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Guest Contribution

Information Technology Research in the European Community

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Abstract

It has been said that one reason why the US and Japanese information technology industries are ahead of those in Europe is that, where these countries see opportunities, European industry and its customers see primarily risks. Recognising this as well as the strategic importance of information technology and integrated communications systems for the future economic development of Europe, the Community launched the first of several five year programmes in information technology and public communication systems in the mid-eighties. In this report we describe the main programme called ESPRIT, how it works and some of the results achieved to date.

Introduction

The European Community consists of 12 nations with a GNP of US$billion 4 862 (1988 figures). By the year 2000 the information technology and electronics sector of the European Community is likely to become the largest industry, representing some 300 billion ECUs (1 ECU = R3,82) or 6,7% of GDP. With the major impact these enabling technologies have on the competitiveness of the whole of a modern economy, Europe recognised very early that information technology is of crucial importance to the success of the planned, unified internal market and an essential factor in the Community's development strategy.

At the same time however, the positive balance of trade of the European Community in information technology amounting to some ECU 1,7 billion in 1975 was declining rapidly (it reached a deficit of almost ECU 22 billion at the end of 1988) and the Community decided something drastic had to be done. As a result it launched the First 5 year European Strategic Programme for Research and Development in Information Technology or ESPRIT I. It started on January 1st 1984 with a budget of 1,5 billion ECUs.

Table 1. The EC and its top 3 partners in numbers (1988)

	Population (millions)	GNP (US$ billion)	Per Capita GNP (US$)
West Germany	61,0	1 120,0	18 400
France	56,0	939,2	16 800
Italy	57,5	814,0	14 200
EC	**325,1**	**4 475,1**	**13 770**
USA	248,0	4 862,0	19 600

Source: US Department of State, Bureau of Public Affairs

The overall strategic goal of ESPRIT was to provide the European information technology industry with the technology base which it needs to become and stay competitive with the US and Japan in the 1990s. In addition to this primary objective, two secondary objectives were defined, namely:

- to promote cooperation in the information technology field between industries, universities and European research bodies on R&D projects up to pre-competitive level; i.e., prior to the development of commercial products, and
- to contribute to the development of international standards.

At about the same time the crucial importance of public digital telecommunications to the future social and economic infrastructure of Europe was recognised. Consequently a separate Research and Development programme in Advanced Communications Technologies in Europe (or RACE) was launched in 1985 with a budget of ECU 1,1 billion. The stated goal of this latter programme was

- to introduce Integrated Broadband Communication (IBC) into the European Community taking into account the evolving ISDN and national strategies while progressing towards Community-wide services by 1995.

Both these programmes have since progressed to second 5 year phases as, respectively, ESPRIT II with a budget of 3,2 billion ECUs, and RACE II with 1,039 billion ECU. In the meanwhile ESPRIT III is in its initial planning phases.

RACE is similar to ESPRIT in terms of its financing and organisation. Space does not allow us to detail all aspects of the programme in this report.

Strategic Themes

Although the ESPRIT programme broadly addresses the information technology and electronics industry, ESPRIT I had 5 major strategic themes.

1. *Microelectronics.* This field was perceived as the key strategic area for information technology R&D in the future.
2. *Software Technology.* The stated goal of this research area was to do what was necessary to put the software development process on a sound engineering footing. Sub-areas were defined to deal with formal methods, development tools, management aspects, quality measurement and the development environment.
3. *Advanced Information Processing.* This area covered knowledge-based systems, new computer architectures and speech- and image-processing.
4. *Office Systems.* When initially conceived in 1984, this application area was viewed as of strategic importance for the efficiency of business throughout the Community.
5. *Computer Integrated Manufacturing.* This area comprised the total range of computer integrated manufacturing activities, including: computer aided design (CAD), computer aided engineering (CAE), computer aided manufacturing (CAM), flexible machining and assembly systems, robotics, testing and quality control. The area was selected for its potential impact on the methods and economies of production, particularly in the information technology industries, and also for the manufacturing industry in general.

In addition, the Information Exchange System project was started with the twofold objective of

- providing communication services to ESPRIT participants, both industrial and academic; and
- encouraging the development and adoption of OSI standards.

It is indicative of the experience gained in ESPRIT I and technology developments since it was started, to note how the strategic fields chosen for ESPRIT II differ from those of ESPRIT I. R&D in ESPRIT II is carried out in the following four major areas:

1. *Microelectronics* was retained as the key strategic area for information technology R&D in the future.
2. *Information Processing Systems and Software.* The work in this field will provide the fundamental and generic technologies which will support the development of information technology products expected on the market in the next decade. Thereby ESPRIT II recognised that information and its efficient use is not only a means of administration and communication, but that it is part of an enterprise's competitive advantage.

   As an aside, it is interesting to note that, of the 30 billion ECU expenditure on software and services in 1989, about 50% was provided by the manufacturing, banking and other financial services. This is expected to remain true through to 1994, when the market is expected to be worth 70 billion ECU. About one third of this market comprises customer services, consultancy, training and services while packaged software represents about 40% of the market. The latter component is expected to increase to 50% of the market by 1994 with services and training remaining constant at 30%.
3. *Advanced Business and Home Systems and Peripherals.* It is clear that information technology in the business environment is moving to advanced integrated systems capable of serving all the functions of the enterprise in an integrated multimedia environment. The priorities for work in the Community documents reflect these salient points.
4. *Computer Integrated Manufacturing.* The emphasis in this strategic area has not changed significantly from ESPRIT I to II.

In addition to the above, the *Open Microprocessor systems Initiative (OMI)* was started in ESPRIT II. The major motivating factor for the Community was the 82% dependence on non-European sources for microcomponents, representing 7 billion ECU in 1989 and which is expected to rise to 16 billion ECU by 1994.

