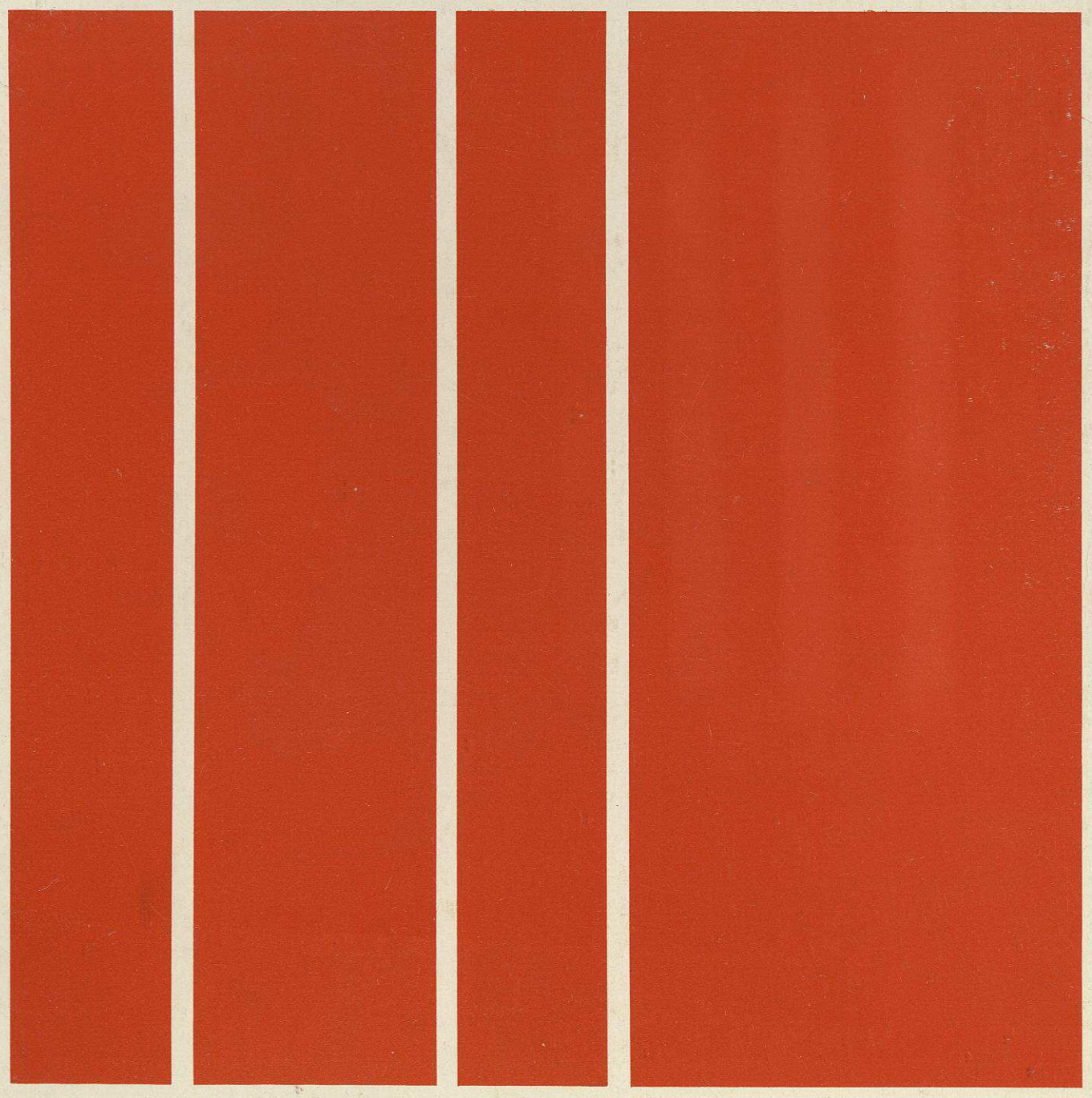
John Kinnear

Transcript

Management Conference

Birmingham
November 14 & 15 1979



The Butler Cox Foundation

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MANAGEMENT CONFERENCE TRANSCRIPT

Birmingham, November 14 and 15, 1979

Butler Cox & Partners Limited Morley House 26 Holborn Viaduct London EC1A 2BP

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CONFERENCE OPENING

David Butler,
Butler Cox & Partners Limited

Good morning ladies and gentlemen. For our last conference we were obliged, mainly for technical reasons, to drag you as far as the New York Hilton. I am sorry to have to say that next May it will be our painful duty to insist that you accompany us to Venice. Once in a while, however, we do try to make things easy for you, so here we are, in up-town Birmingham, offering, particularly to those of you who arrived by train, an unguided tour of the world's largest nuclear fallout shelter

Since we started the work of the Butler Cox Foundation, one common thread which has run through all our deliberations has been the role of the management services director and the function of management services itself. It is a critical role for a number of reasons; perhaps the most obvious is the one which was brought home to me a few years ago, when I was watching a political leader give a talk. He asked a rhetorical question: "Why do I stress the role of the navy in defence?" And a voice from the audience called out, "Because you are in Devonport!" Why do I stress the role of management services? Obviously because most of the people in this room work in management services and are concerned about its future role.

But I think there is also a corporate reason why the role of management services is a critical one. In Butler Cox & Partners, we can judge from the number of requests that we receive to mount seminars, discussions, training meetings for the boards of directors of our client companies, that interest in the management services function at the highest level in companies has, for the last two years or so, been rising and I think will continue to do so.

Perhaps it is a judgment on those of us who work in management services that this interest in the subject at top management level possibly owes more to television directors such as Edwyn Goldwyn, who made the film *Now the Chips are Down*, and to the late Chris Evans whose television series *The Mighty Micro* is now being shown in Britain. Perhaps it is a judgment on us that their awareness probably owes more to those gentlemen than it does to us.

Anyway, the awareness of the importance of management services at the top level in companies is there, and it is growing. The question is: how do we deal with it? How do we exploit it? How do we learn to bring together the unique blend of technical, economic and human factors which is required to provide effective systems for our organisations. We hope that the agenda put together for this conference reflects the importance of those three aspects: the technical, the economic and the human.

In opening the conference, I should like to offer you some brief lines of guidance. We in Butler Cox & Partners have a notice board in our office. It sometimes reminds me of the walls in the Great Square in Peking in that what you put up on the notice board seems to reflect gusts of philosophy and opinion within the company and also the popularity of the management. I pinched this from our notice board because I thought it might be useful to you. It is 15 lines of guidance to a project manager and I think they also apply to a management services director.

1: You cannot produce a baby in one month by impregnating nine women.

2: The same work under the same conditions will be estimated differently by ten different estimators or one estimator at ten different times.

3: The most useful and least used word in a project manager's vocabulary is . . .

4: You can trick someone into committing to an unreasonable target but you can't bully him into meeting it.

5: The more ridiculous the deadline the more it costs to try to meet it.

6: The more desperate the situation the more desperate the situatee.

7: Too few people on a project can't solve the problems; too many create more than they solve.

8: You can freeze the user's specifications but he won't stop expecting them.

9: Frozen specifications and the abominable snowman are alike: they are both myths and they both melt when sufficient heat is supplied.

10: The conditions attached to a promise are forgotten and the promise is remembered.

11: What you don't know hurts you.

12: A user will tell you anything you ask about; nothing more.

13: Of several possible interpretations of a communication, the least convenient is the correct one.

14: What is not on paper has not been said.

15: Parkinson and Murphy are alive and well — and living in your project.

We are going to begin the conference with a summary of some of the factors influencing the role of management services. To present this summary we have asked the partner in Butler Cox and Partners who is responsible both for the conduct of the research which goes into the Foundation reports and also for the conduct of research elements that go into our consultancy projects, Tony Gunton.

SESSION A

THE FACTORS WHICH ARE AFFECTING THE ROLE OF MANAGEMENT SERVICES

Tony Gunton,
Butler Cox & Partners Limited

Tony Gunton is in charge of all the research carried out for the Foundation and also for Butler Cox & Partners' consultancy clients. Since graduating from Cambridge University with a modern languages degree, he has spent 14 years in data processing and allied subjects as practitioner, manager and consultant. He is one of Butler Cox & Partners' founding partners and is author of several Foundation reports as well as a number of published articles and papers.

Ladies and gentlemen, what I should like to achieve in this presentation is to whet your appetite for the feast to come. Most of our speakers at this conference are not now management services people, although I suspect that most of them were pretty near to or actually in the environment for at least part of their careers. One or two of our speakers who are actually right in the thick of the action. My view is really the first of the outside views of management services based both on the sort of information that our research is turning up and also on some of our corporate views on the technology and systems possibilities, and so on.

To summarise the position of management services or, more particularly, of data processing — which despite the talk of other systems of one kind or another is still the major part of the management service effort of most organisations — it seems to us that data processing is facing a crisis of disappointed expectations. It is not necessarily that data processing is not tending to deliver anything of value, it is more that users do not perceive the value to the degree that one might hope. Users perhaps understand that they are getting something of quality but, for various reasons, they feel that they are not getting the quality that they are entitled to expect. Retailers often say that the customer is always right. I think that in the DP context what that means is that the user's disappointed expectations have to be met, regardless of the basic value of what he is being given.

If you put this crisis of disappointed expectations together with the fact that the role of management services is expected to broaden — and one aspect of that, the possible role of management services in office automation is what Michael Zisman will be talking about later — and if you also couple the limited credibility of management services with the pressure on management services to enter into new fields, you can see that some choices need to be made and some priorities need to be set.

In this presentation I will try to present convergence, which is really what we are talking about, in system terms, to try to suggest a way that the choices can be approached systematically rather than on an ad hoc basis. Just to summarise what I am trying to say about the position of management services, I imagine that many people are fed up with those who make clever comments about data processing because it is something that data processing has to live with, but when I was preparing this talk I noticed one that seemed particularly apposite. The comment was: Getting involved with our data processing department is like elephants mating: everything takes place at a very high level and the results take years to appear.

In fact that comment seems to me to put its finger right on the real problems in data processing. Firstly as most users see it, there is a remoteness about the whole operation, and secondly, that DP is not really able to deliver the goods in the quantity and in the time that users would like. Taking that as a starting point, I should like to try to develop it to see where that might be taking us and what impact the new influences on the situation might have.

I should like to run quickly over the major issues facing management services as we see them. I have divided this into four sections. First, I should like you to note that the scope of the responsibilities that management services might take on itself is very wide, and that itself represents a great danger. One could say that as people tend to belittle what management services does for them, at the same time events require management services to address itself to a whole range of issues. And some of these issues are new and some of them, for one reason or another, have not seemed too important before.

Management services battleground

People	Organisation	Environment	Technology
Systems productivity	Scope	Human factor	Convergence
Skills	User interface	Legislation/IR	Suppliers

Under the people heading, there is the obvious question of systems productivity. My own view is that it is not so much that productivity in the systems environment is poor, but just that it is not sufficient to meet the demands that are being placed on it — which I suppose in the end comes to the same thing.

Then there is the question of skills. We have a lot of skilled people in DP, I am sure of that. The question is whether they really have the right skills and whether they can be re-trained for the new tasks that management services might be planning to take on. Some of the later speakers will deal with particular aspects of that, such as Millard Collins on O & M. This question is something that goes all the way up to management level — we are not talking just about Indians with new skills. As one of the later speakers will, I believe, show, the data processing manager and presumably also his boss, will need to learn new skills and new attitudes.

Under organisation, the scope of management services is tending to expand. If convergence means anything, it must mean that some group has a co-ordinating role within the convergent areas that we are talking about. DP is the mainstay of operations so far; but what about telecommunications and office systems? Whether or not these are the province of management services is really the issue that we are trying to address here. Later today, John Pollard is going to talk about telecommunications which, although it is a part of DP, perhaps has not yet impacted management services to the extent that it might do in the near future.

Secondly, there is the question of who does what. At the moment the apparent entry costs into systems in general are low for almost everybody concerned. Suppliers can get into the business fairly easily because they can buy components cheaply. The range of skills and the amount of investment suppliers need in order to couple these things together into something that looks like a reasonable system are far less than if they want to get into manufacturing. Equally, users have access to this range of suppliers of cheap equipment and for them, too, the entry costs are very low. This raises the question of just what the interface should be between management services who traditionally have supplied systems and the users who are the consumers.

Third, environment. Data processing, right from its beginnings, has steadily been working

outwards towards the users, but now office systems probably have begun to force the pace and to make it clear that if systems are to be successful at all, they must be face to face systems, delivered right to the user's door. This means that when we are designing these systems we are forced to take account of human factors. We can no longer rely on some kind of buffer between the people who are using the services that we are supplying and the production shop itself. This buffer is convenient in many ways. It means that we can iron out the little idiosyncrasies of the real world to deliver to our production shop in the form that is convenient. Once that buffer is taken away there is a new element to the design of systems. Ken Eason will be talking specifically about human factors in systems design later today.

Perhaps events in this country will give the lie to this, but there have been signs that the legislative environment and the industrial relations environment are becoming much more difficult to deal with, and that systems need to take account of them. Many commentators have suggested that we are on the verge of a post-industrial society when the pressures that we work under are very different and also that social factors will perhaps increasingly influence both the way that we put systems together and what we ask them to do.

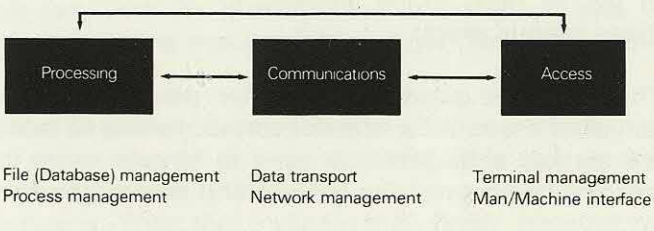
Fourth and finally, technology. The way that I see the technology at present is that it presents a problem of choice. Generally, for a given systems problem, the question that you need to ask is not "Where shall I get it?" but "How does it fit?". "If I choose this option rather than that, how does that affect what I have already and where does it take me?" If you are looking for a particular piece of technology for a particular problem, generally speaking you have a choice provided that you look round for it. But maybe the difficulty is in deciding what the implications of that choice are. That is an issue that I want to take up in more detail in the remainder of this presentation.

The important thing is, first, to be aware of the alternatives that are available at present. There always have been alternatives to the middle of the road products, but perhaps previously they have lacked credibility and have not obviously been cost effective. It seems to me that now, more often than not, the alternatives that previously were quite rightly looked on as a bit off-beat and rather risky, typically are both credible and cost effective.

One example of those is Xibus which Mike Bevan is going to talk about later this morning. I will leave it to you to judge for yourselves how credible and potentially cost effective you find that. But, in general, I think that one can say that there is a range of alternatives and they are credible ones; and they need to be evaluated and used where appropriate. I am really saying that you no longer need to think of yourself as being adventurous if you go beyond the obvious choices, because the obvious choices — just because they are obvious — are not necessarily any more, for that reason alone, solid and reliable choices.

That brings me to the theme of this talk, which is how we are to make sense of these choices. I should like to start from a fairly simple model of the information system. I have divided this model into three main functional sections: processing, communications and access. I want to make it clear at the start that to see processing as DP, communications as telecommunications, and access as office automation, gives a false view of the model, although it is easy to view it that way. These

Information systems functions



File (Database) management Process management	Data transport Network management	Terminal management Man/Machine interface

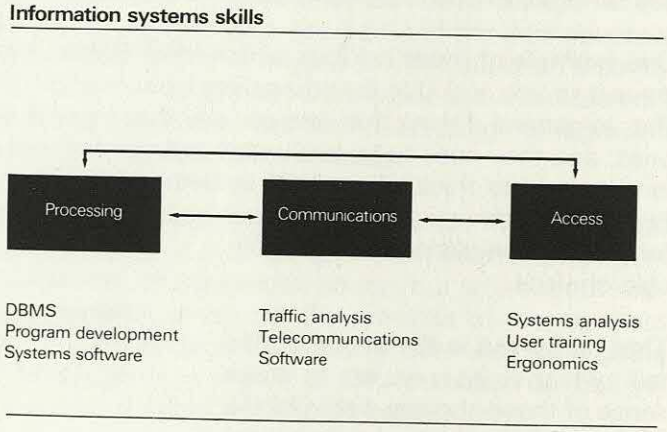
functions are all functions that DP has to concern itself with, and does concern itself with, in its present systems.

That does not necessarily mean that all the aspects of information systems need to be automatic. Where we started from — all the tasks represented here, processing which involves us in dealing with the information, getting it into the form that we need it, manipulating it and so on, is something that has always been done. We have always had geographical distances over which to feed the information. We have always had to take account of the fact that people will need access to this information — which, after all, is really the only reason for having the information system there in the first place. So really, in all these areas, we have a choice of whether we are going to do these things manually or automatically.

The arrows indicate the interfaces in which we then get involved. There is the physical interface between the processing function and the access function, and the communication system that carries the information about the organisation. We also have a logical interface across the top between processing and access. Clearly, to provide access to the information with which we are dealing, we need to coordinate the methods we use to get it in and we need to organise the methods we use to get it out. That is what the yellow arrow across the top means.

Across the bottom you can see some examples of the sort of functions that are actually involved in DP: processing, file management, database management, process management, deciding what we want to do with the information, and so on. Also, communications — data transport, network management. And on the access side, we have to manage the terminals themselves that people use to get into the systems and we have to deal with the interface with the people who are actually using the terminals.

Before I develop this theme further, I want to have a quick look at the skills which are involved in each of these areas, in setting up these information systems. Again, I have given examples from DP of the sort of skills that we need to ask our staff to apply in these different areas. The important point that I want to make here is that there are different skills involved in each of these areas. They are not only different, but many specialists have suggested that perhaps the skills in each area are so different that they require different types of people to do these tasks. So we are not necessarily able to push our pool of staff out into all of these areas and expect them to perform these tasks after re-training. Maybe it means that different types of people need to be involved in these various areas.

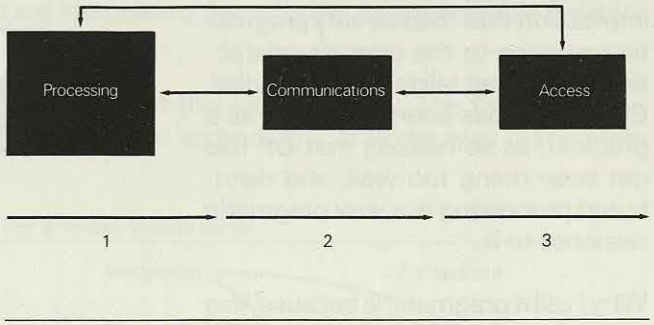


That raises the question of whether management services itself can reasonably expect to maintain all of these skills; and if it cannot, which of these skills it should choose to maintain. What are the key skills that you need to have in order to operate satisfactorily in the information systems business of the present and then of the future?

Before I develop this model further, I want to look at how the mainframe has developed. Broadly, one could summarise the development of the mainframe — which is the workhorse of data processing, and I suspect will remain so for some time — and say that progressively it has

moved its influence out from the processing section — which is the reason that we put it in first of all — into communications, in a fairly Mickey Mouse fashion initially. We put things out there so that people could get in, but it was not much more than a pipeline into our processing systems.

