facts gathered during analysis are used to design those parts of the system which are dependent upon the computer technical environment.

This is carried out in sufficient detail for construction and operation to be adequately costed. This design includes data storage structures, computer programs, operational procedures and interfaces.

The level of detail in the design is dependent upon the selection of implementation vehicle, e.g. system generators have much of the technical structure predefined.

Note that there is no summary on Arthur Andersen's productivity tool.

Section 3: Critical Success factors:

3.1: Introduction:

Faced with an increasingly complex world, managers today are demanding access to the information which is pertinent to their roles and responsibilities.

One method of determining these needs is the "critical success factor"(CSF)

Method:

CSF was introduced in a Harvard Business Review article called "Chief Executives Define Their Own Data Needs" and the method is now being utilised in a growing number of organisations.

Critical success factors are the few key areas of activity in which favourable results are absolutely necessary for a particular manager to reach his goals.

Because these areas of activities are so critical, he should have appropriate information to allow him to assess events are proceeding sufficiently well in each area.

The CSF interview method is designated to provide a structured technique which can be used by the interviewer to assist managers to see these critical success factors and to determine the information needs.

In this document we look at:
- General background information on CSF concept.
- Interview technique.
- Method analyzing the data.

The CSF method allows the interviewer to comfortably extract the manager's view of the world and must importantly to enable the manager to easily identify those few matters which demand continuing scrutiny by him. The interview should assist the manager to explicitly focus attention on what is really important so the priorities can be set.

Definition and Concepts:

Definition: CSFs are the limited number of areas in which satisfactory results will ensure successful competitive performance for the individual, department or organisation.
CSFs are the few key areas where things must go right "for the business to flourish and for the manager's goals to be achieved".

3.2: General background on CSF:

Terms like goals and strategy have a long and honoured place in management literature. Their definitions are relatively precise today and the concepts are well understood. The same is not true for CSF.

There is no clear algorithm which will aid an interviewer to help a manager to find his CSFs.

CSFs are related to specifics of a particular manager's situation. This means they must be tailored to the industry, the company and the individual being interviewed.

CSF's changes as the industry's environment changes, as the company's position within an industry changes, or as particular problems or opportunities arise for a particular manager. It is also important to understand what CSFs are not.

They are not set of standard measures called "Key Indicators" which can be applied to all divisions of a company. They are not limited to factors which can be reported on only by historical, aggregated, accounting information.

3.3: Prime Sources of CSFs:

CSFs arise from five major sources and should be researched by a potential CSF interviewer. They are:

1) The industry: each industry has a set of critical success factors and each company within the industry must pay attention to these factors. For example, according to Harvard Business review in the supermarket industry there are four CSFs and they are: product mix, inventory, sales promotion and price.

2) Competitive strategy and industry position:
Each company within an industry has its own position determined by it history and current competitive strategy.

Any given current position within the industry dominated by a single major firm, a CSF for all the others is to understand to leader's strategies and their probable impacts, or for a small company within industry a CSF is to concern, to protect its particular industry niche.

Also, the geographic positioning of the company can generate CSFs for example; retail firms in rural areas may have transportation management as a CSF while for more urban companies this is more critical.

3) Environmental Factors:

These are the factors that the organisation has little or no control. Two obvious sources of these CSFs are the fluctuations of the economy and national politics. Some companies are more sensitive to additional factors such as population trends, regulatory trends and energy sources.

4) Temporal Factors:

These are the activities within the organisation which becomes critical for a particular period of time because something out of the ordinary has taken place like loss of a large number of executives in an airplane. Crash would generate the short term CSF of "rebuilding the executive group".

5) Managerial Position;
Each functional managerial position has a generic set of CSFs associated with it. For example, almost manufacturing managers are concerned with product generality, inventory control and cash control.

The hierarchical nature of CSFs.

There are four levels of CSFs, each of which must be considered. These are:
- Industry CSFs.

- Corporate CSFs.
- Sub-organizational CSFs.
- Individual CSFs.

No organisation can afford to develop a strategy without adequate attention to the principal factors that underline success in that industry.

In turn the strategy, industry, objectives and goals developed by a company lead to development of a particular set of critical success factors for the corporation.

This is the corporate CSFs. Each corporation will develop a set of CSFs unique to its own circumstances. This in turn becomes input for each sub-organisation in the corporation. This can be continued for as many levels of organizational hierarchy as exist.

Managers at each of these levels will have an individual set of CSFs which depends heavily on their particular roles and on temporal factors, and less heavily upon the industry and the environment; nevertheless each of these individual sets of CSFs must be determined in the light of all the higher level managerial developments concerning strategy, objectives, goals and/or CSFs. In turn the company CSFs will play important role in determining the CSFs of the executives at the corporate level.

Each executive however will have individual CSF depending on his role and responsibilities. This top-down influence pattern is then repeated at each sub-organizational level.