Funding

ESPRIT is an industrial programme and it was not started for, or by, academics. The main driving force behind the ESPRIT I programme was industry, who first defined the research areas and then the goals and workplans. Industry was represented by the largest 12 information technology companies (known collectively as "The Twelve") in Europe.

ESPRIT R&D projects are implemented by shared-cost research and technological development contracts, with the Community financial participation normally not exceeding 50%. Universities and other research centres participating in shared-cost projects have the option of requesting, for each project, either 50% funding of total expenditure or 100% funding of the additional marginal costs. ESPRIT projects have a maximum duration of 5 years but should normally be shorter.

In the case of ESPRIT I, the Twelve received 50% of the ESPRIT budget and were involved in 70% of all projects. Small- to medium-sized enterprises (SMEs) participated in 65% of the projects and received 14% of the funding. The funding allocation by sector participating in ESPRIT I is illustrated by the chart in Figure 1.

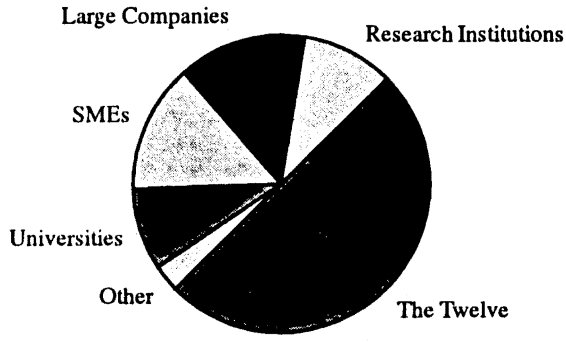

Figure 1. ESPRIT I funding allocation by participating sector

Basic Research

While ESPRIT I made no special provision for basic research, ESPRIT II includes a sub-programme, with a budget of 130 million ECU, aimed at developing new knowledge and expertise in the basic disciplines considered essential to secure the long-term future of information technology in European. Some 62 projects have been selected to carry out basic research in areas such as super-conductivity, optical and neural computers, speech and image processing and so on. In all, 211 university laboratories, 57 research bodies and 17 industrial companies are participating in these projects.

Apart from such projects, basic research activities also involve

- *Working Groups* which are concerted efforts to improve the systematic exchange of information and for which short scientific visits and workshop are funded, or
- *Networks of Excellence* which are composed of both academic and industrial teams geographically distributed throughout the Community. These are set up to provide a critical mass of complementary knowledge and expertise and to share limited and expensive resources. Funding for Networks of Excellence is restricted to the marginal costs of establishing the administrative and communications infrastructure necessary to carry out the coordination.

The evaluation criteria for basic research projects are less specific about the value for market exploitation of the expected results and more specific about conformity with the basic ESPRIT technical objectives, inter-disciplinary nature and scientific calibre of the partners.

Programme Management

Participation in the programme is solicited by a "call for proposals" made by a "consortium" comprising at least two participants or "partners" from different members within the Community [1] and usually no more than six – except for standards projects.

The proposals are then evaluated by external experts who take account of the following points in particular:

- The impact and potential for industrial exploitation of the expected results of the project.
- Eligibility of the partners.
- Technical merit of the proposal including a justification of the proposed theories and methods.
- Soundness of the proposal with regard to issues like the assessment of major technical risks and technological advances expected.
- All proposals are scrutinized for human and organisational factors to ensure that the results would be appropriate for the intended user base.
- Soundness of project plans with respect to the distribution of effort, clear and well defined roles for each partner, realistic timescales and the proposed management structure and methods of supervision.

Once a project has proceeded to contract signature[2] it is periodically subjected to four different audits until its completion:

- A *strategic audit* is carried out periodically to examine the evolution of the political, economic and social objectives in the light of world-wide strategic developments.
- An annual *technical audit* examines the progress of all projects which comprise the Programme. It is performed by a team of independent experts.
- A *programme management audit* evaluates overall management performance as well as individual project management and deliverables.
- The usual *financial audit* is done to ensure the correct use of public money.

Results

A total of 227 projects were implemented during ESPRIT I. They involved 536 participating entities and some 3 000 full-time researchers.

- Of the 327 participating industrial companies, almost 45% were firms employing fewer than 500 people and 40% of those employed fewer than 50. SMEs were extremely active, being involved in more than half the projects and being responsible for more than 25% of the research work in 60% of the cases.
- Nearly 200 universities and research institutes participated in approximately 70% of the projects. In more than half the cases, these scientific institutions were responsible for at least 25% of the work.

Towards the end of ESPRIT I, nearly 165 projects had delivered concrete results. Of those, 75 had already helped to put specific products and services onto the market, while for another 60 projects, the research worked had resulted in the transfer of technology for uses not directly linked to the project itself.

One detailed example is work in the Information Processing Systems and Software sub-field which let to the definition of a reference model for CASE (computer-aided software engineering) tools that has been adopted by the European Computer Manufacturing Association (ECMA). This has let to requests from the US National Institute of Standards and Technology to collaborate on the ECMA model as the basis for their own work on a reference model. Details about this and all other European Community research projects can be obtained from CORDIS mentioned below.

ESPRIT I participants who were questioned about their perceived successes of the programme considered increased knowledge as the most important benefit (69%), followed by a belief that research goals more ambitious than would otherwise have been set, had been reached.

[1] Partners in ESPRIT from outside the community are not eligible for financial support. A programme called EUREKA fosters extra-European research.
[2] Only 20% of all proposed projects in the case of ESPRIT I.

There have been direct benefits in being able to cover a wider range of research topics quicker by sharing results with the project partners.

A significant number of responses claimed a contribution either to existing products (35%) or new products (45%). It was felt, however, that there needs to be a greater degree of concerted action by project teams and a sharper strategic focus on market opportunities while, simultaneously, basic research must continue and even be increased.