Development of the mainframe



More recently, we have put more power in the access area, with intelligent terminals and so on. I talk about it as though it was a recent development, but on-line systems that cover all of these areas have been in place for some considerable time. The point that I should like to make about all this is that our research indicates that the degree of satisfaction users have with the services that are offered tends to decrease the more remote those services are. That is a generalisation, of course; and by remoteness I am talking not only about geographical remoteness, but also about remoteness compounded of all kinds of things apart from how far away you happen to be from the equipment doing all the work. (In fact, the experience many of you probably had in checking into the hotel last night showed just how remote a local system can be.)

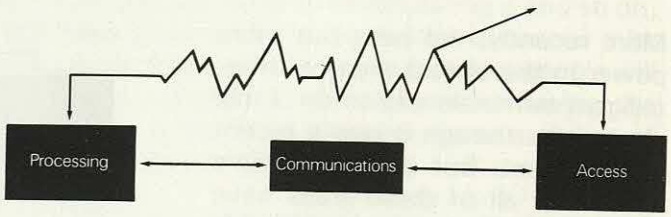
Going back to what I said right at the beginning, there is a clear sense of the remoteness of these services at present, coupled with an awareness of the value of the systems. The users to whom we talked in our survey and who filled in questionnaires are able, within a very short space of time, to say, "I am overcharged. The service is hopeless", and then say, "As far as the future is concerned, I see a continuing expansion in my use of computer-based services." So there is an obvious conflict there. It seems to us to suggest that users do not perceive the value of these services, because of all kinds of factors arising from the way that the services are presented. The services are perceived as being remote, and this causes user frustration, dissatisfaction and so on, which tends to obscure the clear understanding that the business in many cases cannot operate without those services.

What I am leading up to is the question that I should like you to consider, which is whether this progressive development through which we have seen the mainframe take us is really the direction that information systems should be taking. This really reflects the ability of the technology to cope with these things. It has found its way outwards as we develop the system skills and the equipment to cope with these different environments — processing, communications and access. The question is: Is the technology leading us astray now? Has it taken us so far and evolved in a quite natural way so far as its own capabilities were concerned, and should we now not be attempting to evolve any further? Should we be looking for a revolution in the way that our systems operate rather than a continuation of this evolution which, as I have suggested, is not apparently coping at this time with the problems out at the access end — which is the sharp end and the aspect of these systems that determines how the people using them perceive their value?

We have seen something akin to a revolution in data processing itself, and that is distributed processing. If I can represent distributed processing on this same model, this slide seems to me to summarise what distributed processing means. I think that people are trying to decouple the access to systems from the processing. What that means is that, firstly, because we are putting more power out this end — autonomous power that can cope flexibly with the demands of users — clearly we improve access to the facilities. Also, we reduce the need for communications.

The cost to us is interface problems between the processing — typically now carried out on a centralised basis — and the access systems — the devices that we are putting out at the sharp end. This is something that has been going on for some time.

Distributed processing



Benefits - Better access
Less communications

Cost - Interface problems

In talking to people who are implementing this type of system, I get the impression that this is a very pragmatic response to the user dissatisfaction that I was talking about earlier. Clearly this has been perceived as a problem, as something that DP has not been doing too well, and distributed processing is a very pragmatic response to it.

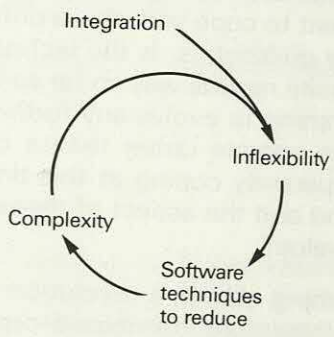
Why I call it pragmatic is because, in a sense, it really goes against the grain. The thing about this development of the mainframe that I talked about earlier is that it really pushed the integrated system progressively out to the users. It meant that as we pushed the power of the information system out towards the user, we were still able to control the whole environment: we still had an integrated system.

What distributed processing does is to start chopping the thing up. So in that sense it very much goes against the trend in data processing from its earliest days. I suspect that that probably is the aspect of distributed processing that worries a lot of DP and management services people. Their worry is summarised by the yellow line across the top. The worry is that, by doing this and improving the access systems, we will start to lose a lot of what we have built up over the years in our processing systems. We will get noise on this interface, or possibly even go off altogether. We will lose the ability to get some kind of synergy between the information systems that we have built up and the user facilities that we are putting in at the same time.

The question that arises is whether the DP industry can be expected to pull itself together and give us the best of both the mainframe world and the distributed processing world; to give us the ability to meet users' demands in a very flexible way by putting the equipment right where it is needed so that the users can influence the way the equipment operates, whilst at the same time getting the benefits of the integrated systems that we have been building up for a long period of time.

Before trying to answer that question, I should like to present what seems to me to be happening to software and, in more general terms to systems, at the present time. What seems to me to be happening is that, as we have built up these integrated systems, we have learnt how they best need to operate, as we have perfected them, and as a result of the very nature of integrated systems themselves, we have built a great deal of inflexibility into the systems. That, as much as anything, is where users feel that our mainframe-based systems are at fault.

The software vicious circle



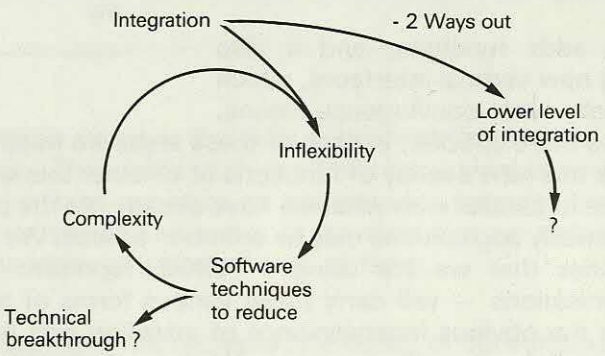
The DP industry's response to that inflexibility has been to use various software techniques designed to build the flexibility back in. In theory that is all very fine. Unfortunately, we then get

very complex software systems. Complexity itself is a form of inflexibility. If we couple the complexity of the integrated software systems that are being implemented today with the shortage of skills, it leads us directly into a vicious circle. If the flexibility is there and we do not have the people to exploit it, then effectively it is not there at all.

I am not necessarily suggesting that software and systems technology is not making any progress. Perhaps what I am suggesting is that we might be getting towards the limit of what we can do with our integrated systems; that we are making them totally unmanageable if we try to go forward much further.

There are two ways in which we might try to get out of this vicious circle. The first would be through some kind of technical breakthrough in software technology, or in the way that people design systems. Probably many of our suppliers would like us to believe that that will happen, but I for one would not stake my job on such a thing coming about.

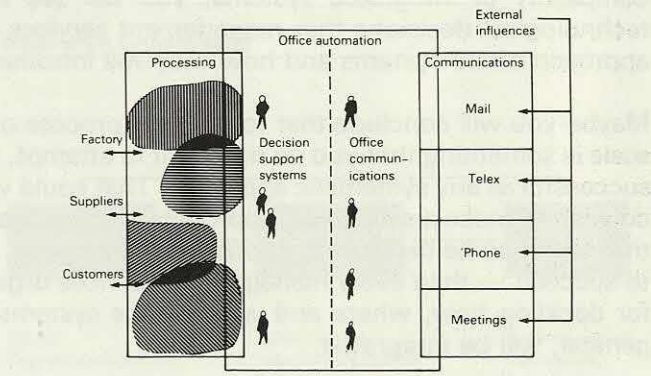
The software vicious circle



The other possibility is that we deliberately opt for a lower level of integration in the systems that we implement. Here again I suspect that our traditional supplier would not be so keen on that way out, and probably neither would be many of our technical managers who thrive on the sort of systems that I have been talking about.

So far, I have talked about data processing only. I should like to add on to that some comments about office systems. First, may I remind you of the way that David Butler presented office systems at the New York conference. In no sense is it a total departure from what has been going on before. It is a way of making up for the deficiencies of systems in the DP environment, with limited connectivity between them, nor an ideal interface with the people who have to use them. I think that the same is true of the communications systems that we have in place today. The office systems are there for these people in the middle who have been using these processing and communications systems for some time and have found their way round most of the deficiencies. But now it appears that we have the technology available to address these deficiencies and to make the jobs of the men in the middle there, in offices, a little easier.

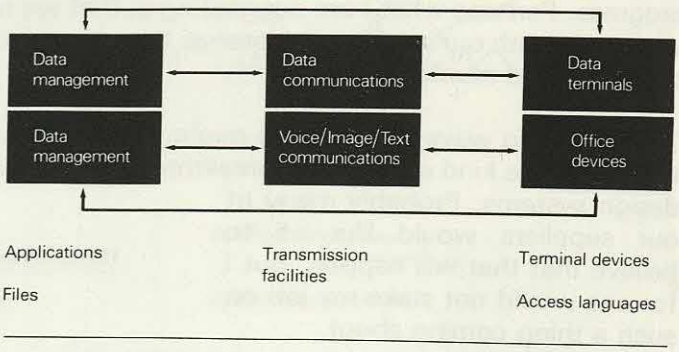
Model of the business



If we look at office system in terms of the information systems model, quite genuinely it adds a new dimension to the systems problem. We have various new functions in these different areas. Presumably at some stage we are going to process documents as well as data, although in a sense DP always has handled documents. After all, an invoice is something that you stick in an

envelope and put in the mail. But probably we are talking about dealing with much less structured information than we have done previously in DP. We have other forms of information to carry about the place. Voice, of course, always has been an important component of our communications systems; also image and text that we presumably will want to communicate about the business in the way that we have communicated data and voice in the past. We are probably thinking in terms of introducing new communicating devices into the office, possibly alongside the data terminals that are lying about the business now.

DP & office systems - Integrating factors



This adds functons, and it also adds new vertical interfaces, which is really what convergence means. To be more specific, in each of these areas we need to consider whether we are going to integrate this new overlay of functions or whether this is a new set of information systems that just reside in parallel with what we have already. At the processing end, files may be common, and potentially applications may be common as well. We have to consider whether the transmission facilities that we are using — which represent a pretty expensive fixed asset in most organisations — will carry these various forms of communication. Out at the sharp end you have the obvious inconvenience of installing side by side terminals for our data systems and terminals for our office systems. We have the problem of how people deal with these systems, and the languages they use. We have to decide whether we are going to look for common languages or whether we are going to keep the things apart.

It seems to me that in many of these areas where we might integrate our systems we need to think about whether they cut across the traditional organisational boundaries and also cut across many skills boundaries. If you take this together with what I have been saying about the complexity of integrated systems, you will see that these are likely to represent the key technological decisions that management services people have to make about how they will approach office systems and how they will introduce them into the present organisation.

Maybe you will conclude that to plan the process of introducing office systems on this sort of scale is something that you do not want to attempt, and that ad hoc decisions are likely to be as successful as any systematic approach. That could very well be a valid view. Assuming that you do wish to make a systematic approach to office systems — and considering the credibility gap that seems to be developing about data processing, nothing but a systematic approach is likely to succeed — then every management services organisation does need to have a set of criteria for deciding how, where and when office systems in particular, and information systems in general, will be integrated.

At the top must come the business requirements. That is an obvious thing to say, but it is important nonetheless. It is all the more important in the present circumstances to recognise what these requirements are and not force them into the mould that technology encourages us to. We now have enough choices available for this no longer to cause difficulties. But we must also operate in the real world. We cannot make our choices solely on the basis of business requirements because we have got to get the technology to meet the needs and we have to make it work. So we must take account of the supplier capability — of where he is likely to take us, of what he is really able to take care of for us and what he cannot take care of for us. That sets the limit on what we want to do.

We must try to build systems that the people we have available are capable of putting together and managing. This represents something of a "Catch 22" because a lot of the interest for technical people in management services is in the integrated systems that they have built so far, and if we try to cut our coat according to the cloth available we risk losing the most able of the staff that we rely on now. What I am saying really is that perhaps we need to give serious consideration to approaches that probably would seem unsophisticated at present. But by taking some of these approaches perhaps we will cut down the risk of outrunning the skills that we have available.

Integration criteria

Business requirement

Supplier capability

In-house skills (catch 22)

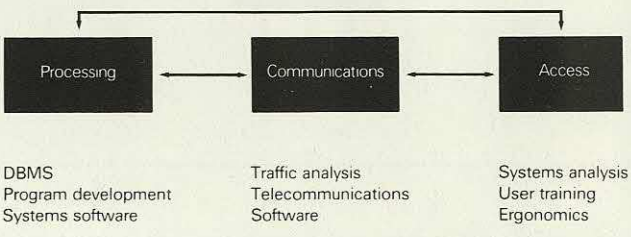
Division of responsibilities

Finally, there is the question of the division of responsibilities. We need to consider who has the skills in the organisation and who can best bring them to bear on the problems. That deliberately is a fairly naive view of how we will make decisions on these questions, because we have to operate in a complex human environment. But for the purposes of this presentation it sums up the view that we should be trying to take of these systems if we are to make any kind of a go of them.

I should like to emphasise that what I am saying is not necessarily a denial of convergence or coherence, but we do need to consider very carefully how we are going to get there. Convergence is not an end in itself, but a means to an end. If we adopt the wrong means we risk nullifying the end altogether.

I should like to remind you again of the range of skills that are involved in putting together information systems. What I would suggest to you is that typically the skills in data processing — which probably often means the skills in management services — are concentrated towards the lefthand end of this schematic. Clearly, office systems will demand that we push the skills up to the righthand end — the sharp end. It also means that we must be flexible in the way that we apply the skills that we have available. We must consider how many of these skills are available in-house, and if we cannot sustain them all in-house where we are going to concentrate our efforts.

Information systems skills



I believe that, in putting together coherent systems, integration is not a necessary condition. To some extent I believe that the almost unstoppable trend towards more and more complex integrated systems has been created by an unholy alliance of suppliers and technicians whose interest is too much in the technology and not enough in the systems themselves and in the business needs that the systems are trying to serve.

I believe that the tools are available to build integrated convergent systems. The problem is choosing the route to get there. If I may use a homely analogy to sum up what I am trying to say, if you look on office automation as a baby that we have got to get washed, you could say that at present in most organisations we have already got a bath that we have been using for some time. We have washed a lot of babies in it. As a consequence, the water has got a bit dirty. The temptation then is to say, "Leave this baby strictly alone; leave it to wash itself." In some cases probably the temptation is to say that we will throw the bath out altogether, muddy water and all, because it has not met expectations.

It seems to me that we need to get clean water in the bath before we can get the baby washed. By this I mean that office systems really do present an opportunity to take a new view of data processing. And unless we take a new view of data processing, then we will miss the boat altogether.

SESSION B

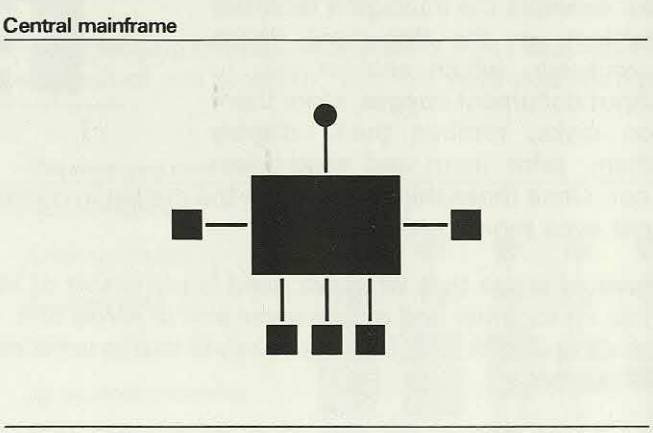
AN INTEGRATED CORPORATE SYSTEMS ARCHITECTURE — OBJECTIVES AND IMPLICATIONS

Mike Bevan,
Xionics Limited

Mike Bevan is Managing Director of Xionics Limited, a microprocessor systems development company. Most of his eighteen years in the computer industry have been spent in establishing systems and manufacturing activities for large organisations wishing to diversify into advanced computing technology. He has also served as chairman of the trade association for the software industry, as a referee for Science Research Council grant applications, and as a member of the Advisory Committee for the Advanced Computer Technology Project of the Department of Industry.

Xibus is a development that Xionics is undertaking at the moment and we are nearing completion on it. It is a sort of architecture and aims to provide a strategic view of a possible solution to the problems of convergence.

Let us start by looking at the way that architectures have developed over the last 15 to 20 years. In the 1960s this is what passed for an architecture. It was all very simple. There were comparatively few suppliers and they all produced more or less the same thing, and life was very straightforward in those days.

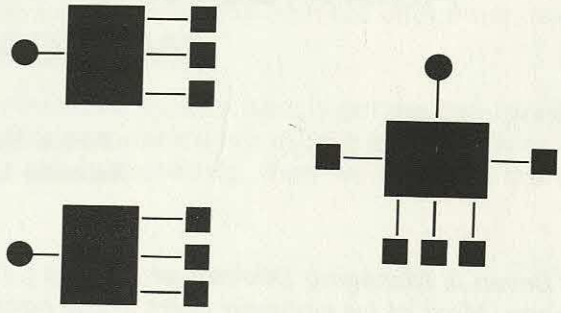


In the early 1970s, the mini began to become respectable. An early example of the introduction of minicomputers into organisations was typified by key to disk systems. That might represent a typical arrangement of equipment in a medium size or large organisation some years ago. Even in those days, problems of data compatibility and data transferral were beginning to manifest themselves, and it is still the case that if you want to get data from your key to disk system to your mainframe, the way you go about it is to take the data off your disk file, where it is put initially, and transfer it to an industry-compatible magnetic tape. You do a manual transfer of that tape to the mainframe; read it in off the tape deck on your mainframe and write it back out to a disk drive. That does not make very much sense if you look at it in terms of the actual functions of the equipment.

That then began to grow and other minicomputers began to work their way in, for various purposes. They offered cost/effective solutions to localised problems. Then

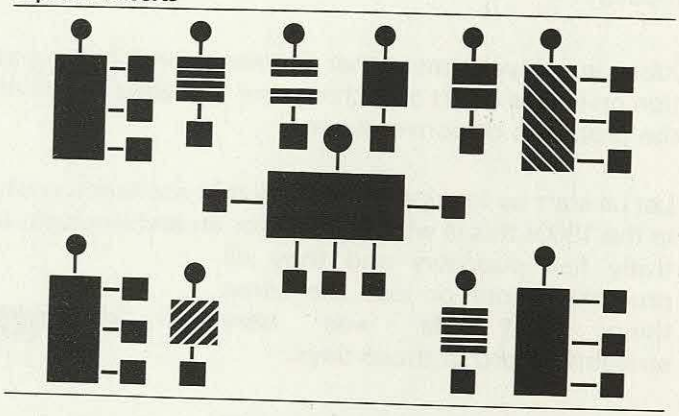
came the beginnings of word processing. Organisations have begun to experiment; they probably have either a Vydec or an AES, or both around the place, purely on an experimental basis. The latest phenomenon is the microcomputer, and Pets and Apples are now beginning to spring up all over the place, quite often without the knowledge or participation of the management services organisation. In the meantime, the OR department has its Hewlett-Packard, and one or two other things are slipping in, too.

Central mainframe plus



Where we have got to now is what one of the audience described to me as "liquorice allsorts". I do not think that is an exaggeration, nor is it the end of the road. The small £2,000 system that it is very easy for any line manager to afford out of his budget will be the £1,000 system before very long, and then the £500 system. It will be very difficult to stop these systems coming in.

Liquorice allsorts



Beyond that, even newer forms of information processing systems are under development at the moment, for example the intelligent facsimile system, or the document image processor, which enables you to input document images, store them on disks, retrieve them, display them, print them and send them out. Once those things are out in the market in quantity from multiple suppliers the situation will get even more confused.