In theory, the development of CSF should be top-down, however, where corporate or sub-organisation CSFs have not been explicitly developed, they can be inferred upward from a careful analysis of each individual manager's stated CSFs.

3.4 INTERVIEW PROCEDURES AND TECHNIQUES:

There are three main areas that we will discuss here. They are:
- Objectives of the interview.
- Pre-interview preparation.
- Interview procedure.

Objectives of the interview:

The interview should seek to accomplish all of the following four objectives:

1- To understand the interviewer's organisation and the mission and role of the interviewee (the world view) within the context of his organisation as the interviewee perceives them.

2- To understand the goals and objectives of the interviewee.

3- To elicit CSFs and measures from the interviewee.

4- To assist the manager to comprehend his own information needs.

Pre interview preparation:

The following steps represent major pre interview actions that are useful.

1- Familiarize yourself with the concept of CSF reading thoroughly the relevant articles on CSF such as "Chief Executives Define Their Own Data Needs" and "Executive Information Support Systems".

2- Get thoroughly familiar with the industry, and its competitive forces, trends, environments, currents problems, issues and new makers.

3- Study the company or companies to be interviewed. One should spend time with the people in the company who are sponsoring the study to understand the issues affecting the CSF.

4- Ask the top management to inform the interviewees about the interview explaining the purpose of the undertaking and their support for it.
5- Plan to start interviews at the lowest level of management and work up. In this way the interviewer can become more comfortable in discussing the company and industry issues before being confronted with the top two or three managers in the company.

6- Plan to have a key manager from the company to accompany the interviewer on the interviews. There are pros and cons to this. On the pro side there is someone available who can clarify company related obscure points during the interviews.

On the minus side, the interviewee may not be as honest and frank during the interview because an insider is present.

7- Study the role of the interviewee.

8- Brush up on interviewing skill.

Interview procedures:

With the necessary preparation out of the way, the following: steps would help to hold a successful interview.
1) Opening the interview.
2) Interviewee's description of mission and role.
3) Discussion of interviewee's goals.
4) Developing CSFs.
5) Prioritizing CSFs.
6) Determining measures.

1) Open the interview: This should be an introduction to the CSF method of determining management information needs.

2) Ask the interviewee to describe his mission and role. This question serves two major purposes.

First it is an easy way to get the interviewee into the process and to start him talking about what he knows best, his company and his job. Second, as he talks about his job, he almost always provides clues as to how he "views the world" and many things that are important to him come to light, including, often a few critical success factors.

The interviewer should take careful notes during this section of the interview.

3) Discuss the manager's goals:

This discussion of goals must have the time horizon (short or long) to make it meaningful.

The choice of the time-span and nature of the goals selected is useful in itself since it provides further insight into the way the manager views his job.

A fair number of managers, when asked to discuss their goals will provides the set of goals been drawn formally by the board and managers performances being measured during the current year.

Seeing this list, the interviewer should make a note of them and should ask the manager of the informal goals which are often as important if not more important than the agreed goals. Here managers sometimes expose significant, unspoken goals.

4) Develop the manager's CSFs:

Usually this should not be very difficult if the manager has been thinking about the interview and purpose of it and also there are questions like the following which facilitate the CSFs coming to surface.

"Will you please tell me, in whatever order they come to mind, those things that you see as critical success factors in your job at this time?"

"Let me ask you the same question in another way: In what areas, would a failure will hurt you the most?"
"In short, where would you most hate to see something go wrong?"

As the manager proceeds the interviewer, should ask for clarification of CSF where it is unclear.

5) Prioritize CSFs:
General indication of what the interviewee's views as most important is usually enough. In fact, some managers will not prioritize CSFs, because they are after, all a small high priority set of things, all of which are critical and quite often no one is more critical than the others.

6) Determine measures after the CSFs have been determined and priorities to discuss possible ways of measuring each. In general however it is useful to get some feedback from the manager on this but this part of the interview can wait

until after the entire initial CSF exercise has been completed.

3.5 ANALYSIS OF DATA:

The following two major steps in the analysis are:

A) Reviewing CSFs. Each interviewee's CSFs should be reviewed against the clarifications noted in the previous section to check whether the interviewee has covered all the major area of his job.

In addition, one can check interviewee's against each other to see if it fits to a pattern of CSFs. If there are major gaps, this should be brought up in a subsequent review meeting with the particular interviewee.

It is usually a good idea to prepare a written version of the CSF. To be reviewed and approved by the interviewee, this may also invoke additional information.

B) Aggregating CSFs from the individual manager interviews. After the initial interviews of the executives, aggregating the CSFs from the individual interviews, the interviewer can discuss for example exactly what information databases are most necessary to support the managers.

At this point, the CSF data should be in a suitable form to feed into the company's information systems planning process.