15% saw no direct benefit.

Apart from technological reasons, ESPRIT and RACE were started, in the first instance, as Community programmes to promote cooperation in the information technology field between industries, universities and European research bodies on R&D projects. The extent to which this was achieved is thus an important criterion for measuring its technological successes. In this respect it is a general consensus that ESPRIT has indeed achieved a profound change in attitude in the Community. Cooperative, precompetitive research and development is now a formula which is working effectively.

Summary

It is apparent from the many ESPRIT reports that some participants in ESPRIT I, particular those from the Twelve, were originally rather sceptical about the likely successes of the programme. No small reason for this was that they had no accord on the product priorities for the industry as a whole.

Five years ago, the largest European companies viewed one another much more as competitors than collaborators. Five years later, however, apart from the major technological progress, a major, if not *the* major achievement is that there now exists a spirit of pre-competitive cooperation in the Community to the common advantage of all.

ESPRIT has become symbolic of the technological awakening of a European Community wishing to ensure its freedom to make the technological choices necessary for its own future prosperity.

Further Information

The European Community has set up an on-line information service to give quick and easy access to information on European Community research programmes. The Community Research and Development Information Service (CORDIS) is at present offered free of charge and comprises eight data-bases.

More information and CORDIS registration forms can be obtained from

ECHO Customer Service
CORDIS Operations
BP 2373
L-1023 Luxembourg
Tel.: (+352)34 98 11 Fax.: (+352) 34 98 12 34

Pieter Kritzinger is professor and currently head of the Computer Science Department at the University of Cape Town. During 1992 he was on research and study leave at the University of Dortmund in Germany and was thus able to observe programmes like ESPRIT and RACE at close hand.

Editor's Notes

A number of the articles in this issue of the South African Computer journal are in the field of Information Systems. Research in this area is beginning to blossom in the country. There are probably many more researchers in Information Systems than there are in Computer Science. It is hoped that not only academics, but also professional practitioners will submit articles.

Research in this area normally falls into three main categories. The first of these is pure research. This is a difficult area. Few researchers make a contribution here, mostly because the theory progresses slowly. However, these articles are to be encouraged. The second category of research is the collection of information from a variety of people in the field by means of questionnaire or interview and the use of this data to formulate policy and trends. An important aspect of this research is in order to corroborate theories or to identify areas where new theories are needed, or old theories amended. This has proved to be a very fruitful area of research and many beneficial results have accrued from it. The third category of research is performing careful analysis on a specific Case Study. In this area the case under study will need to display something which is innovative, either in the system itself, or in the way it was implemented. The case will need to prove something new and important or to break grounds into areas which have not formally been addressed.

All three types of work is worthy of publication if the results that they deliver are of benefit to the community which they serve. All three will be considered for publication by this Journal.

The journal divides into two sections. The primary section is involved with research while there also is a section on viewpoints and communications. Articles submitted for the latter are not refereed, but can be included after study by the editors. On some occasions articles submitted for the research section have been found appropriate for this section. This policy also applies to articles in the Information Systems field.

John Shochot
Subeditor: Information Systems

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The Key Issues in Information Management for the Mid-1990s. Back to business basics through the commercialisation of the ISD.

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Abstract

This paper takes a business or commercial perspective of the key issues in Information Management for the mid-1990s. It focuses on how organisations may use information systems to improve their efficiency and effectiveness as well as how these systems may be used directly in the process of wealth creation. This is referred to as bringing the ISD back to business basics. In this context the paper looks at the major concerns which exercise the minds of senior information managers and information technology directors as they proceed into the mid-1990s. This paper expounds the view that the next few years will see a greater emphasis on the business aspects of information systems i.e. their commercialisation rather than a simple concern for the employment of the technology itself. Although the issues specially addressed in this paper have been drawn from research in the business area the same principles are relevant to other organisations in the government, in educational institutions and other not-for-profit enterprises.

Keywords: *Management issues, Rightsizing, Outsourcing, Culture, Change, Partnership, Systems Ownership.*
Computing Review Categories: *K.6*

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1 An Introductory Background

Information system management is changing. It is changing rapidly and quite profoundly so that by the mid-1990s information management will be quite different to what it is today. The principal driver of this change is the attitude of senior management towards the economics of information systems. This has been well expressed by Lincoln [20] who stated that

> "The past few years have seen a marked shift in the attitude of senior executives towards the use of information technology. No longer are expenditures seen as low and investments 'acts of faith'. Now executives require that their information systems are both profitable and can be shown to be profitable."

The enormity of the change to information management was highlighted by Cane [4] when he reviewed research conducted by Pagoda Associates in London, and in which he pointed out

> "... two thirds of big companies are reducing their IT budgets ... and half the companies have cut the number of (IT) staff they employ while some central IT functions have disappeared completely."

To understand the issues which are currently concerning those involved in information management and which are likely to be important for the remainder of the decade, it is necessary to examine how the subject of information management has developed over the past few decades.

Information management traces its roots back about 40 years [10] to the introduction of the first business computers in the UK and the USA in the first years of the 1950s [12]. In the UK the first business computer was acquired by the Lyons Food Group, while in the USA the first business computer was set to work in the Federal Census Office [2]. Both of these machines performed very elementary administrative tasks which in a very real way set the scope for computers for quite some years.

The key features of these early computers besides their substantial cost, were their enormous size, their complexity, their unreliability and the difficulty to program them to perform any productive work. These unfortunate characteristics set the tone for the relationship between information management and the rest of the organisation for many years. The discomfort of management and especially top management with information systems is best described by Robert Townsend [38] in the following famous quotation.