I would argue that what we need is some sort of imposed structure, something which brings that lot together and makes some sort of sense of it. I will argue from a long term viewpoint first of all, and then later I will try to relate that to what organisations already have in terms of pieces of equipment.

So let us look at the sort of characteristics that in an ideal world we would specify as the properties of the architecture that we would like to see operating by the late 1980s. By "comprehensive" I mean that it should be capable of coping with any form of information that the organisation might wish to process electronically. Not just conventional computer data but also word processing data, software, digital representations of documents, digitised speech, graphics, and digitised video in due course.

By "non-stop" I mean that it should be 100% available. As you attach more and more systems to this architecture, its continued operation becomes more and more critical to the continued operation of the company. It is not like putting the payroll run back for three or four hours on a Thursday afternoon, it is much more fundamental than that: it means that the managing director cannot get at his letters.

It must be secure. It must look after the data that it passes around. It must not let that data be accessed by people who are not authorised to access it. It must protect the data from accidental corruption and accidental loss.

Ideal architecture

1. Comprehensive.
2. Non-stop.
3. Secure.
4. Very high throughput.
5. Open.
6. Presents unified view of corporate data.
7. Exploits low-cost technology.

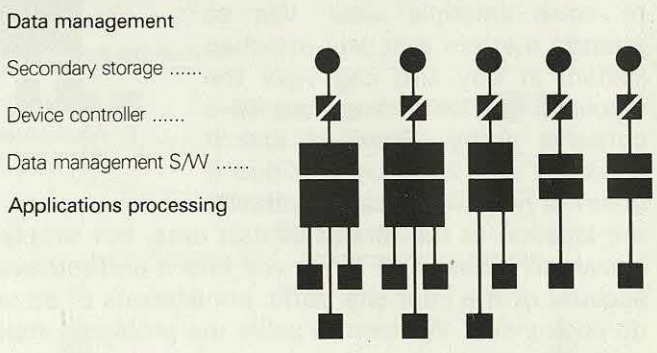
Very high throughput. When we are talking about digital representations of documents, we are talking about very large pieces of data. An A4 sheet scanned by a facsimile scanner with a resolution of 100 lines to the inch produces about a megabit as a gross data format. That can be compressed, and it will be compressed more and more as better compression algorithms are produced. But it will still be a very large piece of data that is sent off to your database, is sent through the system and is retrieved by users for display. Digital speech will produce massive data throughputs as well; we are talking about 6,400 bits uncompressed per second coming out of a speech digitiser.

By "open" I mean that it should not be a locking-in strategy replacing the locking in strategies that you already have; it should enable you to attach to the architecture whatever foreign bodies you wish to buy. You should be able to continue to buy the systems that you want to buy from whoever takes your fancy as a supplier.

"Presents a unified view of corporate data" is to some extent self-explanatory, but I shall explain in more detail what I mean by that later. "Exploits low cost technology" again is obvious and self-explanatory.

I want to lead into the rationale for Xibus by rearranging the liquorice allsorts that I showed you before in such a way as to suggest some way out of this problem. You will note that we have the same processing systems. I have put them in line and I distinguish between something called data management and something called applications processing.

The underlying structure



Applications processing is the thing which is different as between each application, as between each use of the architecture as a whole or each use of the individual system. Data management is the thing which all of these individual systems have in common — they all need it. It is in the distribution of the data management function that the problems arise. Applications processing can be done wherever it is appropriate to do it. We argue that it is the spreading of the data management function around these small systems that is causing all the problems.

Just to be quite clear, by "data mangement" we are talking about everything to do with the storage and retrieval of information from secondary or tertiary storage devices. We are

talking about all of the provisions that are made for the security and privacy of that information; and we are talking about everything to do with the communication of that information between the systems and between the users.

Data management

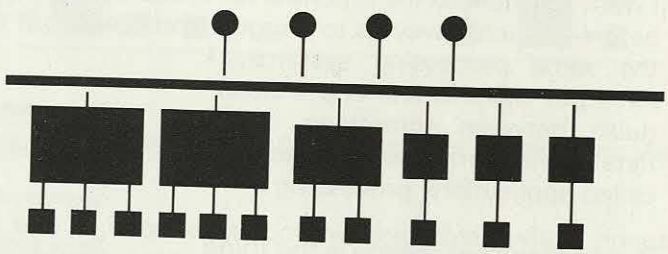
1. Storage & retrieval.
2. Physical & logical organisation.
3. Security & privacy.
4. Communication.

What we have done in the computer industry is to take that common set of facilities and implement it separately on each processing system or subsystem, differently on each system. And on all but the best mainframes we have implemented it inadequately. The provisions for data security and privacy on the small systems are virtually non-existent. I have lost track of the number of horror stories that I have heard about users losing floppy disks, treading on floppy disks, and spilling coffee on floppy disks, and not bothering to copy them at the end of the day because the machine did not break down. I expect we have all seen the word processing system which has a drawer underneath, with 50 or 60 floppy disks in. Yes, the typist knows where the data is, but what happens when she is on holiday?

So you will be ahead of me by now. The Xibus concept is based on taking the data management function away from the individual application systems and providing it as a unified corporate resource. It is not, of course, suggested that you put all your data and data management at one site for the whole of the geographical spread of your organisation, but that at a particular site you centralise the data management and the data functions.

Xibus

Data management



Applications processing

The principle of Xibus is extended to cover multiple sites. We so arrange matters that any attached system at any site can view the whole of the corporate data as a cohesive entity. Provided that it accesses that data by a Xibus it does not need to concern itself with the location or the format of that data, but simply addresses it by some name by which it is known to Xibus, and Xibus will find it and retrieve it. Yes, of course, somebody has to take account of the inter-site traffic implications of an architecture of that nature, but they have to do so anyway. We cannot solve the problems imposed on us by the Post Office.

Let us come to what Xibus actually looks like in terms of its internal architecture. This is a very superficial and simple diagram. The top ring is Xibus itself. It is a ring structure. We looked at numerous ways of interconnecting multiple functional processors and we are pretty sure that ring structures are now the best way of doing it. The central ring — the top one — sits in a cabinet and goes quite fast, as we will see in a moment. There are identifiable functional processors attached to it, carrying out its integral functions. The database manager (DBM) — that is the processors — does what you would expect of a database manager: it looks after security,

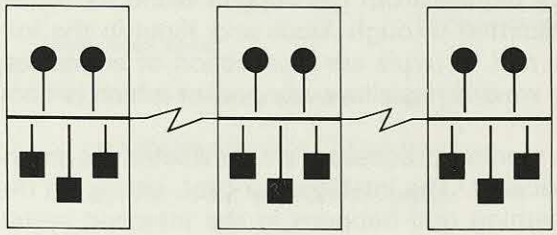
privacy and access. It generally manages the data manipulation operations of the Xibus system at a particular site.

LBC is the logical backing store controller, which is a rather long name for a logical disk controller. We will also be able to control other forms of secondary storage device, for example, tape decks, with an LBC. The monitor processor attends to a number of matters. It looks generally after the house-keeping of the system. It is the point to which the system reports any faults found in its internal operation. Also any unusual user behaviour is informed to the monitor processor. It provides the database administrator with statistics about the growth of system traffic, the usage of physical disk space and so on.

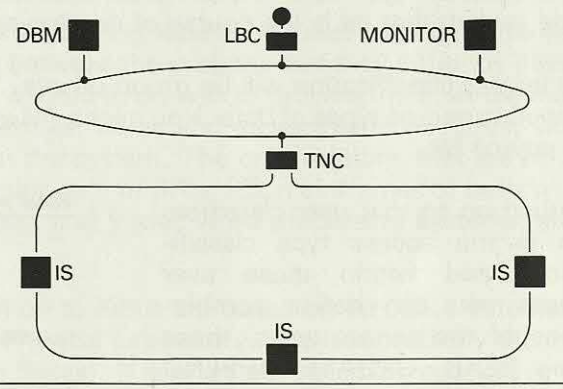
Round the front of the Xibus ring is the terminal network controller (TNC). That controls Xinet, which is the ring which goes around the building and manifests itself in the offices of users in the form of something called an intelligent socket. You can have as many Xinets and as many intelligent sockets as you wish, obviously up to the point at which the traffic becomes a problem.

Let me show you in more detail what it looks like. Rings are beautifully simple architectural structures, but they are not resilient shapes. If you cut a ring, you lose everything on it. So we duplicate the Xibus simple ring. In fact we go a great deal further than that. The two rings constituting Xibus are run completely in parallel. There is no question of automatic switchover on failure, they are run totally in parallel.

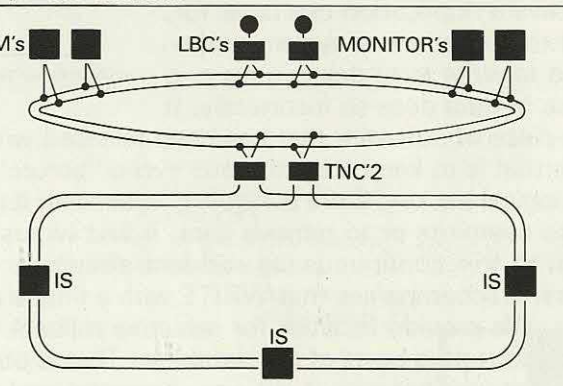
Multi-site Xibus



Xibus/Xinet basic shape



Xibus/Xinet architecture



We provide between those two rings continuous crossover paths, operating in both directions, and effectively that simple Xibus ring is quadruplicated. We can lose most of both rings and there will be no degradation in system performance.

We attach every external resource to both rings and we duplicate every external resource; and so every function that is carried out by Xibus is carried out twice. The DBMs both act quite independently, simultaneously upon the same command or message from the outside world. The logical backing store controllers are duplicated, and the disk drives that they control are duplicated. That means that every piece of data that is stored within Xibus is stored twice, and every request from the outside world for a piece of data results in two responses. All data is transmitted through Xibus and Xinet in the form of 256 byte packets, of which 240 bytes are data and 16 bytes are a collection of addresses, flags and check sums which make quite sure that we will not allow any packet which is damaged or in error to pass through the system.

The monitor processors are duplicated, as are the TNC's. The Xinet ring or rings themselves are duplicated. The intelligent socket, sitting on the wall of the user's office, sits on both rings. If something odd happens in the attached system and the user suspects the communications path, he can switch his system over to the alternate ring and his presence there will be automatically detected.

Access to Xibus is fairly stringently controlled. The security system enables the user to define the data in various ways. He can define data as multi-site public. That means that anybody, at any site, can access that data. He can define it as single-site public, which means that only systems or individuals at the site at which the data is located can access that data. He can define the data as being private to a particular individual. These might be his half-written reports or some system that he is the course of developing and is not yet ready to release.

The largest classification will be group private. You can define groups of individuals who are allowed to access types of data. You might, for example, allow the payroll department to access the payroll file.

Mapped on to that user classification is the access type classification. and within those user classes you can define combinations of the access types, these being READ, UPDATE, APPEND and BLOCK.

Xibus access

User classes:	Access modes:
1. Multi-site public.	1. Read.
2. Single-site public.	2. Update.
3. Individual private.	3. Append.
4. Group private.	4. Lock.

Extending the security provisions still further, there is a class of data corruption which no amount of hardware duplication can cater for, and that is where a system authorised to write to or delete a file or a piece of data does so incorrectly. It is a piece of software that has been released with a bug in it, perhaps. The way that we cope with that is to keep a continuous cyclic "before" image transaction log. That is maintained by the logical backing store controller. Whenever it receives a command, the effect of which would be to overwrite or to remove data, it first writes a copy of the piece of data in its unamended form to this continuous log resident elsewhere on the same disk drive and not accessible to users. It accompanies that WRITE with a time stamp and the identity of the updating system or user. We provide facilities for selective rollback of those update transactions so that you can undo corrupted parts of the database. That is obviously a facility available only to the database administrator because it is a very powerful tool and a very complicated tool to use.

I will now flash up some general statistics about Xibus. I do so not in order to enable you to compare it with any other form of processing system, because that would be like comparing chalk with cheese. It is a fast, powerful system, but it would be no good at doing the sort of

things that your 370 does. The gross data rate on the central ring of 40 megabytes per second takes into account the fact that we have quadruplicated the central ring, so the effective data rate is one quarter of that — 10 megabytes per second. That is equivalent to 40,000 packets per second.

Throughput

Basic Xibus system:

1. Gross data rate on central ring: 40 megabytes/sec
2. Xibus effective data rate: 40,000 packets/sec
3. Xinet effective data rate: 4,000 packets/sec
4. Gross computational throughput: C. 330 M.I.P.S.

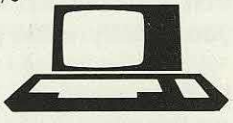
On Xinet we are talking about a data rate of one-tenth of the Xibus data rate, which is 1 megabyte per second on Xinet. It is a parallel transmission system. The gross computational throughput is based on the fact that there are all sorts of high-speed processors buried inside Xibus that were not on the diagram, partly because I am not prepared to tell you about them. These are processors which we have designed to carry out the very fast logical and arithmetic operations that are necessary on data as it enters the system and passes through the system.

That broadly is Xibus and Xinet. The users that are buying Xibus and Xinet will take some years to sculpt the software and hardware interfaces between the systems that they currently have — their mainframes, minis and micros. What we wanted to do was to provide them, in the meantime, with some set of usable facilities, resident on Xibus and accessible from Xibus, which would enable them to get immediate use from the system. The organisations that are buying Xibus require over a period of time the connection to it of 370s, ICL mainframes of both types, Honeywell mainframes, Univac 1100s, Wordplex and Vydec word processing systems, and a variety of smaller beasts.

So the facilities which we have decided to put on to Xibus are based on an office automation system which was developed at the National Physical Laboratory, and it is probably the most successfully used office automation system in Britain. It is a system called Scrapbook. It was developed during 1972 and 1973 as a research project at the National Physical Laboratory, and it has been in use since 1973 by about 300 people at NPL, the large majority of whom are not computer people; they are clerks, researchers, managers, directors and typists. With the cooperation of the National Physical Laboratory, we have taken the facilities that they have there and reimplemented them on Xibus.

Basic workstation

1. CRT display.
2. Usage mode selection.
3. General purpose keyboard.
4. CPU (Z80).
5. 16-64K BYTES memory.
6. Interfaces: Printer
   Facsimile
   Digital speech I/O



Those facilities are made available to users through an intelligent workstation which we are also developing. That is what the basic workstation consists of. It is a 15-inch, green phosphor, high resolution, cathode ray tube display. I will come back to usage mode selection in a moment. It has a general-purpose keyboard, a Z80 processor. As standard it would have 32K bytes of memory, but you can upgrade it to 64 currently and more than that in due course. It has a variety of interfaces to permit currently the connection of printers

and, in due course — when they become available — facsimile input and output devices and digital speech. We shall certainly be providing facilities for digital speech insertion through the workstations, initially for the purpose of recording spoken data in the database and retrieving it, also for sending short, spoken messages to other workstations. But in due course it will be possible to have simultaneous, two-way conversations, using digital speech, between workstations.

The workstation modes are these. They are mutually exclusive and we hope that they are comprehensive. A lot of you will probably know that most of the thinking in the direcion of multi-function workstations is along the lines of modal segregation, to simplify the use of the workstation for the many classes of user on whose desk it will materialise.

Workstation modes

1. Display.
2. Edit.
3. Process.
4. Communicate.

I should like to take you through these modes, one at a time, in some detail, to give you a feeling for the sort of integrated system that we are trying to put together. In display mode, you can simply call for things to be displayed on your workstation by typing in their name. Every piece of data, whether it is a couple of fields or a large collection of data, which you can access through Xibus, has some name by which it is known to Xibus. It may not be resident within the Xibus database, it may be resident in the database of an attached system; and in that attached system it may be called something entirely different. But the name by which you access through display mode on your workstation is intended to be some familiar name, some name meaningful to people in the outside world.

After you have called for it, it is retrieved and brought back to your workstation and displayed. If it is a piece of text, it is simply put on to the screen of your workstation. If it is a coded record,then it will be unpacked in a manner that I will describe later, and it will be displayed in some user-comprehensible manner.

There are other things that you can do in display mode. You can look at the Xibus directories. The directories are the index of all data that Xibus knows about within its own database and within the databases of attached systems at this site and elsewhere. These directories are maintained essentially in readable format; provided that you are allowed to look at the data to which they refer, you can look at the directories. So you can find your way around the database by looking at these directories.

Another thing that you can do in display mode is to look at your trace record. Everything that you do at your workstation is recorded, not in order to keep a check on whether you are doing naughty things because that is catered for elsewhere, but as an aid to memory in case you forget what you were doing last Tuesday afternoon or what you called that new record or file that you created. When you want to you can look back through your trace record and it will tell you exactly what you were doing.

Finally, in display mode you can receive messages; but that will not make sense until I have explained communicate mode. In edit mode, you can alter documents. These will be textual documents which you have security permission to alter. I must stress that in providing these edit facilities we are not seeking to compete with conventional word processing systems; these

are a collection of simple editing commands, suitable for use by ordinary people, the sort of people who would not normally be seated at a Vydec or a Wordplex. You can insert and delete characters, lines and paragraphs, and you can copy things and change them round in a very simple manner.

In process mode you cause to be executed in your workstation or elsewhere some process. "Elsewhere" implies the collaboration of elsewhere, and I will come back to that in a moment. What happens when you enter process mode will be user organisation dependent, but typically what you will see is a menu. The menu might say:

- accounting processes
- statistical processes
- utility processes
- compilers

and so on. You would work your way down through this menu of choice until you came to the actual thing that you wanted to execute, which would then be resident in your workstation — or at least the first part of it would be.

If the piece of software that you want to execute is aware that it has the option to execute in your workstation or elsewhere, it will ask you where you want it to execute; and you can choose your workstation or you can specify generally "elsewhere". The database manager will find an "elsewhere" appropriate to the piece of software to be executed, for it to be executed, and will attend to transmitting the necessary JCL or equivalent to get that done.

Communicate mode is all about electronic mail and electronic memos. Again, you proceed through a menu of choice when you enter communicate mode. You can send a message which you may just have created on the screen of your display, or which may be some piece of data already resident in the system. You can send it to a user, identified by his user identity. That is an expression of his identity by which he is known to Xibus and other users. It is not his password, which is something different; it is an external, invisible identity. You can send the message to a group of such users, specifying their identities at the time of initiating the communication. You can send the message to a group of users, identified by some distribution list, which itself is a record stored somewhere in Xibus. Or you can do combinations of those things.

You can send the message similarly to a physical terminal address, which may be some other computer, by specifying the terminal address; and all systems attached to Xibus have unique physical addresses rather like internal telephone numbers. You can specify the addressees as groups of terminals, in the same way as with groups of users. You can specify the communication either as being routine or as being urgent. If you specify routine it is appended to the message file of the designated recipient or recipients, and it will be there the next time that they look at their message file. If you specify it to be urgent, the same thing will occur, but additionally — assuming that the user is signed on to the system — the DBM will send him an urgent notification to the workstation or other system where he has signed on.

The method by which he is notified, if he is sitting at a workstation that a message has arrived is that a light on his workstation (the message waiting lamp) illuminates and he can then, at his leisure, enter display mode, press the receive message button, and the message will be displayed on the screen. If the message waiting lamp stays on it means that another message is being queued for him.