Section 4: Commitments of respondent companies to IT:

My findings substantiate the out come of MORI research that regardless of the models or methodologies they use for their IT planning, their commitment to IT is enormous.

Let's look at some examples:

4.1: Halifax Building Society:

They believe information is the life blood of any organization and Halifax is no exception. Providing the most appropriate information at the right time and in the right format is the aim of **BIS**.

How are things going?

One of the most basic management control questions but by no means the simplest to answer. The **BIS** information technology answer is Keyfax the Halifax's own viewdata system.

Over 15,000 pages of up to the minute information are at the very fingertips of the society's decision makers.

What if?

Planning is an issue that is only ignored at the peril of the business. **BIS** try to make the way ahead clear by supporting the use of a range of specialist statistical systems. These will be either mainframe or personal computer based depending on the exact need.

Who needs to know?

BIS also helps get the message across quickly. With a number of different terminal systems supporting different business needs **BIS** designed and installed its own Mailbox system allowing any Halifax terminal user to talk to any other anywhere in the UK.

Teamwork:

BIS in Halifax is built up from a number of different but interrelated working units.

Over 100 analysts are there to solve the business problems for a wide range of society contacts, improve the branch systems or liaise in the field of money transmission.

Also supporting the business, 11 teams of applications programmers and technical support specialists make the business solutions a reality.

The majority of programs are written in Assembler language for speed and efficiency but that dose not preclude the society from using other well established languages or customising prewritten software, it all depends on the business need.

4.2: British Airways:

British Airways stresses that Information technology is an integral part of their business providing a valuable service for their customers. On time departure, automated ticketing and touch screen information are effective applications where IT improves customer service by reducing costs and increasing business efficiency.

Behind the scenes an ever-increasing range of commercial and technical functions rely on IT: marketing, telephone sale, and engineering, stock control, crew scheduling, operations control, flight planning and executive decision support.

British Airways believes that the more competitive the business of running an airline becomes, the more the innovative use of IT will give them the advantage.

In both internal and external communications, information technology is critical and British Airways extensive telecommunications network has been developed to make their global operations fast, effective and manageable.

British Airways has over 2,000 IT professionals in a wide range of applications or support areas using many different technologies and specialist skills.
The IT systems themselves range from many large mainframe-based on-line systems with thousands of terminals connected world-wide, through mini computer systems with local area network, to stand-alone personal computers.

British Airways sells a full range of IT services-software and training to the industry and to more than 80 airlines throughout the world.

4.3: London Electricity Board (LEB):

Planning for the development of information systems in LEB is undertaken on a five

year rolling basis with priorities being set at the highest level in the board. The development program is strictly aligned to support the Board's major business objectives.

All applications are developed within the systems architecture of the Business Area of which they are apart. Within these fifteen business areas thirty seven mainframe computer systems are currently installed.

The board has a considerable investment in computing hardware both at Newington House and at its remote locations.

LEB is an IBM technology installation operating a large mainframe with 85 GB of DASD, using IBM and SIEMENS laser printers.
LEB's operating is MVS/XA, with VTAM to control the network of 1,000 plus terminals, situated at all Board location throughout London.

LEB has adopted the structured development methodology LSDM supported by its own analyst workbench Automate+ to aid system analysis and design. High volume applications are developed using PL/1 and the fourth generation application generator TELON.
FOCUS a fourth generation language for small and medium size mainframe applications are also used.

Although many of LEB's systems are mainframe based but they are increasingly using PC's to meet the business needs of their users.

The increased demand for computer systems within the board has created an interesting and varied working environment within the computer operation branch.

The branch is moving towards an IT service centre method of operation with reliability and efficient working practices being the main theme. Help desk problem and Change Management and Resource Management procedures are being developed to support this objective using products such as UCC1, UCC7, DFHSM and INFOMAN.

4.4: Lloyds Bank:

Lloyds Bank is a large organisation that recognises the vital role of information

technology in achieving business objectives.

The mission of Information Technology Division (ITD) Is:
"To use both information and technology to meet the requirements of Bank's business strategy by providing systems which will improve the Bank's competitive position and profitability?"

The bank's investment in technology equipment stands at more than £200 million and this is being increased to over £800 million in the 1990s.
ITD employs 2,500 people, and is looking for more.

Lloyd's two key computer centres are in Peterborough and at Sampson House, and are among the most advanced computer complexes in the country, using the largest mainframes (IBM/TANDEM) and the latest software.