> "First get it through your head that computers are big, expensive, fast, dumb, adding-machine-typewriters. Then realise that most of the computer technicians that you are likely to meet or hire are complicators, not simplifiers. They're trying to make it look tough. Not easy. They're building mystique, a priesthood, their own mumbo-jumbo ritual to keep you from knowing what they and you are doing."

Although the situation described by Townsend appertained to the 1960s and 1970s many of the problems of inadequate human communications and consequential suspicion between information systems specialists and other members of staff still remain, and it continues to be a major problem in many firms as to how to bridge this gap. Deckle [7] develops the culture gap theme by stating that corporate management perceives data processing management as being

"obtuse, purposely enigmatic and ambiguous, overseeing a department populated with bearded, tennis shoed, dreamy-eyed refugees from the video wars."

In turn IS management see corporate management as being

"insensitive, manipulative and totally out of touch with the data processing operation in terms of people, operational dynamics and technology."

In 1990 the National Computer Centre [26] defined the objective of Impact, its major research study as:

"To enable the partners to build the bridge of understanding between the IS management and the organisation it serves so that the organisation is able to make the most effective use of IT to meet its objectives."

In a more recent publication Kit Grindley [13] quotes, on the cover of the book, a chief executive who clearly wished to remain anonymous as saying

"Like other chief executives, I feel I'm being blackmailed. Not just by the suppliers, I expect that. But by my own IT staff who never stop telling me what the competition are spending....."

Although fortunately some organisations are beginning to build bridges of trust and working partnerships between information systems staff and computer users this distrust problem remains. In fact Grindley [13] points out that the results of his recent research shows that

"The 'Culture Gap' between those knowledgeable about IT and company managers and users in general is stated by 62% of IT directors to be their top problem"

As well as the culture problem described above, the history of computing in the 60s and the 70s is one of large sums of money being spent, mostly on systems which produced some return on their expenditure, but usually these returns were nowhere near the benefits promised by the vendors. Totally unrealistic vendor hype is as old as the computer itself and remains a problem even to this day. Another feature of the early period of business computing was that these large sums of money spent on business computing were highly controlled by a centralised electronic data processing or information management function. There are many pros and cons to information systems centralisation but it is generally accepted that it produced delays in system development and led to excessive costs. However in the centralised type of organisational environment the exact amount spent on information systems was precisely known and this is regarded by many as an important advantage.

2 The Two Revolutions of the 1970s and the 1980s

By the end of the 70s much of the way in which information systems were regarded and managed was beginning to change. Some firms, unfortunately not many, were reporting very substantial competitive advantage through the use of strategic information systems.

A strategic information system is also known as a competitive edge system and may be defined as

"an information system which helps a firm improve its long term performance by achieving its corporate strategy and thereby directly increasing its value added contribution to the industry value chain."

Thus a strategic information system will give management an opportunity to increase the effectiveness with which a firm relates to and operates within its industry value chain [29].

These new types of systems were delivering very real direct business benefits and this development opened up the scope of information systems more than any other previous development. No longer were computers confined to automating administrative tasks or providing useful information but they could actually play a central role in how the firm conducted its business.

The concept of information systems being able to assist the firm in achieving its corporate strategy was received with open arms by information systems professionals, consultants and academics. It was perceived by some as the holy grail of the information management profession [32]. It was no less than a conceptual revolution. It brought information systems out of the back room where they performed routine administrative functions and put them fairly and squarely into the corporate spotlight as an integral part of corporate strategy. There are many examples of strategic information systems but some of the firms which have become legend for these systems are American Airlines, American Hospital Supplies, Meryl Lynch, Thompson Holidays, Benetton and The Xerox Corporation [30].

During the same period the integrated circuit revolution profoundly changed the fundamental economics of computer manufacturing [30] which was in turn to radically change business computing. Within a few years of the first microcomputers a number of firms were producing machines for a few hundred dollars with computing power which had previously cost tens or even hundreds of thousands of dollars. By the late 1980s microcomputers which were more powerful than the mini computers of the early 1980s were being sold for quite modest amounts. Some of these computers included 25MHz processors, 16MB of memory and 200MB disk drives. This was to bring about an enormous and irreversible change to both the computer industry and to the way computers would be used.

The speed at which this new technology was embraced by business was staggering. Research in the USA shows that

"...from 1983 to 1985, the number of personal computers used in Fortune 1,000 corporations in America increased from 2.5m to 18.4m. In the same sample, the percentage of white collar staff who used PCs rose from 7% to 56%. Spending on PCs grew more than 12 fold." [17]

The benefits of microcomputers, which later, due to the dominance of IBM, became known as personal computers, has been well documented. But what hasn't been fully spelled out is the way that personal computers changed the

relationship between the information systems department and the rest of the firm. These small inexpensive systems caused a number of impressive changes in the way that firms use computing. The most significant change was perhaps the shift from the centralised control of information management and information systems expenditure to decentralised authority for expense at specific functional level. Department heads, as well as individual managers and executives were often able to buy their own system without reference to any central authority. This decentralised type of organisational environment meant that the exact amount spent on information systems was sometimes not precisely known and this was regarded by many as an important disadvantage.

Expenditure throughout the 1980s

The result of both of these crucial developments was an explosion of spending on information systems in the 1980s. According to The Economist "corporate America gorged itself on Information Technology" [11, p30].

As previously stated it has been estimated that between 1983 and 1985 alone, expenditure on personal computers increased in the USA by a factor of 12 times. Of course this skyrocketing expenditure was not limited to the USA but was mirrored in the Europe, the Far East, South Africa and various other parts of the world. Some business commentators refer to information systems spending in this period as being the black hole of corporate bits and bytes and of course corporate expense. In addition a sizable amount of this expenditure was wasted on systems that did not work or that were inappropriate. The exact size of this expenditure is unknown because, as mentioned above, many, if not most firms did not, and still do not, monitor all the monies spent by individual managers and executives on personal computing. But the sums are huge and by the end of the 80s many firms felt that their spending on information systems was out of control. At the same time little or no attempt was made to measure the benefits delivered by or derived from information systems. It was believed by many that it was very difficult to cost-justify information systems and thus the results of cost benefit analysis may not be reliable.