If you address a message to a user who is not signed on at the system — by which I mean not signed on at any Xibus system attached anywhere, because we will find the user at whichever geographical location he is — then the DBM will so report and will simply tell you that user X is not signed on to the system. If you address the message directly to the terminal, it does not go via the DBM, but the intelligent socket will tell you if the addressed terminal is not switched on or not in use. It will send a message back to you.

There is one other thing that we do with the message file. Every user has a message file, and every other user has append access to it, but only the owner of the message file has any other form of access to it. You can take advantage of something called a "call forward" facility. You insert into any page or pages of your message file the date of which information is to be brought to your attention.

The way that that is done is that when the user signs on, the first thing that takes place is that his message file is scanned. He is then sent messages in the way that I have just described, which cause his light to illuminate on his workstation. And when he interrogates those messages he will find that they are called forward messages.

One further refinement of that is that you can specify any character in the DDMMYY string as X, meaning immaterial. So if, for example, you wanted to cause yourself to be reminded on the 25th of each month to take some specific action, say, to complete a report, you would specify the date as 25XXXX; and on that date each month the item would be brought to your attention. Where the data is specified in full the comparison is equal to or earlier than, so that if you go away on holiday the messages are stored for you and you will be notified when you get back.

A word now about the attachment of and the addressing of foreign bodies, existing computer systems. The first thing that we will be doing is making it possible for users at workstations to call for the display of pieces of data which may be resident on attached mainframes and mini-computers, in such a way that the user ought not to know that that is what he is doing. He ought not to care where the data is coming from.

If we suppose, for example, that on your mainframe computer you have your stock file and you want to allow the financial director or somebody in the accounts department with a workstation to address that data, he might do so by typing in in display mode something like "stock 1234" which identifies some collection of data within the stock file on the mainframe relating to part number 1234 perhaps. In all innocence, he simply keys in that as an identifier of the data set. The workstation makes up a request packet, and sends it off to its local database manager.

The DBM then looks in its directories and finds that that piece of data is not resident within its own database, it is resident at terminal N. So it sends off a request packet which it finds already prepared for it in the directories, to terminal N. In between terminal N and the mainframe and Xinet — to which it would probably be attached — there is a box called an adaptor which takes care of the packet assembly/disassembly protocol conversion and so on, and is able to communicate with the mainframe in terms which the mainframe comprehends.

Inside the mainframe, or whatever attached system it is, there must clearly be some permanently resident piece of enabling software able to cooperate in the exchange which is involved. It will receive this request packet. The request for data will be expressed in terms which it understands. It will not say, "Stock 1234" it will say, "File X record Y" perhaps. It will then retrieve that data from its own database and send it back to the adaptor, and via the adaptor to the workstation which orginated the request.

In the meantime, the DBM, knowing that it was a request for data at a foreign system, will have pulled out a formatting record and will have sent that back to the workstation. At some point in time the workstation will have both the formatting rules which will say, "Bytes 3 to 6 are the code identifier. They need to be put in the following position on the screen and preceded by a label saying 'this'". It will have both the formatting rules and the actual data. It will then be able to construct the display for the user. To him it should feel very much like retrieving any record from his local Xibus database. The response time might be slightly longer, but apart from that it should feel exactly the same.

We take that concept a little further and allow the user to call for displays of data where that

data may not exist as a cohesive set on any individual attached system. It may be that he has a display which he uses from time to time of a stock record, where part of the data is stored on a 370, part on a CMC Reality and part on the local Xibus database.

Again, very simply, the same sort of thing happens. The request is sent off to the local DBM. When it looks in its directories it finds that it has to send out not one request packet but three. It sends off these request packets to the addressed systems. They in turn respond in the way that I have described. In due course the workstation receives the three response packets. Again, in the meantime, the DBM has sent back to the workstation the formatting rules, telling the workstation to expect three packets and telling it how to unpack the data and how to display it. That, as far as file interrogation is concerned, is how we will be dealing with providing access to attached systems for workstation users.

Where the task to be carried out at the workstation is to invoke a process at some attached system, then a comparable but slightly different procedure will be gone through. This will be very much attached system dependent. It may in many cases require the cooperation of the operating staff of the attached system. Indeed, all that may occur as a result of invoking a processor in process mode may be that a message is sent to a workstation positioned in the operations room, instructing the operators what the man wants done, which tapes he wants hung, and so on.

We see it going a little further than that by using something akin to RJE concepts, where it should be possible automatically to provoke the execution of tasks within the attached systems.

Finally, the attachment of word processing systems. There we will be doing it a little differently. It will not be easy to access word processing data, letters, reports, specifications, and so on, because they do not tend to be held en masse, on-line, on word processing systems; they are shunted off on to floppy disks and stored away in drawers. What we suggest occurs there is that the data is transferred from the floppy disk on which it was first recorded back into Xibus for access by its author. We have established reasonably good relationships with suppliers of various word processing systems and we are now working in detail on the method by which this will occur.

For example, in the case of the Vydec word processor — and the Vydec suppliers have been very helpful — what we are suggesting will occur is that at intervals during the day when the girl has constructed a floppy disk full of data, she will enter communicate mode on the Vydec system and that will cause the data to be transferred from the floppy disk back into Xibus, and it will go back into Xibus onto the message records of the authors. These will be urgent updates of their message records so that the authors will receive a notification saying "Your typing is ready", or words to that effect. They can then access that typing from their message record. They can do such small alterations as they wish themselves at their workstations. We have looked into format character convertibility and problems in that area and they are soluble. If they want substantial rework done they send it back to the Vydec, but otherwise it is then available for them to do what they want with. They can store it in the database, print it out and so on.

In short, what we are saying is that here is a possible strategy which offers some hope of long-term relevance to the emerging new technology that we can expect to see during the 1980s. But none of it is compulsory. If the idea of taking, in due course, your data and all of your data management away from your mainframe offends you, then don't worry about it; you are not obliged to do it. Treat it as a tactical option. You have the option in the longer term of doing so if you wish anyway. It is an open, enabling architecture. You can use it as an unintelligent network, as a fairly intelligent network, or as a full-scale data management facility — whichever suits your management style and your current configuration of equipment.

SESSION C

CONVERGING TECHNOLOGIES — THE IMPLICATIONS FOR TELEPHONE MANAGEMENT

John Pollard,
Plessey Telecommunications Limited

John Pollard read for the Natural Sciences Tripos at Cambridge and first worked with the De Havilland Aircraft Company, later joining Ericsson Telephones Limited at Beeston at the end of 1947.

He was promoted to Head of Research of that company in 1957 and was in charge of work on the early electronic telephone exchange.

In 1965 he was in charge of the research and development programme in the field of electronic telephone exchanges for the Plessey Telecommunications Group.

More recently he has been working on digital systems and networks, particulary with regard to the problems of interfaces between new and old systems and the provision of complete networks of such systems. He is currently Director, Systems Research, Plessey Telecommunications Systems Limited.

I hope that my remarks will to a large extent be a reinforcement of what has been said so far rather than actually a contradiction, although I do have a number of items of information which may come as a surprise to some of you. I have plenty of problems to expose to you but remarkably few solutions, although I will give you an indication of possible methods of making progress.

The concept of convergence is far too well known for me to spend any time introducing it as a topic. In fact, in my company we have been taking it very seriously over the last decade. But the implications of convergence are not anything like as well known, especially in the field to which reference has just been made. Commenting initially on the concept itself, I do not believe when we get down to fundamentals that the convergence concept is totally welcome, either in the data processing industry or in telecommunications.

We are using the word "convergence" very freely, especially on such occasions as the present conference. I myself do not think that the relationship between communications and computing will be much more than a shotgun marriage. I do not believe that there is any real impetus on either party to get together, except on the basis that they will continue to do it their own way.

People in the data processing industry, whether we look at the manufacturers of equipment or the users of the equipment, have a tendency to regard telecomms as just a carrier of data: "Perhaps we'll use a land line instead of sending a man carrying a reel of tape." Data processing people recognise, probably more than anyone, the possibilities of convergence, and they are well aware that switching transmission and other telecomms jargon will play an increasing part

in their own activities. They will be incorporated into data processing systems of whatever kind. But we have already seen, and other occasions have shown me, that there is a feeling that data processing systems and, indeed, the converged system of the future, will remain basically data processing systems.

The reason for this is quite simple. Data processing people — and I have a lot of friends in the industry and shall shortly be attacking the telecomms industry similarly, so do not all react in a hostile way to me — have spent more than 20 years already in establishing their activities. People have massive investments, large computer rooms, a great deal of other equipment, some of it very advanced in its technology, and all of it extremely complex in its operation. As a result of these large investments in particular, people in the data processing industry have tended to become conservative in their outlook. They started out as extremely specialist, extremely innovative, and, above all, extremely expert people — if you like, technological prima donnas. Nowadays, they are doing very important, and commercially very significant, work. Correspondingly, they enjoy substantial status in their company management hierarchy and all the other attributes of senior responsibility. It is therefore only human that they should wish not to surrender any of their comfortable position and security by moving into that part of communications where most information is handled — people talking over the telephone. The data processing people will certainly feel that I am simply talking from the standpoint of a typical telecomms man attacking the data processing industry. Far from it. My view of my own industry is that, if anything, telecomms people are worse.

Most of our telecomms engineers, much of our telecomms management, and, perhaps, less understandably but much more serious, many of the people in telephone administration — such as AT&T in the States, and the British Post Office — are hardly aware of how important the data processing industry is. Some of this is just complacency on the part of telecomms people. More of it arises from the fact that, notwithstanding claims that are being made elsewhere, telecomms worldwide is by far the largest sector of the electronics industry — followed by consumer electronics and then by computing.

The attitude of telecomms people and data processing people is therefore perhaps both understandable and, equally, deplorable. Nevertheless, technology is forcing the changes where there is a move towards convergence, in spite of the reluctance to it or the opposition so far being encountered. The fundamental reason is in the economic plane.

Computing in general "apparently" costs too much for what the customer gets. It is, of course, self-evident that the real cost of the typical data processing operation is greatly reduced in comparison with a decade ago. It is equally true that the number of operations and their complexity has grown more rapidly still, so that the apparent cost of a data processing department has grown, in many cases, disproportionately.

Quite apart from the cost aspect of electronic data processing, comparatively minor departmental managers, say in a manufacturing organisation such as my own, who needs and uses information prepared by EDP, has the feeling, perhaps unjustified, that EDP does not actually provide him with what he requires, in the form in which he requires it, and it does not provide it quickly enough for him.

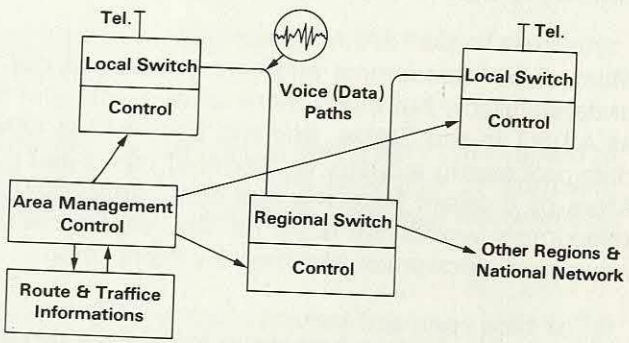
I believe that one of the benefits of convergence and, indeed, probably the one factor that will force it through, is that if we can converge communications and computing, we can greatly reduce the component of the cost which is represented by equipment, by the hardware, simply by the ability to use identical equipment and common networks.

Much more significantly, we can, as the previous speaker has said, provide a fast, responsive, and to a large extent interactive service on every manager's desk, through the medium of a properly organised communications network. The importance of these economic aspects cannot be overemphasised. We are just at the significant build up stage of the applications of digital technology to telecommunications. It is completely clear to the telecomms people that it will reduce both the capital cost and the operating cost by substantial factors. It remains to be seen whether it will actually reduce the price of service to the users.

However, in the United States — where, as a result of Public Information Acts, the activities of the Federal Communications Commission and other bodies and their economic aspects have recently come very much more out into the open air — it now appears to make good economic sense to replace a conventional electromechanical trunk exchange after only perhaps five years' service instead of the anticipated 20 years' service, simply because a stored program controlled digital switch system is very much lower in capital cost and enormously cheaper in its operating costs and problems.

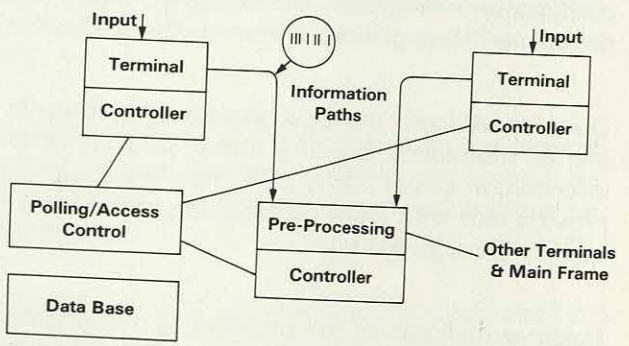
I want to talk primarily about the network implications of convergence. Let us start by looking at a couple of networks. That is your old, familiar telecommunications network. It has local switching. Each local switch has an associated box of control, switching at regional levels. To avoid confusion, I have not shown on the diagram the switching that goes on at higher levels for the national network. Each switch has its own control, and nowadays these are to a very large extent under a degree of central management control. The whole of the network in present day terms is essentially handling voice, as a voice wave form. To a small extent it is handling data turned into the equivalent of a voice wave form by the modulator — the modem which is interposed beween the data processing installation and the telecomms link.

Telecommunications network



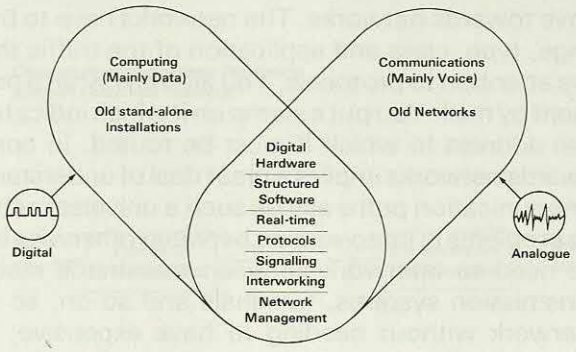
This, if you like, is a telecomm man's idea of a computing network. It is arguable that it is distorted to make it look like the telecomms network which was on the previous slide. Conceding that point to a large extent, it is nevertheless true that the similarity is striking. The significant difference — and it is quite key to the understanding of the convergence concept — is that, in the computer world, information is handled almost exclusively in digital form, and everything that happens is almost entirely under software control. This is where we identify the starting point of the convergence and were we also start to identify the problems.

Computing Network



This shows the two starting points: on the left computing, and on the the right communications. Computing originally to a large extent stand-alone installations, but right from first principles digital. Voice communications. Old-fashioned networks entirely analogue in character. The overlap area shows what in fact has to emerge if convergence is to succeed.

Technology Convergence



Firstly, let me say that the most hardened telecomms man — and I regard myself as such — would readily admit that almost all the advances in digital technology have arisen in computing and related fields. These have produced digital hardware, so it is incumbent on the telecomms people to exploit digital technologies by introducing digital methods of handling communication traffic and abandoning the present analogue methods.

It is perhaps in the software area — and you might say this is a paradox — that the benefit of convergence might be most significant. You may treat this as an ironic statement since it is well known that the overwhelming majority of the software which has been created is that which is associated with data processing and the data processing users.

I might perhaps remind you by analogy that there is a Victorian definition of a machine. A machine is that which goes round, and round, and round, until it pulls you in. Software is that which runs and runs and runs, until it crashes. There is good historic reason for this. Most computers are engaged in some kind of number manipulation operations, in many cases associated with money, and these operations are often subject to very detailed audit procedures. This being so, computer users have to give very considerable attention to making the calculation and the manipulation aspects essentially infallible. There has to be very large protection against error. If, for some reason, the possibility of an error is detected, the processing must instantly be halted.

Telecommunications has to have a different philosophy. A telephone exchange desirably should never make any mistakes. What is absolutely imperative is that it never ceases to work. Correspondingly, software engaged in driving a telephone exchange perhaps might not need quite such a substantial level of error protection as software used with money calculations, but it must be totally proof against crashing and looping.

In addition, telecomms software has to operate in real time. Experience with the early telecomms systems — running on, if you like, modified data processing machines and using multiple levels of interrupts according to the priority of tasks — has demonstrated both the extravagance and the lack of utility of this approach. Telecomms software simply has to operate in real time, inherently as a part of its design and structure. It tends to be very heavily structured and event driven.

You may say that this is a telecomm man's defence against software failures, and this unfortunately — or fortunately as the case may be — arises from the fact that a telephone exchange solves its real time problem by the expedient of providing that amount of equipment which will produce an acceptable probability of error — that is a limited number of wrong numbers — at the designated peak hour level of traffic. This concept of equipment provision according to real time load is one which has been very thoroughly studied over the last century

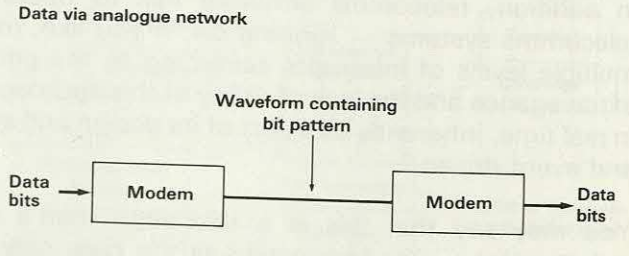
in the telecomms industry. Accordingly, telecomms software has to match these standards. It has to be more reliable and, hopefully, it will less rapidly go through different generations than more conventional software currently used on stand-alone data processing installations of the older types.

However — and this is where we come to one of the plus points — convergence also implies the move towards networks. The networks have to be general-purpose, both in their use and in their range, type, class and application of the traffic that they have to carry. Accordingly, we have to give attention to protocols. You all know what a protocol is: it is like the front of an envelope which is sent by mail. You put a stamp on it which indicates the class of handling it must have and you give it an address to which it must be routed. In communications and computing terms the move towards networks implies a great deal of understanding of the signalling methods used to establish communication paths across such a universal network. It presupposes a proper understanding of the problems in interworking between otherwise incompatible terminals. So we have to recognise the need to interwork between mainframe machines, mini machines, telephone exchanges, transmission systems, terminals and so on, so that equipment inherently will match and will interwork without needing to have expensive, and often unsatisfactory, conversion devices attached to it.

We have to have the appropriate degree of network management. Some of this is inherent and automatic within the network, so that if part of the network is faulty we get proper provision for alternate routeing. Other aspects may involve manual intervention. I have already used the analogy of the postal service. We already have in telecommunications the equivalent of a two-tier telecommunications service. One hopes that it is not quite so inadequate as the postal manifestation. In the telecomms service, the first class service is conventional switching such as is used on telephone calls. It is usually called circuit switching. The second class service, which imposes a slight delay, but one hopes only a trivial one, is the message switching. The intermediate case is the packet switching case.

As an indication of the significance of this network approach I was fascinated to hear Mike Bevan a few moments ago talking about a ring structure for interconnecting devices. If you search the telecommunications literature, you will see that this ring structure was first adopted on a working telephone exchange for linking the processing and peripheral devices in a switched network in 1966. We first had an application of it in 1968, and it has been fairly commonplace in our industry from 1972. I mention this not because I am attacking the Xibus, I wholeheartedly support the Xibus approach. It is encouraging to see that in fact the manifest advantages of this are going to spread elsewhere. I commend also to the Xibus people the telecomms use of the Dijkstra capbility mechanism for additional protection against hardware and software faults in the system.