IBM SOFTWARE

Operating systems MVS/XA JES2, MVS/ESA
Data Management Systems IMS/VS, DB/DC, FASTPATH, DB2, GRS, CICS, INFOMAN, CA/DATACOM
Network Systems ACF/VTAM, VSPC, PCF, CUS, TSO, TPNS, NETVIEW
Languages COBOL, PL1, ASSEMBLER, DL1, RAMIS, ADF c, MS/WINDOWS, CA/IDEL

TANDEM SOFTWARE

Operating Systems GUARDIAN C10
Data Management Systems ENCOMPASS, PATHWAY, SAFEGUARD
Network Systems EXPAND, SNAX, X25
Languages SCOBOL, COMOL, TAL, SQL, C10PATHWAY, TACL, PCL, ENFORM, ENABLE

In terms of applications development, they utilise CASE tools and development Repository using structured development methodology.

Applications include: base 24
CAP (Centralised Accounting Project)

CHAPS
BNS (Branch Network System)

BIT (Branch Information Technology)

VISA

+KBS

Section 5: Models and Methodologies in practice:

A view of the steps taken by British companies for their information strategy planning.

5.1: Philips Electronics:

In response to my second letter (see appendix i) I received the following:

- I have to tell you that two models that you refer to, TOZER and HAYWARD are not Known to me, and although I have had discussions with most of our sites in the UK and with the Central Information System Resources of Philips in Europe I am not aware of any part of our company that has made use of them.

In a reappraisal of the methods used by Philips to determine its strategy for information systems which was carried out about five or six years ago a number of methodologies were reviewed. The result of this was the selection of James Martin Associates (JMA) Information Strategy Planning (ISP).
Certain aspects of this ISP methodology were, in consultation with JMA, modified to give an even better fit to the needs of Philips and to conform to certain existing Phillips standards.

It is not possible for me to give you full details of this method however the following description may be of interest.

The Philips version consists of five main phases:-

1. Plan the project
2. Analyse the Business strategy
3. Outline the information requirements
4. Define the architectures
5. Determine the IT strategy

Each of the phases is divided into a number of major tasks, some seventeen in total, and within each task there are around six sub-tasks each with defined inputs and deliverables.

From this you will see that this is a highly structured methodology and should result in well defined Data, Systems and Technical Architectures, the areas for development and the priorities for that development.

Perhaps the most important aspects of this whole process is that a proper analysis of the BUSINESS STRATEGY is the only starting point, and that strategic information systems are those that contribute directly to those business factors which, by proper analysis, have been determined as critical to the success of that business.

Almost all Philips sites in the UK have carried out this process to some degree. Its success relates directly to the amount and quality of the effort that is applied to it.

There are many aspects of such a project which management can not delegate, and the process must be business led rather than be seen as the task of the IS department.

The models/architectures produced are unique to each site (and as such confidential) and there are marked differences between industrial and commercial activities.

Finally it is important that ISP is not seen as a one off project. The business is dynamic and the supporting information strategy must match it. Therefore regular and systematic reviews must be carried out.

(S.W Heywood Senior Consultant Business Group Systems)

5.2: Abbey National:

In a Management Systems Development (MSD) reorganisation over a year and half ago Abbey National included the establishment of an IT planning and support, with primary responsibility for strategic planning.

The history of IT planning:

The nature of planning has had to evolve within MSD over time.
In the early days, simple automation was the goal, and line management viewed technology purely as a cost. The internal focus was on project planning and budgets.

As technology became more and more vital to the business it could not continue to be treated as a simple service function. The high information content within financial products, and the importance of IT to customer service and market opportunities, combined to make IT "strategic" to degree matched in only few other businesses (e.g. airlines).

As a result, the planning function had to extend beyond the interface with other departments, into the heart of business strategy. IT joined with finance and human resources, as a key element of overall corporate planning.
This process occurred over a number of years but what precipitated the need for a separate planning function were the increasing complexities of the systems brought about by the rapid diversification of the business together with their many interrelationships.

A role as a facilitator:

The strategy itself is the responsibility of all senior staff in MSD. So, the role of

IT strategy is to integrate the contribution of MSD, with the corporate goals and business objectives of Abbey National as a whole (transcending line-of-business boundaries). This is very much a two way process.

It must be ensured that MSD's internal plans reflect and support the business plans, also that the new technology opportunities are considered and adopted in those business plans.

It is the responsibility of the new function to incorporate both of these aspects in the Information System Strategy, effectively the corporate wide requirements for applications, or "demand" for IT.

Also within the scope of IT strategy is the longer term perspective of "supply", in other words, ensuring that Technology Architecture keeps abreast of new technology and continues to match the business needs of Abbey National.

Other aspects of the role include competitive Analysis, and the evaluation of IT in prospective business acquisitions.

Information Systems Strategy:

Initial efforts were to identify a framework or methodology for developing the IT strategy preferably resulting in a "living" model rather than a paper document that would obsolesce and gather dust.

Abbey National invited seven firms of consultants to tender and selected Auther Young in March 1989.
(Note, this firm has since merged with Ernst and Whinney to become "Ernst and Young").
With the assistance of two consultants, Abbey National undertook an IT Strategic planning exercise between April and June 1989, resulting in what Abbey National calls "Initial Baseline" IT Strategy.