Opinion surveys and research studies

As corporate computing proliferated during the 1970s and 1980s it became necessary to attract a much higher calibre of individual to work in this field. For men and women working with these very high value investments it was no longer sufficient to be only technically competent. A wide variety of business skills were now required ranging from project management to interpersonal skills, from financial know-how to accounting proficiency, to mention only a few areas. Courses were set up in information management. Information management became an important part of the MBA degree at many universities. A considerable amount of research was undertaken into how firms should manage their computer installations.

As information management and managers became more and more professional so the views of its practitioners became increasingly more important. Surveys were regularly conducted into a number of issues concerning the management of information systems.

Research studies conducted among information management professionals during the later part of the 1980s [3, 37, 23] and early 1990s [24] show that information managers were very concerned about issues relating to strategy, strategic alignment, re-configuration, productivity and value for money. Surveys produced lists of concerns such as the following:

- the development of information systems strategy,
- the use of information systems to reshape business processes,
- the alignment of information systems and corporate goals,
- the implementation of cross functional systems,
- the increase in programmer productivity,
- the better utilisation of data/information, and
- the realisation of benefits.

It may be easily seen that strategy and value for money dominated the information management scene. This is hardly surprising as linking strategy and information systems was the great conceptual breakthrough of the 1980s. By the end of that decade many firms felt that their information systems expenditure was out of control and there was growing concern as to whether a suitable return on investment was being earned by the firm's computers.

Numerous research studies addressed the question of value for money and most of them produced depressing results. The following are the key findings of a few such research studies:

- IT is not linked to overall productivity increases [25].
- 70% of users declared that their systems were not returning their company's investment [33].
- Only 31% of companies report that the introduction of IT has been very successful [1].
- Only 24% of firms claim an above average return on capital from their IT [15].
- 20% of IT spend is wasted and 30-40% of IS projects realise no net benefit whatsoever, however measured [40].

According to The Economist manufacturers who purchased Information Technology in the late 70s and the early 80s earned such a low return on their money invested that they "would have done better ..... to have invested that same capital in almost any other part of their businesses." [11, p30]

3 The beginning of the 1990s.

The 40 years of business computing has resulted in the most extensive use of computers. Almost every organisation, other than the very smallest, and those in very underdeveloped countries, use computers. Information systems touch every aspect of business activity from product design, to production, marketing and support. Information technology has penetrated deeply into many firms impacting all levels of the organisation and this has resulted in

the need for new paradigms for managing the use of this technology [8].

From a general point of view computers have become essential to the life style of individuals living in the so-called western world. Computers directly affect the transportation system, the production of energy, the management of hospitals, the production of food etc, etc. Without computers our society would not function as we know it today. Worldwide hundreds of billions of dollars are spent on computers each year. According to Willcocks [40] in 1991 UK firms alone spent over L10B. Again on a worldwide basis several million people are employed by the computer industry which remains one of the few showing reasonable growth during a period of considerable worldwide recession.

However despite the above there is a discomfort among many business executives who authorise the purchase of information systems. This is based on both the so-called culture gap and the fact that it is not always obvious how successfully information systems are being employed in the organisation. In addition there is a growing frustration with information systems departments which do not produce systems within budgets. Thus according to research conducted by Datamation [6] staying within budgets is the top issue for 1992. Similarly Duffy [9] points out that cost containment is one of the key issues for the year 1992.

What is really needed is a new paradigm for information management which introduces basic business principles through the commercialisation of the information systems department. In this context commercialisation means that the information systems department must develop an attitude and a means of performing whereby they achieve financial or other business results through assisting the organisation to minimise information costs and/or maximise the benefits to be derived from their technology. This is not the simple matter of introducing cost and benefit measurement procedures but requires that the information systems department and other corporate functions work closely together to achieve corporate objectives. This means removing the culture gap between these different corporate functions.

The following considers the areas or key issues which must be addressed if information management is to be commercialised and the success of this function is to be assured in the mid-1990s. The main ingredients of a commercialisation programme are the orientation of the ISD towards costs and benefits and to achieve this it will be necessary to remove the so-called culture gap.

4 Information Management in the Mid-1990s

To capture the essence of what is required to commercialise the ISD it is useful to consider three propositions.

The first proposition is:

Despite the enormous amount of new technology in the pipeline which is about to be delivered by the vendors there is already enough or even too much technology available and too many firms are over spending on it.

For the vast majority of firms, the current state of hardware is quite adequate. Many firms are already very substantially over supplied with hardware. This has occurred because traditionally the primary driver for hardware purchase has been the vendors promoting technological innovations. The vendors have worked very hard indeed to ensure that the use of hardware is supply lead. New systems are rolled out faster than most firms can reasonably absorb them. Vendors regard it as their sacred right to try to obsolete their own equipment as quickly as possible. The result of this is that many firms frequently experience much more hardware expense than is strictly necessary.

Upgrading hardware simply because it exists has become common place and this is a profoundly wasteful habit which needs to be curtailed. The exception to this rule of changing hardware can only be in the area of downsizing, which refers to substituting mini computers or even microcomputers for mainframes. More will be said about downsizing later in this paper.

The utilisation of current hardware should be maximised and all expenditure on new equipment strictly cost justified. This rule should also apply to strategic information systems which in the past have frequently been approved without much cost-benefit analysis on the grounds that it was essential to the survival of the firm.

The second proposition is:

There is a growing need for more and better applications.