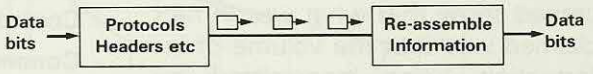
I should like to look next at the way in which networks will develop. At the moment we have mostly analogue networks in telecommunications, both in this country and elsewhere. I shall be showing you later what the consequences are of these becoming digital. But this is what we are stuck with at the moment. I am talking now not about transmission within a site, but transmission between sites engaged at some distance from each other. At the moment, there is little alternative to transforming your digital information into the



equivalent of an analogue signal for transmission — if you like, transmitting a wave form which has your information imbedded into it — and recovering it at the far end. For this purpose you use the much detested and relatively unsatisfactory modem.

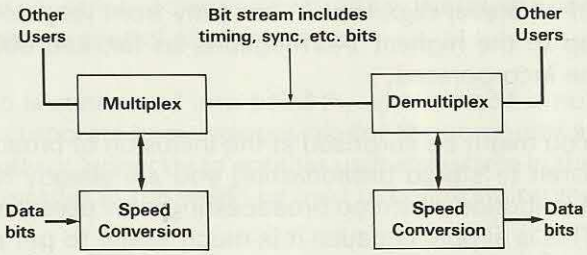
The intermediate case, which I have already mentioned, is the packet switching network. This, to the user, does look like a proper digital network, although transmission within the network is over a variety of media. One of the important things about the packet switching network is that the user does not have to be aware of the transmission medium used in packet switching, because he puts in his information and gets it back in packet — hopefully in the right order and free from errors — in precisely the way in which he operates.

Data via special purpose dedicated (packet switched) network



The ultimate, which I hope to show later, is much closer than any of you will possibly believe. It is that we have a universal digital network, and in this the whole of the network consists of streams of bits flowing between switching nodes, being routed and distributed appropriately through the nodes, and the whole is organised as a result of a series of levels of multiplexing, of digital data bits coming from many users. It can just as well be data processing terminals, mainframes, viewdata, Prestel, people talking on the telephone, many other services, and so on. In the case of data streams, there may well be a need for speed, and perhaps code conversion before the bits are multiplexed into the bit stream being carried by the universal digital network.

Data via universal digital network

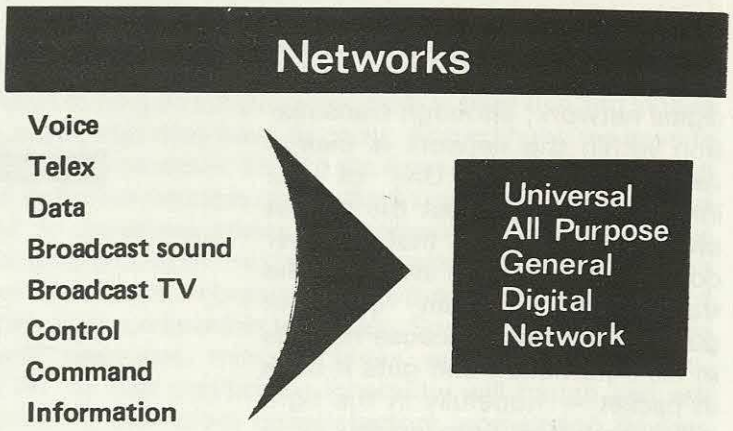


The advantage of this approach — and it will happen for good economic reasons for conventional voice telecommunications, if not for any other reason, so it is on its way — is that, used in this manner, the computer user gets the equivalent of a virtual network. The traffic is actually embodied in a high volume of other traffic, almost certainly greatly exceeding his own volume and consisting almost entirely, at least for the first decade, of digital voice traffic.

The multiplicity of users of this basic universal network is attractive in its operating and its economic aspects also to telecommunications administrations. Again, one hopes that the benefits that they will get out of this will be passed back to the users.

Let us have a look at what will happen on this digital universal network. At the moment, all the services shown on the left each have their own separate network, and this means extra

overheads, extra operating costs and a variety of dissatisfactions. Voice in the new network will certainly be the largest user for a long time. I make this statement notwithstanding the commonly expressed opinion that data will exceed voice, because this statement — which may ultimately prove to be true — certainly appears to have started as a result of a claim made by an AT&T executive, seven or eight years ago, when controversy was waging over who should be responsible for data services in the United States. The record of the proceedings concerned show that what was in fact claimed was that the volume of information being transmitted by data would exceed the volume of information being transmitted by voice. This is not the same thing as saying that data traffic exceeds voice. Data traffic is highly efficient as a method of getting information around. Voice traffic is so full of redundancy, repetition and pauses that it is extremely inefficient. I personally hold to the belief that in terms of the number of circuits being occupied, voice will exceed data for at least the next decade.



Looking at the other services, telex is already digital in form, and as soon as the digital network is available, there will be no justification at all for telex having its own exclusive network. Data, of whatever digit rate — certainly from very slow speed 110 baud for small telex type terminals up to the highest 140 megabits so far, and 500 megabits to come — will certainly be able to be incorporated.

You might be surprised at the inclusion of broadcast sound and broadcast television. But if you listen to stereo broadcasting you are already hearing digital music, because United Kingdom distribution of stereo broadcasting now uses almost entirely pulse code modulation techniques. This is simply because it is much easier to get precise alignment of channels for stereo broadcasting by using digital methods than it is using analogue methods. Colour TV can already be so handled. Conversion in the hands of the Independent Broadcasting Authority between the American system and the British system of television broadcasting is already handled entirely by digital signal processing.

Control and command includes things like the transmission of indicating and supervising information from electricity substations, gas and water pumping stations, and so on. Some of the more suspicious among you might think of more sinister applications, but they will all be lumped together in the single category of information. So what we are talking about then is the universal, all-purpose, general digital network handling information of whatever sort.

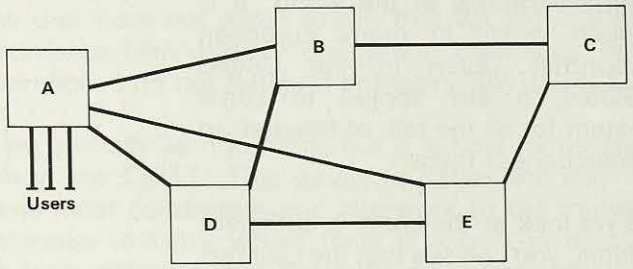
Now I want to come to the question of how we are going to manage this from the standpoint of a corporate body which has a data processing and a data distribution problem, an information circulation problem and a voice communication problem. This will be another area where the undoubted economic and technical advances in convergence will be offset by what I can only describe as "empire building" problems. Some of these are no more than the aspirations of individuals, and whether these aspirations are excessive or legitimate is of no consequence.

There are, however, some genuine underlying problems which will have to be appreciated and resolved by those who will manage in what I think will become known as the "information age".

Much of the advantage to be gained from convergence, as I have said many times already, lies in the use of large scale networks. At the point where these become nationwide, or even more so where the telecommunications component includes international or intercontinental links, matters of politics become every bit as important in network development as does the technology used to implement it.

I should like to expand on this point, because it will be quite crucial to getting real benefit from the convergence concept. Let us look at this quite arbitrary network. Each of the red boxes, A, B, C, D, E symbolises a large-scale, mainframe computing installation, each possibly supports some subsidiary installations and certainly each has a large number of user terminals connected to it.

Computer Network



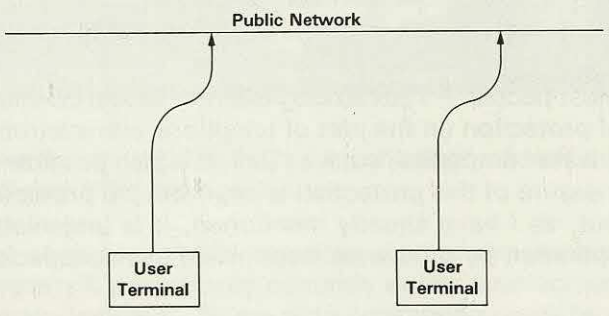
There are two political problems in the way in which this network can be used. The first relates to the attitude that telecommunications administrations have, towards their right — if it exists, but they claim it as a right — to control the use which is made of the network. Looking at the network on the chart, any single link such as A to B, B to C, C to E, is generally speaking acceptable to a telecommunications administration. However, if these computing installations have the property to do a store and forward or a switching mode, most telecommunications administrations in most countries of the world would say that such a use is an infringement of their powers and prerogatives to control all switching.

In addition, with an operation where a user who is connected into point A, who himself is not perhaps a direct associate or a subsidiary of the corporate body responsible for the computer at point A, where this user is connected either directly or indirectly to another user elsewhere in the network, that operation will certainly in most countries in the world be held to be infringing the carrying monopoly of the administration.

You may say that these objections are political. They are. But they are none the less significant for that, and means have got to be found of getting round them. I will come back to this point when I talk later about liberalisation.

Another example of a problem which is just as hot politically is how the user will be connected to the network. This shows, I suspect, what the user wants. He wants to be able to hook his terminal by the simplest possible means direct to some kind of suitable public network. He wants freedom, on demand, to connect his terminals, whatever their nature may be.

What the user wants

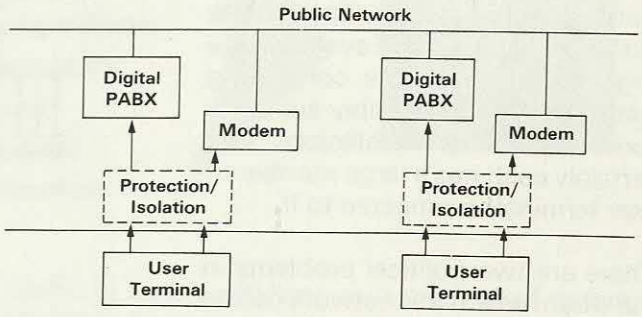


From the standpoint of the person who is planning the installation — which in this case embodies just these two user terminals — the

arrangement apparently affords the easiest method of access to and the use of the data transmission aspect of the public network, and provides him with what he wants, a virtual communication path, transparent to the information that he wants to transmit.

This shows what you will get, what the telecommunications administration wants to provide. Just in case anybody thinks that I am attacking the British Post Office, I must hasten to explain that this kind of stipulation is commonplace in most telecomms administrations in the world. It is much worse in many European countries. Even in the United States, it still applies to some extent for all the talk of freedom to interconnect there.

What the PTT provides



If we look at the chart in sufficient detail, you can see that the user terminal will be connected by way of some kind of protection or isolation equipment, either to a PABX, which these days one imagines would almost certainly be digital, or to the public network after the protection equipment by way of a modem, if the public network is still analogue. Or it would go directly through the protection equipment if the public network is digital.

Almost everywhere in the world, with only some very slight reservations in the case of the United States, everything above the horizontal red line immediately above the user terminals will either be the property of, be controlled by, be specified by, or be supplied and maintained by, the telecomms administration. Telecomms administration justify control of everything above the red line by saying that it is essential that the network be protected from accidental or deliberate misuse by users.

Among the problems to be protected against is the deplorable habit of some users of devising ingenious software methods of obtaining calls without paying for them. Either not paying at all, or paying at a very much lower rate than that which would be required. If you think I am joking about that, one very large hotel chain in the United States had to be threatened to have all its telecommunications service withdrawn unless it desisted from using an ingenious method of getting calls without paying properly for them.

It is also claimed by PTTs that only they are sufficiently careful, responsible and, if you like, trustworthy, to handle the appropriate signalling information to and from the network which sets up the actual communication path which is to be used, and that, at the moment, almost everywhere in the world, the user is not to be entrusted with handling his own signalling.

Most people — I am among them — would conclude that there may well be an excessive degree of protection on the part of telephone administrations whether they be government agencies or private companies, such as Bell. It is also possible to argue, especially in this country, that some measure of this protection arises from job protection on the part of the staff unions concerned. But, as I have already mentioned, it is undeniable that there have been cases of fraudulent operation by otherwise responsible users, especially in the United States.

A further justification for a measure of PTT control of access to the network is related to the problem of working between incompatible equipment. Here I believe the computing industry

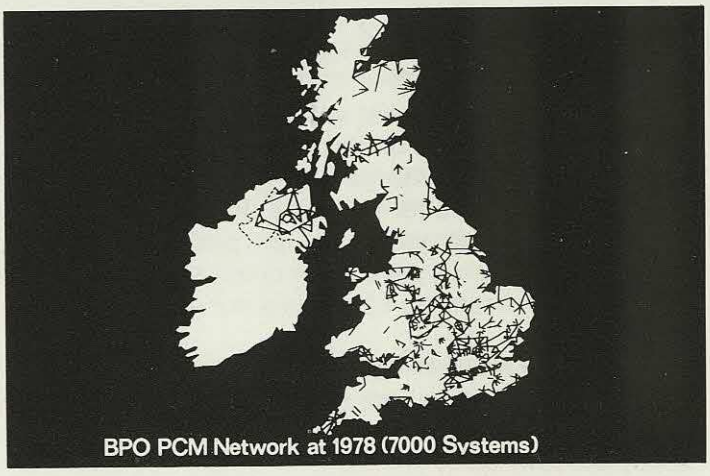
has got something to learn from telecomms, because in telecomms there has been a long record — well over 50 years — of collaboration and co-operation between telecomms administration in one country and another, and between and among the suppliers of telecommunications plant to the administrations.

This means, for example, that if we move into an export country where the basic network was supplied by L. M. Ericsson and Siemens we have no difficulty in establishing easy communication with the L. M. Ericsson and Siemens' equipment. We have just supplied, in Malaysia, one of our electronic exchanges which now drives a substantial chunk of the network which was previously supplied by L. M. Ericsson. Now that does not mean to say that we are in their pocket or that they are in ours — we compete fairly bitterly on getting contracts. But nevertheless there is that measure of collaboration. I do not detect it between IBM and ICL.

This co-operation was initially just bilateral on a totally ad hoc basis, but it is now formalised through an international standardising agency, the CCITT. This serves to define the way in which otherwise totally incompatible systems must collaborate and interwork to the mutual benefit of both. It is a contrast to the computer industry where there is almost invariably program incompatibility between machines from different manufacturers and, regrettably in some cases, even between different generations of machines from the same manufacturer.

I personally would suggest that some computer manufacturers have deliberately sought out methods of ensuring a measure of incompatibility with other manufacturers' products so as to attempt to lock out competition from other suppliers to a particular customer. However — and it is an important "however" — IBM among others is now participating fairly wholeheartedly and in a very responsible way with the CCITT. And I believe that that tendency will increase and that the computing industry as a whole will collaborate in this way, which will relieve, at least to a large measure, the present concerns of PTT administrations, so that we can move towards a more widespread availability of a comprehensive digital network.

In fact, the digital future, so far as telecomms is concerned, is nearer than you think. That shows the network as at the end of 1978 of digital circuits available in this country. It is less than 20 years since digital transmission of signals over long distances by pulse code modulation first emerged from research laboratories into a practical proposition. But over the last 10 years practically all the new growth in transmission links in this country has been digital in character. It still represents only a proportion of the total circuits installed in the country, but you can say now that there are no urban areas and very few areas, other than the thinly populated rural areas, into which digital links have not already penetrated. In this regard we are well up among world leaders. The relative close spacing of cities in Britain and the high concentration of traffic in these cities both favour a rapid build-up of digital PCM transmission.


BPO PCM Network at 1978 (7000 Systems)

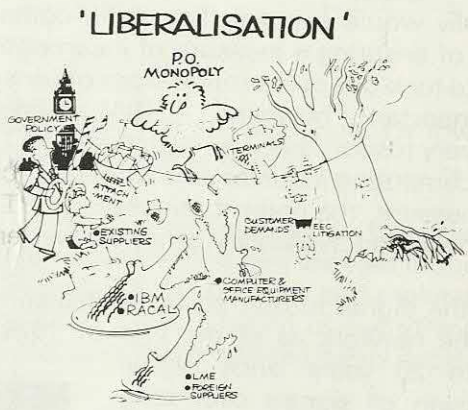
This is important because there has been a lot of press criticism about the slow progress which is being made with the installation of the System X programme currently under development between the Post Office and major British manufacturers. Some data processing users have been fairly vocal on this subject by suggesting that it is not until System X switching systems

are well advanced, which will not be until the middle '80s, that there will be any possibility of a digital network in the United Kingdom.

This in fact shows that the position is quite different. Except in the most thinly populated areas, the possibility already exists of a digital connection, either directly or indirectly, to almost any other area of the United Kingdom. This being so, those services that inherently can benefit from a digital network could do so well before we have a significant introduction of System X switching.

Even in respect of those applications for which digital switching based on System X is required, most of the telephone lines — and by definition this includes most of our business users of communications — are in the larger cities. So, 85% of all telephone circuits are in the 17 largest cities in the country. It is in these major cities that the early System X installations will be concentrated.

I have to mention, because it is a very hot topic at the moment, the question of liberalisation. A fair number of ripples have been cast into the pond by Sir Keith Joseph's announcement of the degree of liberalisation of the Post Office monopoly. It will be seen in very different ways by different people. Perhaps within the short-term thinking of the Post Office Engineering unions it will be seen as an attack on job security. Among at least some manufacturers it will be seen as opening the door to a very profitable cream-skimming operation. But it will certainly make the management of the user of computing and data processing services in the convergence era much more difficult. It will not be easier, it will be more difficult.



It remains to be seen what will be the exact extent of the liberalisation. We do not yet have a policy pronouncement on this. It seems to me very probable that it will fall short of the United States interconnect arrangement whereby almost anyone can compel Bell System to provide a network type service for terminals, with a relatively minimum ability on the part of Bell System to exclude terminals unless they are positively dangerous in the electrical sense. I think that we may well find that we get a more cautious approach than this, probably coupled with some kind of approval or licensing of devices considered suitable.

There will be a lot of in-fighting during the time that the liberalisation policy is being discussed. I fear that the would-be user of telecommunications services, whether for voice or data, will just have to wait and see what sort of packet of goods Buzby can deliver.

I believe that we do need some liberalisation, but it has to be the right sort. Users need to have a well-defined right of access to a digital universal network. In turn, this network has to be of high integrity, impeccable performance and, above all, high reliability. The present endlessly replicated networks for particular services — telex, data, voice and so on — only fragment the task of ultimate unification. People's right to connect has to be unequivocal, and it has to be limited only by those minimum constraints that are unavoidable and essential to prevent accidental or deliberate network misuse. I am sure that all of us are waiting with considerable interest the emergence of policy on this issue.

I should like to conclude my remarks by asking what will be the position of our present experts in the convergence fields. On the one hand we have data processing managers, system experts, management information services experts and so on, with relatively little detailed knowledge and perhaps relatively little detailed appreciation either of telecommunications as a whole, or of the short- and long-term impact of the digital telecommunications network of the future.

On the other hand, there are the dyed-in-the-wool telecomms men — sometimes called engineers, but for the most part more accurately called craftsmen. They have very little knowledge of, and certainly no fundamental appreciation of the emergence of these entirely new concepts in data processing.

Ignoring — because they are not relevant to my argument — considerations of the extent to which data processing users will be served by new, cheap microcomputers on the one hand, or large, central, database-oriented installations on the other — I personally believe that both will be needed and will coexist — it is clear that we will have to move towards a massive use of communication resources by computer users.

If that were not enough, the office environment itself will become increasingly electronic. Some large companies are already moving towards a total integration of information services, with communication network services as a background for functions such as data processing, electronic mail, inter-office messages, voice systems and so on. But the majority of corporations, both small and large, have yet to grasp this nettle and attack the problem of how to move towards the new style of business organisation.