The deliverables comprise a set of presentation material, and three volumes of printed results. All of the data and information relating to the IT strategy is held

in IEW (Information Engineering Workbench).

This is readily available for elaboration or amendment in future iterations of the planning cycle.

Last year Abbey National went through an exercise that they described as "dress rehearsal" for an IT Strategy. They were concerned to validate the approach they were taking, and so they conducted the study largely as a desk exercise, i.e. without talking to real business users about their objectives and system needs.

However they believe this has served its purpose in demonstrating the benefits of the approach, and securing approval to "do IT for real" during 1990.

Abbey National then went on to make arrangements for a series of IT strategy workshop which involved about 45 senior managers throughout the entire organisation during February-May 1990.
This resulted in a much better substantiated Information Systems Strategy and further identification of IT opportunities.

This has helped Abbey National to prioritise new application requirements according to their business justifications, and to identify logical boundaries/interfaces between different applications areas.

A parallel exercise, of cataloguing existing applications, and evaluating them from both a user and an MSD standpoint helped Abbey National to make any necessary rationalisation of the current "portfolio".

Technology Architecture and Research:

A number of topics for technical research have been identified or sponsored, and studies have been taken place in various areas and externally.

The IT strategy Steering Group has been established as a forum for prioritising, and reporting back on research topics.

Current research topics are:

1. Open/Distributed Systems (Workstations, LANs and Departmental Systems)

2. Corporate Database Strategy

3. Development Methods

4. Overseas IT Strategy

A high percentage of these transactions are processed on-line, in real time.

The organisational structure of Management Services has been designed to promote the technical specialisations needed to support and develop each part of the infrastructure, and also to ensure that the overall service provided is of the highest professional quality.

The division is split into four major areas, each reporting through a senior manager to the general manager, Management Services.

The four areas are BUSINESS SYSTEMS, GROUP SYSTEMS, IT.PLANNING AND SUPPORT and COMPUTER OPERATIONS.

5.3: National Cash Register (NCR):

NCR's recent approach to IT has been quite different. We first look at their undertaking a marketing study in preparation for NCR's open, cooperative Computing announcements.

"This was the most exhaustive marketing research effort in NCR's 106-year history," said Charls Exley NCR Chairman."

The study took a year and included focus groups and interviews conducted among some 3,000 people including:

* Approximately 2,000 telephone interviews with information users across eight vertical markets.

- Respondents included senior management, operations and functional management and IS managers.

-Of those interviewed, 75% were non-NCR customers. Almost half represented businesses with more than $1 billion in annual revenue.

* Some 500 telephone interviews with value added resellers and independent software vendors.

* One-hundred-seventy-five in-depth interviews with members of senior management, and IS managers.

* Fifty-five focus groups, totalling several hundred participants, with IS managers, and operations and functional management.

Among major finding of this research efforts were the following points:

* Customers perceive considerable confusion in the industry. In the midst of accelerating change and transition in the technologies underlying the information system business, they are wary and have adopted a wait-and-see attitude.

* Customers view vender reliability as a primary concern. They want their information system providers to live up to their promises and to share in the

business risks.

* The role of management information services departments is undergoing a fundamental change. MIS is being cast more and more as a business and strategic-planning function.

* There is relentless demand for computer literate management for information to make better-informed decisions. In essence, information systems and MIS professionals are being recruited into the competitive struggle.

* Greatly heightened expectations of information system solutions exist among end users. Their growing experience with personal computers has created demands for integration, communications software sourcing and education.

* Service aspects of the information systems business such as business and system consulting, education, system integration and support are taking on a primary role in meeting the needs of customers.

* Customers want total solutions to their problems, not isolated products to construct partial ones. Thus, information system suppliers need to have an intimate knowledge of their customers' businesses, along with an understanding of how best to apply automation to the customer's problem.

* Customers are realising that the "system" and the "network" are the same thing. They wish to integrate "island of information" into a common network. They need to link corporate information to departmental PCs.

"In summary" said Charles Exley NCR Chairman "Our market research revealed that customers are being driven by the need to initiate, control and respond to change".

"To be able to manage change in the 1990s." he said, "customers overwhelmingly said their needed information systems that provide three things: adaptability, flexibility and dependability."

"NCR's open cooperative computing strategy" NCR believes "is designed to meet customer needs by providing:"

The ADAPTABILITY to evolve their systems over time to meet changing organisational needs, without disruption to the business;

The FLEXIBILITY to choose the best available solution from a variety of offerings to optimise an organisation's responds to change;

The DEPENDABILITY to assure high-quality products and services to their internal and external customers, through both responsiveness and reliability.