What the information management profession needs most of all is a way of delivering more and better applications, for less cost and in shorter time-frames. Thus emphasis should be placed on much smarter software development. Furthermore the new systems required should be strategically oriented. They should use platforms of already acquired resources of hardware and software and data. Where possible they should be cross functional in nature. They should optimise the use of current data. These applications should not just simply computerise current manual procedures but should attempt to reshape the actual business processes required for financial success.

And the applications of the 1990s will be significantly different from those of earlier decades. In the first place there will be a much higher emphasis on integration. This will enable advantage to be taken of powerful systems components, modular technology paradigms and evolving organisational architectures. At the same time and on a less dramatic scale, integration will assist the firm in coordinating the industry value chain as well as its own internal requirements. To achieve this high degree of integration a much greater emphasis will be placed on information architecture and data resource management [24].

Artificial intelligence, especially in the form of expert systems, will continue to develop and begin to play an increasingly important role in new applications. This is despite the fact that expert systems have been seen as the snake oil of the 80s [19].

In this area of software development and communications more standards are required. Much work has been

done in this area and by the mid-1990s real benefits will start to be delivered. More software development tools are desperately needed. CASE needs to be perfected and then popularised. CASE is essential in order to be able to build the complex application which will be needed in the mid-1990s [39]. The time required to develop competitive systems must be reduced and CASE is one of the few ways available for this to be achieved. Re-engineering should become an accessible reality and users need more easy-to-use tools so that they may become more independent of information systems professionals.

The third proposition is:

Information systems professionals urgently need to develop management, business and communication skills as well as skills in enabling and directing change.

This is part of the process of bridging the culture gap as well as converting the information systems department from being reactive to becoming proactive which is essential if the firm is to realise major information systems benefits.

As information systems have an enormous potential to fundamentally change how business is conducted it is essential that information systems professionals be able to contribute to this change process. Of course it is not only the responsibility of information systems people to initiate change, but frequently they are called upon to play a major role in this respect.

This movement towards a higher level of skills and especially management skills is part of the continued general professionalisation of information systems management. This general professionalisation should of course be accompanied by a reduction in the culture gap between information systems people and other members of staff. Trusting relationships are the cornerstone to this process. It is exactly the opposite of the phenomenon described by Townsend, Grindley, Deckle etc. The next step after professionalisation is commercialisation which is the requirement of the mid-1990s.

From propositions to action in the mid-1990s

The first two propositions mentioned above are clearly to do with business basics, i.e. system costs and benefits. The third proposition is concerned with removing the culture gap. This is also a basic issue with direct impact on costs and benefits. Much of the wasted time and money in the 80s may be attributed to misunderstandings which were the direct result of the culture gap. Therefore the next step in bringing information management back to basics and to commercialise the information systems department is to convert these propositions to an action programme which focuses on three main issues:

- Reduce Information Systems Costs.
- Increase Information Systems Benefits.
- Develop Internal Partnership and Systems Ownership.

Reduce Information Systems Costs

There are few issues more basic in business than cost control, and ensuring that the information systems department make this a priority is an essential part of the commercialisation process. Keen (cited in [18]) believes that a big part of management concern about IT is directly to do with costs.

There will undoubtedly be much new technology available during the 1990s [37]. However it is important for firms to resist gorging themselves on this just because new features are available. The new emphasis should be on benefits and it is important that these benefits be delivered at as low a cost as is reasonable. It is most important to note that the argument is not that systems should be delivered at the lowest possible price. It is all too possible that in the pursuit of cheapness corners could be cut which frequently results in totally inadequate systems, which may then have to be replaced at great expense.

There are several new approaches to reducing information systems costs and minimising waste but whatever approach is taken it should be accompanied by a much more rigorous attitude towards recording all the major costs of information systems. This primarily means accounting for end user computing as well as information systems department costs.

Downsizing or Rightsizing The first of the new approaches is systems downsizing. Downsizing or rightsizing is a word which is sometimes used in general business to describe making large numbers of people redundant, but has become a term employed by computer professionals to describe swapping large systems for small ones. A number of firms have reported very substantial savings by replacing large hardware and software systems, usually a mainframe or a number of mini computers with a network of personal computers [34]. Downsizing implies using a simpler solution which does not require the substantial overhead costs of large scale computer technology. In a recent case study published by Management Report [22] the IS manager of Windhoek Municipality is quoted as saying "(Downsizing) is cheaper, easier and less painful than some anticipated, and it is working."

Downsizing may not only reduce on-going costs but can also release significant amounts of capital. There have been many cases where mainframes or mini computers have been sold and the funds received from these sales have more than paid for the new systems. The cost of operating small computers is very much less than the cost of big machines and thus on-going expense has been slashed.

Downsizing has in fact been a reality for at least 10 years with mini computers ousting mainframe machines, but the last two or three years has seen the arrival on the market of very powerful personal computers and workstations which have had a very significant impact on the way that some firms are now thinking about their total computer requirements. These machines are now running at up to 50MHz with virtually unlimited memory sizes. The disk storage capacity is also to all practical purposes unlimited with many systems having gigabytes of storage. It is anticipated that within a few years, perhaps by the middle of the decade, a 100MHz system with gigabytes of memory and terabytes of disk storage with microsecond disk access will be marketed as personal computers.

Another important downsizing driver has been the very substantial improvements in the performance of local area networks in the last few years. With high speed ethernet the door has been opened to replace large scale systems with personal computer networks. Ethernet is now readily obtainable at 100Mb/sec with much faster systems about to be released at affordable prices. Furthermore the recurring promise today is that within a few years fibre optic cable, which is one of the current cost constraints, will be as cheap as kite string, and this will mean even greater performance for these relatively small and inexpensive systems.