I believe that at the moment only a very small proportion of those companies that are looking at integrated office systems organisationally have a sufficiently firm grasp of the communications implications of the automated office concept. I know of only one significant statement in this regard — a particularly percipient manager who said that the only paper left in his building will be in the washroom. But that is the implication that faces us.

In the few companies which are moving towards these integrated systems, a recent survey shows that such companies see their local switching systems, their PABXs, as computers, handling data, dealing with bits and bytes equally with voice traffic. From this it follows that these few companies are well aware of the significance of convergence, but they are in the minority.

Most organisations treat their computer operations as by implication being associated with, or part of, the finance function. Office copiers, typewriters, word processing and, above all, telecommunications, report elsewhere in the administration of the company concerned. Typically, no one person in most large companies has a total overview of the significance of convergence and its implications.

Putting it another way, as a member of a company vitally interested in this field, I want to know who signs the purchase requisition for the converged system.

I have to expose one other organisational problem, which is not basically to do with technology but is a direct consequence of it. It is that if we are to take full advantage of these new systems, it will be essential for otherwise general managers and executives to learn to use the system for themselves. Otherwise, the new systems will suffer from the same detached remoteness criticism as the old. Not to put too fine a point on it, executives and managers will have to operate a keyboard for themselves. Indeed, some of you may have seen pictures in the press of Des Pitcher, our telecomms chief executive who was recently interviewed on this topic, and who commented that it was not so much that he minded learning to type, but that he minded having to learn to spell!

I leave you then with the dilemma: I have no solution to it. Does the telecomms manager have to become more sympathetic to data processing, or does the information services manager have to learn about telecommunications? At present, the indisputable benefits of convergence will be lost because of this dichotomy.

SESSION D

THE GROWING SIGNIFICANCE OF HUMAN FACTORS IN SYSTEMS DESIGN

Ken Eason,
University of Technology, Loughborough

Following an early career as a chemist, Ken Eason graduated in psychology from Brunel University in 1968. He is an associate member of the British Psychological Society and a member of Council of the Ergonomics Society. He has specialised in occupational psychology and ergonomics and, after a period with EMI Electronics Limited, he joined Loughborough University in 1970 as Deputy Director of the newly formed Human Sciences and Advanced Technology (HUSAT) Research Group. He is now a senior lecturer in the Department of Human Sciences and a member of the directorate of the research group. He has been active as researcher, lecturer, and consultant on the subjects of the non-specialist's reaction to computer use and the methods by which systems may be designed to accommodate the needs of their users.

I feel rather put out to find that I am really the only academic here and, having spent enough time with business audiences, I know what they tend to think about academics. So the first thing I should like to say is that I hope that we at Loughborough manage to adopt an outward-looking philosophy and that what I have to say will seem relevant to the kinds of problems that you face now and will be facing in the future.

By training I am a psychologist and an ergonomist. We have been concerned for the past 10 years or so with the consequences of technological change for the people who will be affected by it. We have been concerned not only with doing research on those consequences, we have also been concerned with the problems of how we pay attention to potential consequences in the process of designing systems.

Once upon a time, 10 years ago, human factors issues were given a polite interest. Everyone said, "Yes, yes, they are very important." They would listen to what we had to say, but they tended to treat it as something of a gloss to be added to the system. But if it clashed with technological objectives or economic goals it tended somewhat to disappear.

I think that picture is changing. I can hardly pick up a newspaper or look at a television programme these days without the social and human implications of the kind of technological change that we are considering here being made apparent to me. Many people now are claiming that human factors are becoming a crucial issue in successful technological change. I will make no such claims, I will simply try to talk about the kinds of implications that we have been concerned about in the recent past and expect to be concerned about in the future, and the various ways in which a management services department might be confronted by these issues and would therefore have to cope with them.

First, I want to talk about why I think human factors issues are becoming more important and to summarise some of the influences of which no doubt many of you are already aware. And secondly, what issues are there, what do we mean by human factors, what diversity of factors are we considering? And thirdly, how to fit them into systems design and how, most

importantly, does it affect management services and what does it do to the role of management services.

Let's start with the pressures for consideration of human factors. By human factors I mean any issue relating to the people who will use the system or who will be affected by the system. So we can also include the people who will no longer be around when the system is introduced. I will not try to differentiate different sorts of systems, TP systems, word processing systems, communications systems — all of them converge into one. Most of the systems have similar kinds of human factors indications. There are different, specific issues as well, but we will just deal with the general ones.

The Challenge of Human Factors

1. Why are they becoming important?
2. What issues do they cover?
3. How do they fit within systems design and how does it affect management services?

I think that what we can say about all these systems is that they will operate as man/machine systems. I see a lot of TV programmes about robotics and automation, but I am quite convinced that — and everybody has been talking about users this morning — there are still people in there somewhere and giving them a good service that they can cope with and use seems to be a prime consideration that you all face. So we are talking about creating systems which are technological but have human components as well. A "sociotechnical" system is the in-vogue term for the design target of your systems.

Pressures for Consideration of Human Factors

The new users	Social change
Casual users	Organisational consequences
Users with complex tasks	Job loss
Users with discretion	Union awareness
	Legislation

The burden of the argument that I want to put to you is essentially that if we simply develop technological systems we will increasingly run into problems on the human, social and organisational front. If we set out to design "sociotechnical" systems, while we may not avoid all the difficulties at least we will deal with them head on and we can cope with them and deal with them as we go. There are many ways in which technological systems can go, in different forms, with more positive human and social implications than negative ones.

Most departments have lived with these kinds of issues for a long time. You have not suddenly discovered that there are people out there that you are trying to serve, so why is it becoming more important now? I think that part of the problem is that we are getting new kinds of users. We are no longer just talking about people who are relatively full-time users of a technical system. We are more and more dealing with casual users. I do not like that term, it rather implies that they are sloppy about it — which they might be, but that is not the point. They are intermittent users, occasional users. They are people who have other things to do and they are people who may regard the use of the technology as a rather small element of their total job.

That will affect the way that they perceive the system and how much they are prepared to learn about the system, and how willing they are to adapt to its usage. In one way, they become less trainable. You cannot send a lot of these casual users away on training courses to learn to operate systems, you may have to find other ways of getting them to work effectively with systems. I am talking about managers and all kinds of other staff functions in organisations, and indeed the public. Many of us will be concerned with developing systems which have the public as end users.

A second and related point is that we are tending also to deal with users with quite complex and unstructured tasks. I am thinking particularly of managerial environments. Before lunch, someone mentioned that we will expect the future technologies one will expect to be used by the managers themselves directly, hands on. Well, they have complicated — so they tell me — unstructured, awkward, changing kinds of tasks, which means that we are trying to design technologies which will support tasks. That means that we are designing systems where we cannot be precise about what people will need from them. That is a quite difficult issue as well.

Thirdly, a very awkward issue: a lot of these users have considerable discretion. It was all very well to design systems for users whose discretion was at the level of "Well, either you use it or you leave our employ". But it is quite another matter to design systems for users who, if they do not like the look of it, will find some other way of doing whatever they want to do. It is a much tougher nut to crack, a much more difficult target to reach. Users are likely to be much more fickle and more able to vote with their feet if they do not like the things that are being presented to them. Many of you will probably have already tried putting various kinds of systems into managerial environments and will have found that it is not quite as straightforward as some of the textbooks would have us believe.

So different kinds of users are entering the scene; more and more a wider range of users — less knowledgeable — and our ability to train them is becoming less.

On top of all that, we have a different set of problems because of an increasing understanding on the part of the unions in particular, but on the part of people in general, that technological change means organisational and social upheaval, social change of one kind or another. The topic in the media at the moment is primarily the question of job loss, the question of how many people will be needed to run these technological systems of the future. But there are many other kinds of issues as well of an organisational nature. I got hints this morning about various kinds of political struggles, distinctions between departments that made sense once, and perhaps will make much less sense in the future. All those kinds of issues will be brought to the fore by technological change.

There are issues of training, retraining, and other such topics which all have a bearing here. There is a growing union awareness of all these issues. Indeed, some unions, and notably Clive Jenkins and his friends, are claiming that they know and understand much more about the coming technologies than do a lot of managements, and they are leading the way. They are certainly leading the way towards creating within the TUC a policy about the rules that they will put to management when it comes to accepting technological change. So there are important and powerful implications there for the role of the people who are trying to introduce the change.

Finally, I have included legislation here because we are increasingly living in a world where governments legislate on matters that affect the implemvntation of technical change. In this country we have various employee protection laws, health and safety laws and so on that are relevant. What we do not have yet are the kinds of laws which a lot of other countries have already implemented relating to things like the privacy of information. Maybe we will get these one day.

Particularly in Scandinavia, which I know quite well because I spent five months there last year, they have carried the business of legislation with respect to technological change very much further. In Norway, for example, not only are there shop stewards to deal with but there are also people called "data stewards", who are charged with the duties of looking after the union end of any technological change when it is introduced. And organisations are required to involve the data stewards in the process of change.

I have not heard anything from Mrs Thatcher on this kind of subject yet and it may be a long time in coming, but these are the kind of background factors that could be there for the future.

All this means that on a variety of fronts the people who will be affected by the systems that are being introduced are likely to be much less passive and much more difficult to cope with and to serve well than hitherto, with a whole range of problems that they are now asking to be considered. If they are not asking now, they probably soon will.

I want to go through the nature of these issues, to try to classify them for you. I have a problem here in that most of my work is in this area — in trying to classify and organise the different sorts of issues and marshal the kinds of information that is relevant to them. But because of the theme of the conference I do not want to spend too long on this area this afternoon, I want to get on to the roles of management services with respect to those issues. So I will content myself with offering you a classification of the kinds of human factors issues that will be important. I will be only too happy to elaborate on this aspect in questions afterwards if you should so wish.

The Needs and Problems of the Computer User

Task needs

Support needs

Expectations and ease of use

Psychological and organisational consequences

So I am asking the question: what are the human factors issues? It is traditional in our field to talk about there being hardware issues, software issues, organisational issues and things like that. I will approach it in a different way and say, "If we have a potential user, what are his needs? What have we got to do for him if we are to get to the point where he has a service he wants to use, is willing to use and is capable of using? What have we got to do to get to that point?" I have boiled that down to four different issues.

The first issue is called "task needs", which is an obvious one. Presumably if the user has some use for the information processing services that we are putting at his disposal, then he has an information handling task that he is undertaking, and he will be looking to the system to provide facilities: data, data manipulation facilities, communication facilities — be it what they will. He will be looking for something to serve his task.

The problem that we have is how do we determine, ahead of time, what those task needs are. How do we build up the system in such a way that in six months' time the man in department X will find that the system can handle the information that he wants it to handle? That is no great problem when we as designers are in total control of the task environment, where we are dealing with some nicely constrained, clearly defined set of tasks in which the user is engaged, or where we can have some control in determining the nature of those tasks. But we are now talking about moving out into tasks which are unstructured and changeable, where it is very difficult to know what the needs will be in the future.

One of my concerns — and I will come to this later — is techniques whereby one learns what kinds of needs users have, what sort of task needs they will encounter, and techniques by which we embody those needs within the system. Techniques for task analysis and techniques for involving users in accomplishing task analysis. Beyond that, of course, one has to be concerned with the design of the technology such that it has the flexibility to cope with changing needs, and perhaps evolving needs as well. One of my biggest fears is that we might find, in introducing new forms of technology, that we start to constrain organisations to handling those kinds of information that they handle now. We live in a rapidly changing world. The pace of change shows no sign of slackening, and people's needs will change rapidly. So our systems have to be flexible to cope with that. These kinds of issues are very central to getting systems accepted within many user environments.

Let us suppose that, by some piece of magic, we manage to provide the kinds of facilities that the users feel they want. Have we then answered all their needs? Unfortunately not — we are only starting on the process. The next problem is that our users, almost by definition, are unsophisticated with respect to the technology which we are now employing. They will need knowledge and skills. They will need to know what the technology is capable of, what it can do, how it does it, and what they have to do to get it to do it. And if the worst comes to the worst, what they have to do to rescue themselves from the mess that they have got themselves into. They will need to have those kinds of knowledge and skills at their fingertips. Where is that knowledge going to come from?

Traditionally, we have worked through training schemes. We take people away and we develop their keystroke rates or whatever it might be. And we work through procedures manuals which are at the elbow of the user so that he can look up what he has to do under certain circumstances. Neither of those techniques has worked very well in the past, and they show even less likelihood of working much in the future, as our users become more intermittent and casual.

We talk more these days about "point of need" support, meaning that we must find ways of giving the person the help that he needs; the skills that he needs and the knowledge that he needs, at the point that he discovers that he needs it. Just to mention two strategies for that, one is to develop in-system aids, the kinds of help facilities, programmed learning facilities, explanatory error messages and so on, within systems. We have only just begun to touch on the potential of computer-aided instruction as a means of informing the user of the facilities that he has at his disposal at the time that he needs it. That kind of avenue has taken great strides in the past five or so years.

There is another avenue, which is to use human support techniques. I have noticed over the past few years a great burgeoning in the number of liaison staff, support staff of various kinds, involved with the operation of technological systems. If you do not actually plan the development of such roles with respect of systems, you often find that they arise informally. When we go looking at a new technological system, we usually also go looking for the "local experts" as we call them; that is, the person near the end user to whom the user turns for help whenever he finds that he is in a position where he cannot cope. It seems a great strategy. The person is local; he knows something about the task you are doing; and he maybe has learned a bit more about the system than you have. He is accessible, which is a most important thing for most users. The problem really is that the quality of his advice may not be all that special. We often find that it is useful for people creating systems to think about who their representatives will be at the sharp end and concentrate on training and developing them. Make sure that the users have some local supply of expertise near at hand for them. The design of the social system that supports the technical in any operational system is a very important element, when your user population is in a state of ignorance largely about the capability that you are putting at their disposal.

A third point here is that we are dealing with a world in which users have expectations, and a lot

of these expectations relate to ease of user issues. Obviously, when you answer a task need you do so by providing a set of procedures which the user can employ to gain the information that he wants, communicate with whoever he wishes to, and so on. Some of those procedures will be new to him, and they will involve a considerable amount of effort on his part to adapt to.

Many of the users that we meet seem to show a kind of what I can only describe as, implicit cost benefit analysis technique when considering utilising a technological tool. By cost benefit analysis in this instance I do not mean "How much money will it cost us and what do I get for it?" it is much more a cost benefit analysis in terms of, "What is the benefit to me of using this as against other techniques I might use, including guessing and not using the information at all? What is the cost to me in terms of personal effort, personal learning, personal adaptation and, above all, personal time? How much effort have I got to put into mastering these devices?"

These judgments tend to vary very much according to the potential that the user is likely to see for the equipment, but they nevertheless play a considerable part in determining the degree to which the user masters the equipment that is being placed at his disposal. So far as we are concerned, it leads us into questions of how you design the interface for the equipment, for the man with the equipment, so that it is natural to him, so that it involves transparent interfaces, so that it is, above all, easy for him to use. I have used a lot of terms there which are the ones that we bandy around. They essentially tell us the target and what it is we are aiming at. We are quite a long way away from being able to define exactly what those terms mean in all instances, but we do know a lot about the design of hardware, the layout of keyboards, the design of dialogues for communicating between man and systems. We know a lot about those kinds of issues which can help design systems so that they are more acceptable to the user and he does not find that he has to put a lot of his own effort into it in order to make a start in utilising new equipment.

The kinds of issues that I have just been talking about apply very much to casual, intermittent users. If you have full-time users the problems are often of a somewhat different nature. There, it is often a matter of irritation, due to redundancy within the system that they meet a hundred or maybe more times a day when they do not need it. There is a very different set of principles about designing dialogues, for instance, for full-time users as opposed to casual users. It is an entirely different process.

Also, with full time users, a different set of issues is arising, particularly because of union pressures, in the health and safety areas. I imagine that most of you have been aware of the concern about visual display units causing eyestrain. There is a lot of hot air about this issue. Nevertheless it is one which people who are introducing visual display units into users environments — where the users will be employing them quite a lot of the time — can expect to be raised. These are issues that you will hear about. It is being used as a bargaining counter by a lot of unions now. So there are issues of that kind that especially relate to full-time users.

Finally, if we have managed to sort out all of those issues, we are still faced with some very big stumbling blocks because any technological system, when it is introduced, goes into an existing social, cultural, organisational environment where there are a great many issues because of the disruptions that it may cause. They may incidentally be only anxieties. It may be that they would never have the effects imagined. But if the people who will be using the system feel that there are likely to be problems it will affect their behaviour and the way that they receive the system. These issues cover so many different topics that I have listed some of them here just to indicate the direction in which the problems might come.

I have divided these into job implications and organisational implications. Obviously the one that most exercises the minds of employees and their unions is the questions of redundancy and job loss due to any technological innovation. But there are other issues which can be equally difficult. Skill change is a particularly important one. A lot of traditional skills are being devalued;

things that people have built up and that have been their livelihood for many years suddenly are no longer necessary. There is the question of what new skills will be required and what kinds of procedures will be set up in order that new skills can be acquired; and whether it is the same people who will use the new equipment as used the old methods. I do not need to remind you of the problems that *The Times* has had in these areas in the past year.

Potential Implications of Technological Change

Job implications	Organisational implications
Job loss	Work team changes
Skills change	Demarcation between jobs change
Pacing and load changes	Payment systems
Greater formality	Career progression
Job satisfaction	Power and influence Privacy of information

There are more subtle changes. Often, the introduction of new technology means changes in the pacing and the load on employees; different kinds of demands being made on them. Some people have suggested that, far from being a great boon to humanity that some of us here might feel, electronic offices will simply be an environment in which all of the pacing and controlling elements of assembly lines will be transferred from the blue collar worker to the white collar worker. People do not look upon that prospect with any great joy.

Greater formality. Most of the systems that we are talking about mean a lift from rather informal methods into much more formal methods, which people often respond negatively to as well. What a lot of these things add up to are questions about the nature of job satisfaction; whether existing forms of job satisfaction are disappearing and what is replacing them. Will there be any kind of job satisfaction remaining? There is one set of issues there.

Organisationally, there are wider issues. Work team changes. I have deliberately put in something fairly subtle that may not seem very important. Introducing technology may break up existing social relationships. There is a lot of talk about operating from offices in your own home rather than being in a work setting. One of the things that that will do is to disrupt all those relationships that you enjoy, or otherwise, with your colleagues.

Demarcation between jobs change. Another thing in which unions are very interested is where their preciously-protected demarcation lines go to in the future, as technology comes along and disrupts the whole structure of relationships. That can be a very important sticking ground. Again, *The Times* is a very important reminder of that.

Payment systems. You can expect people who accept any kind of change to ask what happens to the payment systems, and there can always be a "buying off" process involved in introducing technological change.

Other strange things happen, such as if you have been treasuring a particular kind of career progression in an organisation and, all of a sudden, it is not there any more. That can have nasty effects upon your feelings of security and vulnerability within an organisation. Power and influence. Privacy of information. All these things play their part.

What I would say about all of these factors is that it is not a feature of every single system that you have to be concerned with all of these issues. The problem is to identify which ones will be important with respect to the systems that you are considering introducing.

The other point about it all is that the nature of the effect is not inevitable. There has been a great deal of research — a lot of it completely wasted — trying to show that computer systems

in all their different forms have universal effects; that they lead to loss of jobs or whatever. What those studies do show is that some systems lead to greater employment, some lead to less, some lead to more skill being required, some lead to less skill being required, some lead to job enrichment, some lead in the opposite direction.