NCR CORPORATION ANNOUNCES OPEN, COOPERATIVE COMPUTING STRATEGY

A Blueprint for managing change

Charles Exley NCR Chairman believes that while open cooperative computing (OCC) is a natural evolution of NCR's decade-old commitment to building products based on open industry standards, it also marks a new chapter in computing history. Exley characterised this emerging era as "one in which a new information infrastructure will allow users to process information on an enterprise wide basis."

An Open Architecture

OCC is supported by NCR's Open, Cooperative Computing Architecture, (OCCA), based on an open client-server model, This, NCR belies will provide customers with a bridge to future technologies while protecting their information investments.

Open, cooperative Computing Architecture is composed of three major elements

1. The **Structure**, which defines the logical relationship of various system components.

2. The **Interface**, which defines the connections of the components.

3. The **Rules**, which defines how the components interact with each other.

OCCA Structure

There are five layers in this structure:

1. **Human Interface layer**, which provides a consistent and intuitive graphical user interface across multiple applications and operating systems.

2. **Application Environment Layer**, which offers services for integrating existing applications and developing new ones.

3. **Cooperative Services Layer**, which serves two purposes: one, to support the distribution of applications and information across the network. Two, to provide a secure, reliable and well-managed cooperative environment.

4. **Communication Services Layer**, which facilitates the movement of information across local area networks and wide area networks.

5. **Base Platform Layer**, which contains the operating systems (UNIX, DOS and OS/2), hardware and the physical network.

Open Interface

A major element of NCR's Open, Cooperative Computing Architecture is the use of open interface, based on industry standards. This allows systems from many vendors to interoperate, and frees customers to choose the best technology for their needs based on cost and functionality.

"The most important interfaces are those that provide the ways an application connects to the user, to the network and to the data base," said Gilbert Williamson, ncr president. "For example, our architecture supports MOTIF, OSI and SQL."

Client-Server Model Key to OCCA

The client-server model makes transparent, enterprise-wide computing practical and manageable. NCR has nearly five years experience in designing and installing client server solutions for financial institutions.

NCR's OCCA client-server model is unlike two other current computing models: a conventional mainframe connected to character-based terminals, or a file-server

system based on a Local Area Network (LAN).

In the former, all the applications, data and human-interface logic reside on the mainframe. In the latter, data is located on the file server, while applications and human-interface logic reside at the workstation.

In NCR's client-server model, the application is split between client and server. The front end of the application and the human interface logic are loaded at the workstation, while the back end of the application and the data are located on the server.

NCR believes that this separation has several advantages; for one it makes maintenance of applications and data easier, it also improves access to both applications and data, and it let's processing tasks is performed at the most effective location on the network.
As to how OCCA will actually work at the user level, an example a current office worker has to use a number of terminals to query separate data bases throughout a company and the combine the resulting information for use whereas with the Open, Cooperative Computing, the user makes a single request to the system.

This is to say that the user's local server will access the required data located in remote servers throughout the enterprise and provide to the user data already combined into useful information.

OCCA Coexistence

In today's environment, Open, Cooperative Computing Architecture enables a user to have windows to multiple processors in the enterprise. For instance, a user can have a window to a host processor running a mainframe application, a window to a UNIX server running a UNIX application, and windows to both DOS and OS/2 applications running cooperatively on the workstation.

Among customer advantages of NCR's Open Cooperative Computing Architecture are the following:

*** Lower hardware costs,** due to the use of microprocessor technology versus conventional mainframe technology, along with increased vendor competition in open environments;

*** Reduced communication costs**, due to lower network use as less information is transferred to the workstation;

*** Faster application development**, through the use of the client-server model in combination with an integrated application-development tool set, standard interfaces and relational data base techniques;

*** Increased user productivity**, through object-oriented, graphical user interfaces;

***** And **heightened organisational effectiveness and flexibility**, through transparent access to applications and information across the enterprise.

5.4: BOC Limited:

This is where we can see the TOZER model has been explicitly employed to develop Information systems.

The recent strategy study was as result of some very senior people in the main board recognising the need prompted by the IT director, to drive their technology development from proper business strategy and then looking very carefully at a number of alternative options.

They were in fact looking at the result of similar works carried out for others by various consultancies and also considering the cost of the studies.

BOC was also interested in the quality of people who were carrying out the studies rather than having preconceived ideas of a particular model when they eventually chose the NOLAN/NORTON consultancy.

However the details of the study are highly sensitive and hence confidential, but we can still look at the approach and the style and examine how satisfied BOC has been with the results.

NOLAN/Norton's work started by studying the existing BOC's systems and how they were utilising their computing power and they were quite happy with a lot of major developments that had been carried out previously and in spite of the fact that some of these systems were already over five years old, they were very close

to the maturity stage.

Now let us look at what was actually done:

We will see that the four stages outlined in the TOZER model was carried out in the following manner.