Of course the development in personal computers begs the question of what now should be the definition of a mainframe, a mini computer and a personal computer. Perhaps these terms are beginning to lose their value. There are those industry commentators who argue that there will always be mainframes, while there are those who ask what should a 400 workstation network, with multiple gigabytes of disk storage, running with response times faster than a traditional mainframe be called? There is much evidence of the general trend towards downsizing. The most dramatic evidence may be seen in the recent poor performance of IBM, DEC and several other hardware vendors. The older vendors selling large scale systems are now under significant financial pressure and it is not certain which of these firms will actually survive. It is clear that as the power of low cost systems increases so more firms will replace old large scale systems with smaller boxes and thus substantially reduce the cost of their information systems function.

Outsourcing Outsourcing is another relatively new word in the computer professional's vocabulary. It is a general word which can be used to describe the buying in of any computer resource, especially related to people, software or time on someone else's hardware.

Virtually all companies have outsourced to some extent over the years by either using a computer bureau, buying software packages or hiring contract programmers. However, today the word outsourcing is being used to refer to subcontracting out either all of the firms computing, or a large portion thereof. Thus outsourcing has recently become a synonym for what was previously known as facilities management.

To some firms outsourcing or facilities management is very attractive. It allows an organisation to focus on its core business without having to acquire a full range of information skills or cope with all the problems involved in managing a modern computer installation. According to Stair [36] "Outsourcing allows client firms to devote their own personnel and systems resources to those issues more vital to the ongoing success of the organisation."

Being able to concentrate on core business issues is one of the most frequent reasons offered today by organisations using outsourcers.

Outsourcing can be relatively inexpensive as the contractor can spread his overheads over several clients. Outsourcers frequently offer not only attractive rates, but also relatively fixed prices over the foreseeable future. Typical is an arrangement whereby the price cannot increase more than the consumer price index for the next 3 to 5 years.

Some outsourcers will also help the firm to make its balance sheet look much healthier. The big players in the field of outsourcing will purchase or buy outright all the organisation's computers as well as take over the contracts for all the information systems staff. In some organisations this selling off of the firm's computers can make a substantial improvement to the published balance sheet and profit and loss account.

Outsourcing also offers the organisation a degree of flexibility in that it can negotiate with the contractor to upgrade or renew equipment. The contractor may be willing to do this because the hardware and/or software may be usable at another of the contractor's clients.

It is argued by some that only firms which have very inefficient information systems departments will benefit from outsourcing. The logic behind this statement is that outsourcers make their money from rationalising inefficient operations which they improve both by economies of scale but also by employing better management practices and techniques.

Some firms have attempted to encourage their information systems departments to become independent and operate as a separate business. In some cases management buy-outs have been arranged with the information systems staff acquiring control of the new outsourcing services firm. This is regarded as a rather high risk strategy for all concerned, as information systems staff do not usually know much about what is required to operate a business. Furthermore, if the new independent business fails financially, then the original firm's computer system may be in jeopardy. For this reason the management buy-out option should only be taken with considerable caution. Large outsourcing contractors such as EDS, IBM and Andersens Consulting are undoubtedly a lower risk.

To take advantage of outsourcing however, the organisation must know precisely what is required from its information systems as well as be able to draw up a contract with an outsourcer which will ensure that the critical level of services it requires are maintained. This is normally achieved through a series of service level agreements between the firm and the outsourcer.

Both IBM and Andersen Consulting state that outsourcing is one of their biggest growth segments in the computer market and that this is likely to remain the case for quite some time.

Although outsourcing is a many faceted activity it is clear that many organisations can achieve substantial reductions to their information systems costs through this route.

There are of course other ways in which information systems costs may be reduced, but this paper has confined itself to addressing two of the more frequently mentioned approaches of downsizing and outsourcing.

Increase Information Systems Benefits

Benefits may be seen as the opposite side of the coin to costs, and alerting the information management function that it is imperative for information systems to deliver real business benefits, is an essential part of the commercialisa-

tion process.

Benefits is an issue which has been avoided by information systems professionals, consultants and academics for quite some time. The reason for this is that it is believed by many that benefits are very difficult to measure, and that it is becoming progressively more difficult to assess the value of information systems [28, 27].

The area of system benefits is usually expressed in terms of the fact that information managers are highly concerned with aligning the information systems strategy to the firm's corporate strategy. It is clearly very important to do this if the maximum impact is to be obtained from the firm's systems. Of course not every firm has an explicit corporate strategy or an information systems strategy and where this is the case it may be necessary to institute these.

Information systems benefits are derived from more than just strategic systems. They can in fact be derived from three quite different types of system. The three systems are efficiency systems, effectiveness systems and empowering systems. Efficiency, effectiveness and empowerment is sometimes referred to as the E3 taxonomy (J Scott Morton, cited in [31]. Each of these systems requires a different approach to both benefit measurement and benefit management. To maximise the possible benefits these different methods must be clearly understood.

Efficiency systems are those which are aimed at improving the firms resource conversion processes. This usually means that efficiency systems are focused at cost reduction i.e. using less resources to obtain the same or better result. They are the easiest to measure and to manage. Simple cost benefit analysis, taking into account cost displacement or cost avoidance is usually adequate to measure the results of these systems. Sometimes they are referred to as first generation systems and many firms have a large installed base of such systems.

Effectiveness systems are those which are aimed at providing better information which will allow managers to make better decisions which will lead to improved performance and therefore profitability. These systems are not confined to improving the resource conversion process but embrace a series of wider business issues which is sometimes referred to as the business dynamic. The business dynamic is said to embrace all the variables, not only cost issues, which must be managed if the performance of the firm is to be optimised. It includes marketing issues, personnel issues, production issues etc.