Further than that, it suggests that when you are in the process of formulating the system there is quite a lot that you can do to organise a system and the way that it will be implemented, in such a way as to take account of these factors and, if possible, to have positive effects rather than negative effects. It is not universally easy to do, but there is a lot more flexibility in the design of systems, and particularly in the way that the system is coupled to the manning structure of the organisation. There is a lot that can be done there to ease the path of implementation. It is taking command of that part of systems design that is most important for getting technological change implemented smoothly and effectively.

That is a very quick run-through of the range of factors that we are considering. I should like you to note that it runs from what kind of keyboard you use and where you put the special function keys, and what contrast there is in the visual display itself, right the way through to questions of job satisfaction and organisational change. As far as the user is concerned, all of those points may be important to him in the way that he responds to the system.

It means that all of that lot needs to be on the minds of the people who are concerned with implementing the system. I want to go on to talk about how, within a systems design process, one takes account of these issues.

I suppose the obvious thing to do is to take the systems design team and appoint somebody to find out about human factors issues and to develop skills and competence with respect to it. That would be the way in which we would handle most new issues that arise in a systems design process. We may even take on a specialist in human factors issues.

Well, that is one route. There is another route which is being peddled, particularly in Scandinavia, which shows a completely different approach. It is an approach that says, "The people who will be affected by this have a right to a say in the systems design process." In its more extreme forms, they not only have the right, they have the total right; that is, the technologist fades into the background as a kind of supplier who is told what is wanted and he gets on and provides it. I have heard these views put very vigorously in Scandinavia, sometimes on the part of user management, sometimes on the part of unions. So it is not as though it is just one group that is claiming the right to run the show, it can be many different groups. In America, they use a term "stakeholders", meaning that any system being introduced affects the lives of quite a variety of people, and they are to be regarded as the "stakeholders" with respect to systems development. The argument then runs that each stakeholder has some right to be involved in the design process. I might also add that the technologists involved are perhaps also considered to be stakeholders in this, so they do not lose out entirely.

How are we supposed to resolve such a dilemma? Here we have an approach which says that the existing technologist, the technological base, will be responsbile for introducing the system, and will take on the human factors issues as well, as against a complete takeover bid in which the system will be designed by the users themselves. How can we resolve that kind of issue?

My approach to this is to say that it is very much too simple to split it into that kind of polarisation. What we need is a more differentiated view, one that takes account of the different kinds of human factors that I have just mentioned, because those different factors need different kinds of treatment. It is appropriate for a management services department to take on different kinds of roles with respect to the different sorts of human factors issues.

I have attempted in this slide to talk about some of the potential roles that can be taken with

respect to human factors issues. I have taken five design issues and asked myself what would be an appropriate breakdown of roles between the users and the designers. This is highly simplified and would very much depend on the type of system and the kind of organisational climate into which it is going. I can think of nothing more stupid than trying to go for full-scale participative design with all the users in a climate where users have never experienced any kind of involvement with anything before. They will be overwhelmed by it, and everybody will be thoroughly confused. But where there is an expectation of involvement it is very dangerous not to try to create it in some way.

Roles in Human Factors Design

Design issue	User	Designer
1. Analysis of tasks	Informant	Analyst
2. Construction of system to support tasks		Expert
3. Interface and support design	Tester	Expert
4. Work organisation design	Participant/ Negotiator	Advisor/ Resource
5. Organisational consequences	Participant/ Negotiator	Advisor/ Resource

Here are some ideas on this front. First, what do we do about the analysis of tasks? What do we do about learning the nature of the task environment which the system is supposed to support? Here I have put the designer in the role of analyst trying to find out, trying to understand that task environment. And I have put the user in the role of informant, the person who tells. There is a long history of problems in this area which suggests to me that the thing that you cannot do is to leave it for the user to tell you exactly what is what. He has usually been so busy doing the job that he has had no time to stand back and consider it in any kind of systematic way that would give you a coherent account to work from.

Similarly, it is very dangerous if the analyst makes assumptions about it, particularly if it is unstructured and changing. We need some kind of dialogue between the designer and the user which will lead to an understanding of what can be established and what cannot be established, because what cannot be established is a demand for flexibility in the system.

One of my interests is in the design of techniques whereby analysts can approach users and support them and help them to work through the nature of their jobs, to express to the designer the information that he needs, before he goes away and decides what the system will do. That particular issue seems to me an important and a difficult one to work on.

The second issue is the construction of a system to support the tasks, what you might call the heart of the matter as far as the technological design is concerned. I have said that most users see no role for themselves in that whatever. These are technological matters, to be fought out between the management services people on behalf of the organisation and the suppliers — the sort of battle that we were talking about this morning. So I have said that the designer here is in the role of expert. I use the term "expert" in a specific way, to mean you have a person who has the knowledge available to provide the answer without going further. You may go further into textbooks and ask other experts and so on, but you do not have to go back to the user in this particular area.

The third part, the interface and support design, I have put the designer in the role of expert here, in the sense that there is information that he can be provided with which will enable him to design interfaces that are easy to use, that are efficient and acceptable, and that embody the right kind of support techniques for the user, and so on.

However, I have put the user in the role of "tester" — you might call it "evaluator". What I am suggesting here is that there is a lot of room for the development of early pilot schemes, trials, in the design of future systems; a lot of room for developing a quick, probably rough-and-ready

version of the system to which the users can respond. The greatest difficulty that the users have is seeing what it is these technological boys are talking about. You do not meet many users who can interpret flow charts, they are much better at responding to real terminals, with real things coming up on screens. What you want to be able to do is to put things up there and then have them knock them down, before you have tied yourself down to it for life. Users can work very readily in that kind of environment. One of the great benefits of getting cheap computing around is that it ought to be possible for us to run many more trials and evaluative efforts before we go for full-scale decisions. It is another area in which we are very keen on working, in helping people to educate the users through presenting things to them early in the design process for them to react to. The designers learn, and particularly the users learn.

This approach has a number of advantages. One is that you are halfway through the training problem then anyway. Secondly, the users feel that they are making a real contribution to the design of the system. Thirdly, that means that it is becoming "their" system rather than "your" system, right from the word go. These issues seem to me to be very important.

Four and five are moving outwards from the technological system into the social and organisational consequences of the system. Work organisation. Who does what jobs. How tasks are divided between the jobs, on into organisational consequences. The job loss issue, the retraining issue, the relationships between departments issues, and so on, moving outwards from there.

This is an area where most technical people would not claim to have any special expertise to apply, and where they would probably be happy if the user showed some inclination to sort out a lot of these things for himself. It is the area in which we hear most about participative design. A lot of the things that I was hearing about in Scandinavia are not really about users dealing with number 2 on that list, they are about users dealing with numbers 4 and 5, or rather employees and user management together working out these issues. I am sure that many technical people would be very happy if they were able to say, "Here is the system we have designed. They are your problems, you sort them out", and then retire into the background.

Unfortunately, it is not as easy as that because we need to be talking about these issues before the system is implemented. We need the designers in some kind of advisory, supportive, resource kind of role in order to explain what the system is capable of, what sort of flexibility there is. This is one of the traps: the assumption that if the system is there it must be used in a certain way. There are often lots of flexibilities and choices which in the user environment the users ought to be debating and considering alternative ways of operating it. At a really advanced stage, one ought to have that debate going on simultaneously with the systems design process, so that information can be fed backwards and forwards between the two sides. We do not see much of that at the moment. It is pretty much a case of designing a technical system, and the organisation then accommodates to it, or perhaps rejects the system as a foreign matter entering its structure.

So I have put the designer in an advisory, resource role here, supporting the negotiations of the users to sort out these matters. It seems to me that it is not a case here of the management services department making these kind of decisions. It is equally not a matter of their saying, "I will stand out of this, the user can do it." There is a need to support that kind of process. In this country certainly, there is not only a need to support this, there is also a need to initiate it, get it moving, and get it started, because often otherwise it does not occur.

I want to try to summarise that by saying that as far as I can see human factors issues can be handled from within the management services domain in two ways. One is by establishing an expert or a number of experts on it. Maybe we all become experts in it to a degree, to an appreciation level degree. That kind of approach to it involves learning about the hardware and the software issues, the way in which one thinks about the environment of the system, the way

in which one does work station analysis, and topics such as this. I am happy to say that we are beginning to get more widely disseminated information on this score. Books are appearing. Tom Stewart, who is now with Butler Cox, having spent a number of years with us at Loughborough University, has recently co-authored a book called the VDT Manual, which sets down a lot of the information on just this kind of topic, on all of the issues relating to the establishment of visual display terminals within a user environment. It also has current knowledge on this visual eyestrain problem. So there is material appearing which will be available to management services staff to handle these topics. I might also point out that we spend a lot of time at Loughborough generating graduates to fill that kind of bill. So, if you need any ergonomists just let me know.

That is the expert role. The other role is rather more difficult to define. It is to be an advisor, to be a supporter, to be a facilitator, to be a kind of catalyst to the whole of the user environment to get them to understand what the technological change means and to take the choices open to them on the process of introducing the change. To determine what they want. At a managerial level what sort of organisation do they want to run? It can have profound effects on that.

At a job level there are issues about who does the work, how it is shared, what sort of skills will be required. The unions need to sort themselves out with respect to these issues as well. It is not enough to stand back and let that happen. We need people around who can facilitate the discussion and who can act as resources in bringing what information and research there is to bear on those issues. What I would like to see is a growth in people within management services departments who have that kind of brief.

I think that naturally we will get people who are the experts on the interface issues. I do not think that we quite so naturally arrive at the kind of facilitator role. A lot of systems analysts find themselves playing the role, not because they have been trained to do it, but because they find that it is necessary. A lot of users generate people who are the main liaisons with the technical staff, who also find themselves playing these kinds of roles, usually in an unsupported, untrained way.

Travelling around the country, talking to different kinds of audiences, I find that many people fit the kind of specification that I am outlining, and they are desperately in need of help, because they are having to make it up as they go along. Well, there is quite a literature. Unfortunately, it is a heavily jargon-laden literature, as you can probably tell from the words that I used to describe it: facilitators, catalysts, and so on. It is rather difficult literature, but it is one which, with help, one can bring to bear to help people engaged in that kind of process. We are beginning to worry about how to help with the training of that kind of person.

SESSION E

INTRODUCING OFFICE AUTOMATION — THE ROLE OF MANAGEMENT SERVICES

Michael Zisman,
Integrated Technologies, Inc.

Dr Zisman is a co-founder and the president of Integrated Technologies, Inc. He consults with a broad range of clients in the planning, analysis, design and implementation of office information systems and product offerings for the office automation marketplace.

Dr Zisman was previously a member of the faculty at the Massachusetts Institute of Technology where he was an assistant professor of management at the Sloan School of Management and a member of the laboratory for computer science. He conducted courses in both the technical and the management issues related to management information systems and decision-support systems, and was co-principal investigator of a major sponsored research contract in office automation. He is presently on leave from the Faculty of MIT.

Before serving in these academic positions, Dr Zisman was an active practitioner in the MIS field. He spent several years in management and technical positions in the MIS department at the University of Pennsylvania, and his last position there was as the director of that department.

I am going to start by giving you my definition of office automation and then I should like to continue by talking about how office automation might evolve, because I think that it will be a relatively long evolution and not a revolution. And lastly, I would like to spend a good deal of time talking about the role of management services in office automation.

I feel some responsibility to start by giving you my bias. I am one of you. I spent several years managing a large database installation in the United States before getting into this area, and so I have some strong feelings about where office automation does, and does not, fit.

Let me start by defining office automation. I am an engineer and I like to take things apart, taking them one piece at a time. Most people look at office automation and focus on the word "automation", because that is rather glamorous. But more important in some sense is the word "office". It sounds rather trite, but I would suggest that we really know precious little about what an office is. That is one of the major problems in office automation: figuring out what we are trying to automate.

Some definitions of an office. If you ask a young child what an office is, he will probably respond with, "That's where Daddy goes every day", or "That's where Mummy goes every day." That is not a very satisfying definition. It answers the "where" and not the "what". Even more worrisome is the fact that the same answer applies to the question: "What is the men's room?". So that is not too good.

The definition offered by a furniture manufacturer in the United States — Herman Miller — is that an office is a place for abstracting transactions, which I like. It actually says in a few words what we do in offices. We move lots of papers around which typically represent other real-world entities.

The most standard definition of an office is that it is a communications facility. That is partially true, yet most of the time when I am asked to talk to managers in companies, the first rule is, "Let's get the hell out of the office so that we can get away from the telephones," and we end up meeting in rooms like this, more often than not.

What is an office?

- 'Where daddy goes everyday'
- 'A place for transacting abstractions'
- A communications facility
- Overhead

Probably the most important aspect of an office that we all have to keep in mind is that an office is an overhead. None of us are in companies that have it as an objective to have offices. An office is something that we need, not something we want. An office really is an overhead.

There is a story about the Stanley Tool Company in the United States. It is probably not true, but the point is valid. There was a meeting of the general management group of the Stanley Tool Company which makes, among other things, DIY power tools. The manager of the electric drill programme was giving his performance statistics and was very happy. He was citing increasing sales of home drills, increasing market share, very good penetration. They knew what the competition was doing and everything looked very rosy indeed. The president of the company was there and was appearing more and more annoyed. Finally, the sales manager asked the president, "You ought to be happy and you seem sad: what is the problem?" The president said, "We have some serious problems here, nobody wants our drills." The sales manager, needless to say, did not take to that too kindly. He said, "Everybody wants our drills," and went through his standard pitch again. The president said, "You've lost the point. Nobody wants drills: people want holes. When they can find a way to have their holes without our drills, we're going to have a problem."

What is automation? Automation is a word that we use too liberally in our field today. To me, automation is two things, and they are both very different. One is using machines to do things. To put it in its rawest terms, it is replacing people with machines. This is what we often do in factories. This is what had led to dramatic productivity improvements in factories over the last 10 or 15 years. More often than not, automation implies using machines to help people to do things; that is not replacing people with machines but giving people tools to help them do things.

Computers have a place in both of those things. Computers can perform tasks which are well understood and well structured. When we automated payroll systems we did not provide tools to help payroll clerks compute payrolls, we did it for them. On the other hand, computers can provide tools to help people solve unstructured problems. We do not use computers to design automobiles, we use computers to provide very good tools to help designers design automobiles because we really do not know how to do that.

What is office automation? Most importantly, it is an evolving definition. The office of the future will always be the office of the future. There will always be a better tomorrow. That is something that we accept. Because of that, office automation is very much an elusive goal. There will always be a better and cheaper technology sometime in the future. Office automation is not a product, it is a process. It is not a destination, it is a journey. Too many of us lose sight of that. Office automation is not really a new term, although it has attracted a great deal of attention in the past four or five years in the United States. Office automation is not a new term, it dates back many years. In fact there are many references to office automation back as far as

1965. At that time, office automation was what we call now data processing, so by that definition everyone in this room is probably very experienced in the area of office automation. Office automation is any use of computers in offices for highly-structured applications. There was a book written here in England, in 1968, entitled *The Social Impact of Office Automation*. It is a title that has a great deal of import today, although it was written 11 years ago. At that time and in that book, office automation meant things like payroll, inventory control, and purchasing; that is, it was any use of computers in offices. In fact, I think that the strict definition of the term applied more then than it does now, because when we tended to automate systems in those times, we were attempting to achieve fairly massive reductions in labour. We used the computer truly to automate functions. I go back to my example of payroll. We really automated the entire payroll process. We did not support people in doing that function, we replaced lots of clerks and had them doing other things.

1965-1970

- Any use of computers in offices for highly structured, high volume data processing - EDP!
  - Payroll
  - General Ledger

Then we came across this thing called the "paperless office" which I call the "paperless office dream". Our industry — and I certainly include myself in that — is a very immature one, and we all tend to act like children at times. We often pursue objectives because someone raised a challenge without ever giving any thought to whether it was a very wise thing to do. The idea of the totally integrated management information system was such a pipe dream, and I think that the paperless office dream is also. It is not clear to me that a totally paperless office is something that we really should be setting our sights on, because I suspect we will be disappointed.

1970-76 The paperless office (dream)!

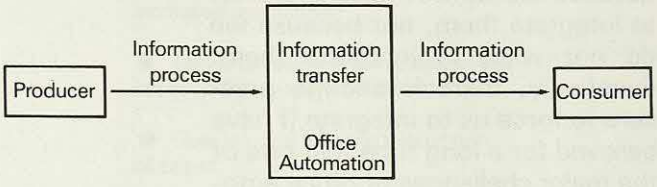
- Address tasks related to information transfer
  - word processing
  - electronic mail
  - electronic filing
  - reprographics
- Focus on text management

We will certainly have offices with lots less paper, but there will be more paper than that just found in the men's room, I am sure. There will be less paper, but there will *be* paper. One implication is that what remains on paper will be driven to much higher quality levels, both in content and in appearance. This paperless office dream concept really addressed tasks related to information transfer and communications. How do I get information from me to you? The information is at task level; it is related to transmission media. That implies a focus on text management. An emphasis on word processing, electronic mail, electronic filing, reprographics and so on. To most people this is the electronic office and office automation. That is not what office automation is to me.

One of the problems with that is that it focuses on only part of the process. If we look at the whole information transfer process, we have a producer, a channel, and a consumer. That rather myopic view of office automation tends to focus on the channel. It is the

communications view of the electronic office. It does not focus on the producer. If you think back to the chart that Tony Gunton showed this morning, where he had office automation consisting of communications support and decision support, this is saying the same thing in some sense; that this stage of office automation focuses on the communications portion. It does not help me, as the producer of information, very much. It helps you, perhaps, as the consumer, a little bit in terms of filing and retrieval, but it does not help you from a knowledge standpoint, from a more information processing standpoint.

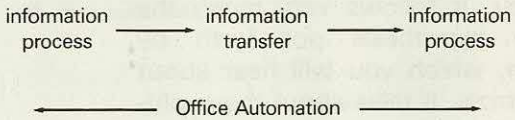
The paperless office (dream)!



We are entering another stage, something that I would call a more holistic view of office systems, where the emphasis is in two places. One is as before, using the technology to support the information. But even more importantly to me, it is supporting the underlying processes which produce and consume that information, and truly automating office functions where possible. As you will see throughout this talk, I believe that we must think very hard about what we mean by automation, and perhaps try to refine our definition.

1977-? Holistic view of office systems:

- Use of technology to support the information flow and underlying processes which produce and consume the information
- Truly automate functions where possible



There are office processes that can be automated. There was a study done by a large manufacturer just a few years ago, which estimated that about 40% of office procedures were subject to automation. I will return to that in a few minutes. I think that we move towards a broader and more global view of office automation. It is not strictly information transfer, it is not the magic network but focuses much more on the man or woman sitting at that terminal and what he or she is going to do.

With that, let me offer this definition: office automation is simply the utilisation of computer systems in offices to enhance effectiveness and productivity. It is a very simple definition. It is a global definition. It is sufficiently content-free that it should not offend anybody. I also am an academic. I have had lots of practice at saying content-free things.

Some people are offended by that. They say, "Why do computers have to be part of the automated office?". I think that in an age where most of us wear more than one computer and offices are everywhere they will certainly be in the office. So I think that is a definition that we can all accept.