1. Determination of business information needs:

NOLAN/NORTON sent a working team to find out these needs and to find out the critical success factors of not only the industry (gases) but also BOCs.

This exercise took over three months and all the senior management in BOC and its subsidiaries were interviewed.

In brief they were trying to establish what BOC was doing well and also what was missing.

As a result of this phase of the study they identified business areas that had pressing information needs and produced the top twenty or so list for each business area. The top ten of each list was seen as strategic and the rest as tactical.

The top ten of each list was reviewed by the senior management and the result they produced was a list of the consolidated top ten things that needed urgent action.

2. Developing architectures for applications and data:

This according to BOC was played down as a result there was no explicit suggestion of any specific new hardware or software but better use of the existing systems.

3. Setting priorities and groupings:

BOC admits that the settings of all the priorities and groupings of the information systems provisions was business driven and the decisions to this end were made by the senior management of BOC rather than the consultants.

The priorities have changed once or twice since the Nolan/Norton studies in early 1989 but some of the projects have been completed; the most significant one is the Engineering Information Management Systems that is putting all their engineering systems on a common integrated footing.

4. Migration planning and presentation of the results:

This was very much intertwined with setting the priorities and cost benefits of alternative project settings were in play.
As mentioned earlier on the consultants did not involve themselves on either hardware or software selection and their main objective was to improve BOC's information systems provisions.

Their advice was very much geared towards the way BOC's business was divided into functional groups and the quality of the systems that were supporting these groups at the time.

This was not just a global message that could have handed in but very much based on deep understanding of the business which resulted the identification of specific system requirements.

Section 6: Review and Conclusion:

I started off this project by writing to 119 companies in the UK in January 1990.

The main reason for this was to gather Information on models and methodologies for development of information systems used by these companies.

I believe the companies were well targeted as they all had high standard of **IT** activities.

This resulted in a good response with following statistics:

NOT REPLIED AT ALL	**DIDN'T SEND INFORMATION**	**INFO. SENT NOT USEFUL**	**USEFUL INFO. SENT**

38	**34**	**17**	**30**
32%	**28.5%**	**14.25%**	**25.25%**

The main reason given for reluctance to disclose information was sensitivity and confidentiality of the documents and more often than not the separation of model or methodology from the target document seemed to be quite impossible simply because the worked was carried out by outside consultancies.

The problem I just mentioned wasn't evident in the cases, where
Either the development of Information Systems was done internally or the person I was dealing with had been involved directly with the project in connection with the outside consultants.

These individuals as a result were the main sources of the information I was seeking and through meetings, telephone conversations and the material received, I was able to put this work together.

On the commitment and attitudes to **IT** MORI research findings very much ties in with what I found and the essence of this is the belief by the respondent companies that the continued success in an ever more complex environments is

crucially dependent upon careful planning with the involvement of staff at all levels to achieve a strong commitment and identification with the work of the **IT** division to service these companies.

Obviously considerable hardware and software resources are required and the evaluation, selection and frequent changes involved require a high level of expertise in the technical and managerial areas.

On the applications of models used by the respondent companies they differ somewhat.

Philips used James Martin Methodology with the following phases:

1 Plan the project

2 Analyse the business strategy

3 Outline the Information requirements

4 Define the Architecture

5 Determine the IT strategy

Abbey National sees their planning as evolutionary and argues that what urged the need for a separate planning function was the increasing complexity of the systems brought about by the rapid diversification of the business systems with their many interrelationships.

The model they used was Arthur Young's; I don't have the details of the model but it is very much based on Technology Architecture and Research.

The work gets underway when a number of topics for technical research were identified or sponsored and studies were taken place in various areas.

There is also a strategy steering committee which is responsible for prioritising, and reporting back on the research topics and these topics were:

1 Open/Distributed system

2 Corporate database strategies

3 Development methods

4 Overseas IT

The essence of this model is that the study of business strategy will result in Information Strategy and the outcome of technical research will determine the Technology Strategy.

NCR started off their information development with a unique marketing study in preparation for what they call "Cooperative Computing Announcement".

Among the findings of the study was that "the customers want total solutions to their problems, not isolated products to construct partial ones, so the information systems developers need to have an intimate knowledge of their customers business, along with an understanding to the customer's problems".

On that philosophy they designed NCR's Open Cooperative Computing Strategy to deliver systems with Adaptability, Flexibility, and Dependability.

Three major element of this model are:

1 The Structure which defines the logical relationships of various system components.

2 The Interface which defines the connections of the components.

3 The Rules which defines how the components interact with each other.

And finally Nolan/Norton adapted Tozer model to develop **BOC**'s Information Systems taking the following steps:

1 To determine the business information needs.
2 To develop Architecture for Application and Data.

3 To set the priorities and groupings.
4 Devise a migration plan.

As far as the objectives of this project is concerned the two models Tozer and Hayward are used in some form or other; this is to say that in most cases the methodologies used to develop information systems do conform to a large extend

to them.