They are not the easiest systems to measure and to manage. They require a detailed understanding of how the organisation functions and the role of information in the management process of the business. A sophisticated business model stating how information is used in the organisation is a prerequisite to measuring the performance of such systems. Techniques such as decision analysis which traces the impact of information on the business processes are used to evaluate these systems. This is not a trivial matter and there are frequently considerable difficulties in measuring the effect of these systems. Sometimes efficiency systems are referred to as second generation systems. Many firms have implemented a number of such systems.

Empowering systems are those which are aimed at significantly changing the way the firm does business. This means that empowering systems are used or applied to reshape, re-configure or re-engineer the business. Although this type of system may address efficiency and/or effectiveness issues it is quite different in that it goes beyond the scope which first and second generation systems traditionally addressed. Empowering systems attempt to revolutionise [35] the way information systems are used in the firm.

When information systems have been used to reconfigure the firm massive improvements have been achieved. The Ford Motor Company have reported slashing their account payable department from 500 staff to 125 staff [14]. Mutual Benefit Life Assurance have reported reducing the number of staff involved with life policy production from 225 to 100 while at the same time issuing 20% more policies [16]. A case study in South Africa from a major insurance company also claimed great success with re-engineering. According to Management Report [21]

> "The benefits have been typical of re-engineering work, and have included staff reductions of 40%, less space requirements, faster turnaround, improved customer service and the ability to measure performance against defined departmental objectives."

Reengineering implies trying to get the most out of every dollar spent on information systems by using the systems in innovative ways. The emphasis is strongly on finding new ways of doing business. Frequently reengineering dispenses with old procedures which were only required because when they were put in place, information technology was not available. The concept of reengineering looks for information systems benefits on the widest front possible, including both cost reductions and improved customer service.

Under the heading of empowering systems, strategic information systems are often discussed. In fact some reengineering systems are definitely strategic in nature. But the concept of empowerment is wider than just systems which give a competitive edge. Nonetheless strategic information systems must also be borne in mind when looking for additional benefits.

There are a wide range of issues to be addressed in the search for information systems benefits and the above are only a few which a commercialised ISD must review.

Internal partnership/systems ownership

Cost reduction and benefit delivery are not really feasible on a sustained basis without there being positive relationships between information systems personnel and end users. Internal partnership means removing all the attitudes described by Robert Townsend and replacing them with positive working relationships. Without this positive relationship, substantial waste is inevitable if for no other reason than through misunderstandings. It is frequently misunderstanding which lead to delays in systems delivery and budgetary overspends. Thus the culture gap must be

closed and the principle of commercialisation is an important approach to this because it provides a basis of common interest to which both sides can relate. Commercialisation means that both users and IS professionals will be talking cost and benefits and not technology features. It means that the technology is not as important as the benefits which it may deliver. To make this commercial attitude work it is essential that internal partnerships be established.

Some firms are extending this concept of partnership to include top managers, users and information systems professionals and this is seen by these firms as a prerequisite for the effective use of Strategic Information Systems [5]. Without this three sided partnership there is little chance of the firm finding truly strategic opportunities for the use of information systems.

The involvement of top management is required for two reasons. In the first place it is essential to have top management as part of the team so that the efforts of the other players do not diverge from the strategic goals of the firm. Thus it is a top management role to ensure that strategic alignment is maintained at all times.

In the second place top management's involvement is required because despite downsizing etc, information systems are still very expensive and thus considerable funds are required. The size of the investment required usually means top management authorisation. The users are required in the triumvirate because they have intimate knowledge of the business and the ISD staff are needed to make the technology work. With anyone of these three groups uncommitted it is likely that a strategic information systems opportunity would fail.

Systems ownership refers to ensuring that it is clearly understood who owns the system. Systems should always be owned by their direct users and not by remote information systems specialists. Many systems failures have been attributed to systems being imposed on users without their consent. Clearly as an information system is a business tool it is essential that the users of the tool must be motivated to use it. If they are not, they will either not use the system or use it badly. Systems ownership starts at an early stage in the software development life cycle by having the future users propose the system, or if not then having them fully involved in the feasibility study, the analysis and design. It is also important that the users access the success of the system. They should decide whether the investment was well spent and whether further funds are required to develop the system to a more advanced stage. In some cases this may be quite hard work, but to ensure successful systems, user ownership is essential.

All of these partnership and ownership issues are basic concerns of commercially minded staff who see corporate financial performance as a critical issue.

5 Conclusions

Whereas the 1970s and 1980s may be thought of as the decades during which the ISD was professionalised, the 1990s is the decade in which it will be commercialised. There are many issues which will occupy the minds of Information Managers as they attempt to bring the information systems department back to business basics in the mid 90s. What have been addressed above are some of the main topics that constitute this commercialisation process and which will which will keep professionals, academics and consultants very busy over the next three to four years.

In general the mid and late 1990s are likely to be a very exciting and challenging period for information management with much to be gained by those who are successful. The primary focus will certainly be to use information systems to further the business objectives of the firm and this should be achieved in the most economical or cost effective way. Information systems cost, together with information systems benefits, i.e. the basic business concerns have become major issues. These cost and benefit issues may be regarded as the firm's consciousness of the need to ensure that it is obtaining value for the money it expends on information.

To ensure commercialisation, and therefore value for money in the mid-1990s firms will have to manage their information resources in innovative ways which will reshape the business, use information and data more fully and ultimately deliver real and measurable business benefits. This means that better costing systems and better benefit measuring and managing systems are required.

To make information systems work in the mid-1990s it is essential that the old culture gap problems described originally by Townsend and corroborated by Grindley must be eradicated. This means that new attitudes of commercialisation need to be inculcated into IT professionals as well as other line and staff managers.

The above amounts to a major challenge for IS management which requires a significant culture change, both in how the department functions internally, as well as how it works with other parts of the business. All this is within the capabilities of most Information System Departments as they proceed into the mid-1990s.

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