As far as the selection of a particular model is concerned the end user normally asks consultants to carry out the study for the development of their information systems and their prime concern is the quality and track record of these professionals rather than having a preconceived idea of a model or methodology to base their project on.

In response to my second letter asking specifically for information on Tozer and Hayward models; four out five said they never heard of them inspire of their close involvements with their IT activities.

The other point worth mentioning is that soon after the initial study of the information systems needs is out of the way all the decisions thereafter are business driven and not IT driven.

This is to say that the senior management will prioritize the actions to be taken on a sequence they feel fit and that by it would inevitably affect any migration strategies.

I also noted that increasing number of mergers and privatisations have been prompting the senior managements to review their current business strategies which normally results in need for new information systems provisions.

I also like to point out that one of the areas of Information Technology that needs more investigation is of the building design where not only provisions for lighting and heating and so on are provided but also computer and communication should be added to the design function.

Appendix I

Correspondence details:

Content of my two letters are shown in this section:

This was the first letter sent to 119 companies using mail-merge

48 Chapel Grove
Addlestone
Weybridge
Surrey
KT15 1UG
5th January 1990

&name&
&add1&
&add2&
&add3&
&add4&

Dear &name&

I am currently studying for an MSc course in Information systems engineering at Southbank Polytechnic.

Personally I have found one of the most interesting parts of the course to be the planning models for management information
Systems and have chosen to do a project in this area.

As your company is in the forefront of I.S development, I would appreciate your help in giving me information on the most recent
developments within your company i.e. corporate plan, IS plan etc and I would be delighted to send you a copy of my completed
research papers acknowledging your contribution.

You would also be consulted beforehand if the papers are to be published.

I look forward to hearing from you soon.

Yours sincerely

F.Azad

This is the content of my second letter to selected companies which had shown interest, but needed clarification of what specific information I was seeking.

Dear....

Thank you for your letter of...

The main objective of my project is to find out what models of IS plans are used in industry. We already know that there are two very well established models available namely TOZER and HAYWARD but what we do not know is how widely they are used and further more if there are other models available that we are not aware of.

I would also be interested to know if there are home made models and if so what are the reasons for the differences; do they differ according to the functionality of the main business or they are result of evolution within the organization reflecting style or other factors.

I am in a way trying to gather as much information as possible to be able to answer these questions.

I hope these answers are to your satisfaction and look forward to hearing from you soon.

Yours sincerely F.Azad

Appendix II

Definition and Concepts of Terms:

Critical Success Factors (CSFs):

CSFs are the limited number of areas in which satisfactory results will ensure successful competitive performance for the individual, department or organization. CSFs are the few key areas where "things must go right" for the business to flourish and for the manager's goals to be attained.

Cooperative Function:

Cooperative computing is the networked distribution of computing functions throughout the business environment. It gives users access to applications and files distributed across a network of computers; it allows applications to be initiated anywhere in the network at the request of any authorized user in the network; and it provides users with the capability, when appropriate, to update files located anywhere in the network.

Goals:

Goals are specific targets which are intended to be reached at a given point in time.
A goal is thus an operational transformation of one or more objectives.

Measures:

Measures are specific standards which allow the calibration of performance for each critical success factor, goal, or objective.
Measures can be either "soft", that is subjective and qualitative, or "hard", that is objective and quantitive.

Objectives:

Objectives are general statements about the directions in which an organization intends to go, without stating specific targets to be reached at particular points in time.

Open System:

An open system is a set of standard relationships that enable different computers, subsystems, and software to operate together. An open system is characterized by all the interfaces that comprise its points of connection to the outside world. This includes hardware interface, such as buses and peripheral interfaces, and software interfaces, such as user and communication interfaces.

Problems:

Problems are specific matters rising to importance as a result of unsatisfactory performance or environmental changes.

Strategy:

Strategy is the pattern of missions, objectives, policies, and
significant resource utilization plans stated in such a way as to define what business the organization is in (or to be in).
The complete statement of strategy will define the product line, the markets and market segments for which products are to be designed, the channels through which these markets will be reached, the means by which the operation is to be financed, the profit objectives, the size of the organization, and the "image" which it will project to employees, suppliers and customers.

Appendix III Bibliography and References:

- Long Range Planning, Vol 19, No. 4 1986 Pergamon Journals Ltd

- Long Range Planning, Vol 19, No. 5 1986 Pergamon Journals Ltd

- Long Range Planning, Vol 20, No. 2 1987 Pergamon Journals Ltd

- Also publications from James Martin Associates, Arthur Anderson, MORI research findings on behalf of CMG (Computer Management Group), and the respondent companies.

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