Let me spend a few minutes talking about the path that I see our following as we go towards the automated office. I think that you will be able to relate to it, because I suspect that we will follow very much the same path that we have in the evolution of data processing systems. In

terms of function, most of us start in the office world with word processing. That is where many companies are today. We tend to evolve from that into what we can call disjointed office automation applications. We are going after lots of different things that represent targets of opportunity to us, without a large measure towards integration, often because we do not have the tools to integrate them, not because we do not want to integrate them. Eventually, there is enough pressure to force us to integrate. I have believed for a long time that one of the major challenges of office automation is integration. To me that means more functional integration than technological integration.

A definition

Office automation is the utilization of computer based systems to enhance the effectiveness and productivity of personnel working in an operational or administrative office

- simple
- global
- inoffensive

Lastly, we reach a stage of process automation and process re-design; that is, office automation gives us the opportunity to design our organisations and processes differently. That does not mean that we will. Unfortunately, many of us will think that because we have the opportunity, we must. That is what I mean by immaturity. It means that we have the opportunity to evaluate alternative designs, particularly in the organisational area, and also the opportunity to automate some office procedures.

Evolution towards the Automated Office

Word processing
↓
Disjointed office automation applications
↓
Integrated office systems
↓
Process automation and process re-design

That might sound familiar to many of you. It follows very much the stage hypothesis put forth by Nolan, which you will hear about tomorrow. It talks about the evolution of computers in general, particularly business applications in organisations. To me office automtion is not fundamentally different. It is another applications area of computers; no doubt a major applications area, but I think that it is an applications area of computing systems and we ought to be able to learn a lot by what has already happened.

If we look at the initiation stage, as Nolan calls it, and apply that to office automation, we tend to see technological opportunities for increased productivity that is technology driven. The bread-and-butter application that Nolan talks about in this case is word processing, text processing. The goal is the more efficient production of paper. Notice that most of the things that we talk about today in the area of office automation are the antithesis of the paperless office. Word processing systems exist by and large for the more efficient production of paper. Even word processing systems that have communications facilities, where one might argue that there is no need to use paper but you have the opportunity for electronic transmission, a precious small percentage of those machines are actually used for communication.

I often describe facsimile machines as paper reproductive organs. You put a sheet of paper in one end and, four to six minutes later, you get a sheet of paper out of the other end. It is a very low gestation period. Copying machines are tremendous reproductive organs for paper, much

to the pleasure of Xerox and some other companies. It is not clear that the rest of us benefit as much.

Initiation

- Technological opportunities for increased productivity
- Text processing is bread and butter application → word processing
- Goal is more efficient production of paper.

The second stage, which I think many companies are in now, in what most people call office automation, ought to be called office mechanisation, because what we are really doing is mechanising offices. We tend to see the rapid development of lots of different tools. Very importantly, we take a task orientation but not a process orientation. By that I mean that most people, in fact almost all of us, when we think of office automation, walk into an individual's office and look at the things in an office and say, "Gee, I can do that better with a computer." We look at the typewriter and say, "I can do that better with a computer". We look at the file cabinet and say, "I can do that better with a computer." Now we are looking at the telephone and saying, "I think I can do that better with a computer," and we say the same about the "in" box and the "out" box. Then we turn round and walk out without ever saying "hello" to the fellow sitting behind the desk.

Expansion: Office mechanization

- Rapid development of disjointed tools
- Task orientation but not process orientation
- Emphasis on merchandizing devices
- Exploitation of existing technology
- Task substitution

Many of you will have had the same experience of looking at detailed "office studies" as I have had, where, after reading a 20-or-30 page paper, I cannot tell you what business that particular organisation is in. All my training tells me there is something wrong there. I can tell you how often the secretary backspaced. I might not be able to tell you that the document that she is typing and on which she had to backspace 20 times just came out of a computer, two floors below her. It is a very micro level. A lot of this came out of the early word processing studies — a very low task level.

The emphasis is on merchandising devices, selling devices; very technology driven. It is very clear to me that today office automation is vendor driven. People like to argue that in fact it is driven by users. I say, "Gee, I wish it was, but I really don't think it is." It is very much vendor driven, and we are trying to exploit existing technology. We hear the phrase all the time, "The technology for the office of the future is here today." A reasonable question to ask is: "Then why isn't the office of the future here today?" It is true that a lot of technology is here.

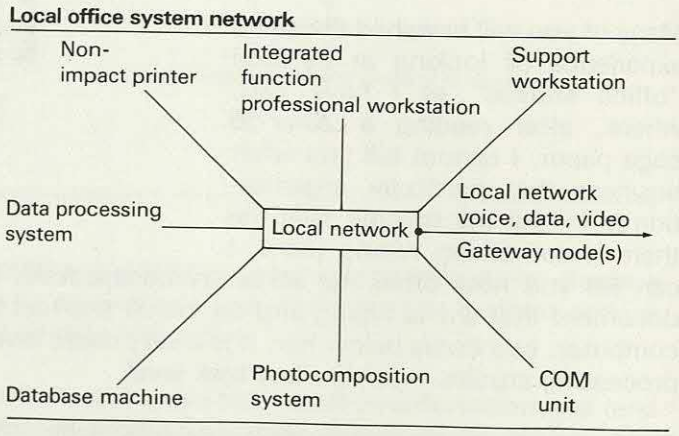
The best way to characterise this stage is to use a term that is used frequently in the innovation literature, "task substitution". I find the whole area of innovation, particularly technological innovation, fascinating. Most of us would agree that office automation, electronic office systems, is an instance of technological innovation. That has been studied quite a bit. Although there is a lot of disagreement about how you motivate people to be innovative, and how you

foster environments for innovation, one thing that most people agree on is that there are two very distinct stages in any innovation.

The first stage is what has been called task substitution, in which we tend to assimilate a new technology, to use the same things that we were doing before, but to do them more efficiently. We bring in a technology and we use it, but we use it in the context of our present task environment. We tend to do things more efficiently. The emphasis is on "How can I use this device to do what I was doing before, but more efficiently?" It is only after we have become comfortable with that that we begin to realise the things that we can do with that technology that we simply could not do before. It is not a question of doing something more efficiently. We start to recognise whole new worlds open to us. We are not very good at predicting them. We do not know what they are and some of the implications are almost impossible to predict. For example, it is often said in the United States that it was the innovation of the automobile and the refrigerator that led to the suburbs: you could get there and keep your food cold. No one predicted that, but when you think about it, it is those innovations that made suburbs possible and, what we are now finding in the United States, the negative implications of that.

When the automobile was first built we called it the "horseless carriage". It was like what we had before but it did not have a horse. Then we realised that we could drive that horseless carriage a lot further. That is an issue to which we must pay attention in office automation. Almost all of the applications that we talk about today are task substitution. We talk about the electronic desk, the electronic office, and the paperless office; but we always go back to analyse the things that we have today. How can we do things as we do them today, but do them more efficiently? I would suggest that we simply do not know what this technology will allow us to do in many cases. The only thing that we can be sure of is that we cannot be sure.

People talk quite a lot about the local communications network. That is a good way of exemplifying the stage of mechanisation where we have a network, perhaps an intelligent network, and we can attach lots of different devices to it and do lots of different things with it. That is a very good objective.

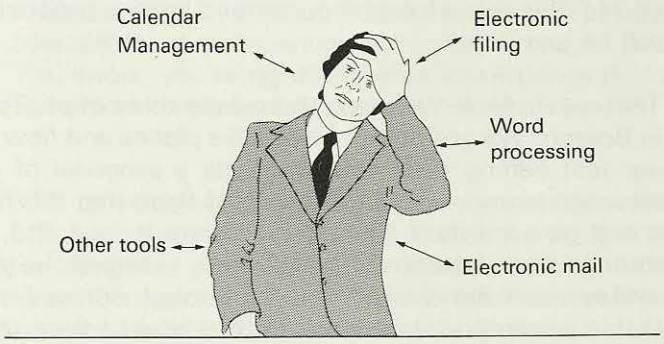


However, if we are not careful, what we end up with is a very confused user, because we are presenting to him lots of different tools on this network that do not hang together very well. We are starting to see that already in some systems — very inconsistent user interfaces. You are in one environment and you type a question mark and you get three pages of very nicely formatted text, telling you what you can do next. You switch to another program, type a question mark, and it comes back saying, "Illegal command". First, there is no law that I know of that says that it is illegal; second, it is very inconsistent.

I do not mean to put this approval down. The mechanised office will have some positive impacts. I do not think that it will meet the sorts of productivity criteria that people, at least in the United States, have been talking about. In talks like this in the States, there is an argument that goes something like the following: "Do you realise that productivity improvement in a factory has gone up 80% or 90% in the past 10 years, whereas productivity improvements in the office have been limited to about 4% in the same period? Do you realise that average capitalisation in

the factory has been about $25,000 and average capitalisation in the office has been about $4,000. Therefore, if we invest $21,000 in each and every office worker, we will improve productivity by 86%". I do not believe that. I do not think that you ought to believe that. Unfortunately, CEOs of lots of offices are hearing that, and it will be another case of unmanaged expectations. The one thing that we fail at most as an industry is not managing expectations. We come across a new tool and we tend to believe that, if we only had that one technology, it would solve all the problems that we now have. We never really solve problems in this world, we trade in problems. We trade in one set of problems for another. Sometimes we come out on the long end of the stick and sometimes on the short end. Hopefully, more often than not, we come out marginally winners.

User confusion!



This environment of a mechanised office has some implications that I should like to relate to you. I live in such a mechanised environment. I am in a firm now that is geographically distributed. We communicate regularly using electronic mail systems, text processing systems. We have used electronic mail systems for a number of years. I should like to relate a couple of experiences which I think shed some light on what you can do in such an environment, both on the positive side and on the negative side.

One of the paradoxes of the electronic environment is that it both speeds things up and it can slow them down, both in a positive sense. I can give you examples. In all of our consulting engagements we put all of our clients on to our electronic mail system, for two reasons. One is that we believe in it and we find it much easier to communicate with people that way than over the telephone. Second, it is obviously a good experience for the client. A few weeks ago, we had a situation where a client who had been using our electronic mail system for some time, had become used to it and was communicating very regularly, found out late one afternoon that he had to attend a meeting the next morning at 8.30. He wanted my comments about the subject of this meeting. He sent me a message at 5 p.m. "Dear Mike, I have a meeting at 8.30 tomorrow morning on such and such a subject. I should like to have your comments. Could you please give me your comments on these three things?"

I have a terminal at home and normally, at some time in the evening, I would log on, see my mail and respond to it. It turned out that I was not at home that night and did not do that. This fellow came back at 8 o'clock the next morning, logged on, went to read his mail box to see the pearls of wisdom that I had laid upon him and, unfortunately, there were none. He was mad. Here is a situation where a person sends a message at 5 in the afternoon and expects a response at 8 o'clock the next morning. He sent me a message at 8.30, saying "Gee, what's going on here? You're not supporting me." There is a real lesson to be learned here. These sorts of systems can really increase the metabolism of the organisation. It changes work environments. It has the potential of changing the boundaries. Today we have fairly definite ideas about where and when we work. We work at the office, during 9 to 5, say. In an automated environment the office is always with you, it is just a wire away. On the positive side it can really increase the metabolism of the organisation.

We had a situation where we were called in very late to make a proposal to an organisation for

a study that we wanted to do very much. We had an experience that I suspect everyone here has gone through. We were called in at 2 in the afternoon; the problem was described to us and we had a chance to respond about how we might approach such a problem. The potential client said, "We like what you're saying. Mike, we want you to go back and give this a lot of thought, because it is very important to us. We want you to write a proposal. It will have to be a fairly detailed proposal because we are well down the path with some other people. We want you to give this a lot of thought and write a proposal. Any time tomorrow you can get it to us will be just fine."

That was in New York, and there were three of us. Two of us lived in Philadelphia, and one of us in Boston. We got on our respective planes and flew home. About 6 o'clock that evening I used our text editing system to generate a proposal of about 30 pages. I sent an electronic mail message to my two cohorts and told them that this file was ready and would they please review it and give me their comments. I went to bed and, by 10.30 the next morning we had gone through three iterations, substantially changed the proposal, revised it and used the electronic mail system extensively. We ran it through our spelling correction program, printed it out on our Diablo printer and, presto, at 11.30 we had a very good proposal. Then we had the problem of how to get the thing to New York. We had to go back to such unreliable means as getting on a plane or a train. But we got the proposal to the client. In fact we got what we wanted: we were able to go ahead and do the study.

You go back and you say, "That's really something. I could never have done that any other way. I simply could not have got that level of interaction and participation." Clearly, I could have sat down, written a proposal, had it typed, and even edited it with the use of a text editing system. But no other way could we have had the participation of three individuals in two different cities over the period of 12 hours.

You step back to the next question and ask, "How long would it have taken you without that sort of technology?" The answer, as we all know, is that it would not have taken any longer because we did not have any longer. We all work in a deadline environment. We did not have two days; we did not have one day; we had to have a proposal there by that afternoon. I did not do it any faster: I did it a lot better. That will be a problem that everyone in this room will face when you try to justify office automation systems, because a great number of the benefits will be of a value added nature, not a cost reduction nature. I did not do it 20% faster, I did it 20% better. That will substantially change the way that we deal with cost benefit analysis.

Let me move on to what I think the third stage will be. To me it is the major stage in office automation — the formalisation stage. Here we have a shift in emphasis from how people do things to what they do. We are coming up a level from a task orientation to a function orientation. Finally, we are going to walk into that office and ask that guy what he does. "What do you do here all day? I am not going to stare at your typewriter for two hours, I'm going to talk to you. What is the business function? What is the business problem?"

Formalization

- Shift in emphasis from HOW people do things to WHAT they do.
- Task orientation - function orientation
- Incorporate notion of PROCESS

  Automation of office procedures
  Integration of mechanized tools

- Automation requires knowledge-based technology, models for office procedures.

I might add that many of you might think that a very backward approach. We all try to teach our staff, "When you want to design a system and you want to solve a

problem, first you decide what to do, then you worry about how to do it." If you want to design a system, first you determine a functional specification, and then you decide how you will implement that functional specification. What I see in offices is just the opposite, in short a bottom up approach.

I see two things happening here. One is starting to focus on automation opportunity, that is looking at things that you do now that in fact can be done by the computer; procedures that we carry out. I have had discussions with presidents of companies and gone through this conversation, and at some point they say "You know, you're right, there's a lot of things that I do that are a pain in the neck and are very mechanical in nature. I do them out of rote memory." That is a good sign.

I mentioned one study that estimated that 40% of much office work could be automated. I am not suggesting that people will not be in offices; what I am suggesting is that we are going down a path, ignoring opportunities to automate office procedures. We assume by definition that we will support an individual in carrying out his tasks. We ought first to ask the question: "Is there an opportunity here to automate the function?" The pendulum has, in some sense, swung too far, away from automation and towards operational decision support.

One of the problems here is that automation requires knowledge-based technology. That just means encoding knowledge about what we are doing and about our procedures in the machine. We do that every time we write a Cobol program. You write a system to implement your inventory, you are encoding your organisation's knowledge of how to conduct inventory control into the computer.

One of the problems in offices is that we do not have very good ways of doing that. Automation, languages for describing office procedures, techniques for representing office procedures, these probably represent the single most major research area in universities and industry today. It certainly is in Xerox, and there is a major effort at IBM and MIT. I go back to my very first question: "What is an office? How do we describe office procedures?" We know that they are much less structured than the kinds of problems that we have already attacked, and that makes them far more difficult.

There are a couple of implications. One is a real need to distinguish mechanisation from automation. This is nothing new. There were a number of studies carried out several years ago. which were motivated by a concern over perceived worker alienation in highly automated environments. Some researchers, at MIT among other places, observed that in some automated environments workers were very unhappy, with very high levels of job alienation. And yet in other supposedly automated environments there were very low levels of alienation, workers seemed very happy and content with the equipment. They sought to understand that. They did some very interesting work in trying to understand the differences. They asked themselves why it was that some people were happy when other people were unhappy.

Distinguish mechanization from automation

- As automation increases, initiating control source moves from men to technology
- Integration of function increases with automation
- Automation:
  - knowing what to do
  - when to do it
  - how to do it

They came up with these two major distinctions between mechanisation and automation.

They concluded that the problem was that everybody was not in automated environments; that it was in fact in highly mechanised environments that we came across very high worker alienation. This study looked both at factory and office environments, and it was carried out in 1970 and 1971. They made these two distinctions between mechanisation and automation. One is that automation increases the initiating control source, it moves from man to technology. We delegate authority but we do not delegate responsibility.

One thing that you have to do as an effective manager is to delegate, but you do not delegate responsibility, you delegate authority. The issue that we face is rendering unto man what is man's, and rendering unto the machine what is the machine's. We have to learn when to delegate to an individual and when to delegate to a machine. That is nothing new. Automation implies the initiating control source moving from man to technology. The technology knows when to do something, not only how to do it. All of the office automation technology that we talk about today is completely passive in nature. It sits there until I walk up and kick it. It does not actively help me.

The second distinction was that there was a high level of integration of function. There is a high level of functional integration in automated environments. They concluded that automation is knowing what to do, when to do it, and how to do it. They cited two examples which I found very useful in trying to understand what these people were getting at.

In the mechanised environments they cited examples of automobile assembly plants. Mechanised environments had the attributes of a very mundane activity, a very high level of repetition, very high sub-division of labour. Everybody is responsible for a very small part of the process and in fact has no sight of the whole of the process. In the US we have had very serious problems with worker alienation in automobile assembly plants. In fact that is the classic example in the US of very serious worker alienation problems.

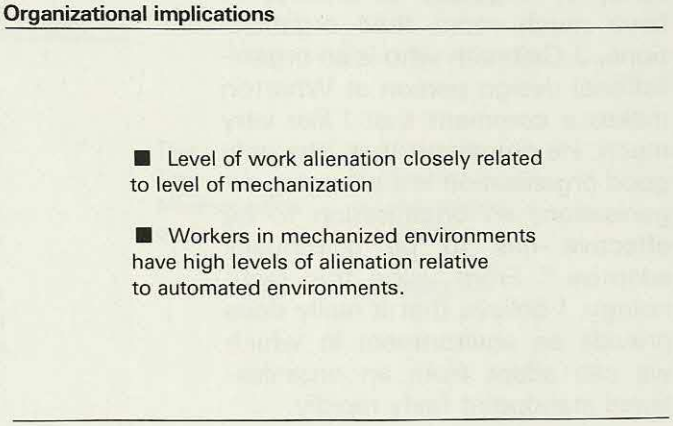
They contrasted that to a highly automated chemical plant or oil refinery, where the individuals tend to be in a control room, in front of a control panel, managing an entire plant. They really see the whole of the process. The interviews with these individuals were particularly fascinating. It came right out at you, the words that they used in describing their jobs. The operator at the chemical plant really viewed the hierarchy as himself, the control room, and the plant. He said to himself "I am in control of the control room, and the control room is in control of the plant". Whereas the guy in the mechanised environment saw the assembly line and then himself, and that assembly line keeps driving him. A very highly mechanised environment and very little control. There is a lot to be learned here.

If we look at attempts to have highly centralised word processing centres that we tried to push in the late 1960s, they have all the attributes of a highly mechanised environment, and they have all the attributes of very high levels of worker alienation. It just pops right out at you in reading these sorts of things. Very detailed sub-division of labour, extremely repetitive. If you talk to word processing operators in such environments, you often find that they view these words as passing by and they have no involvement in the process whatsoever, they are literally typing words on paper. They feel that way because that is exactly what they are doing. They are entirely justified in feeling that way; it is a major step backwards in many senses.

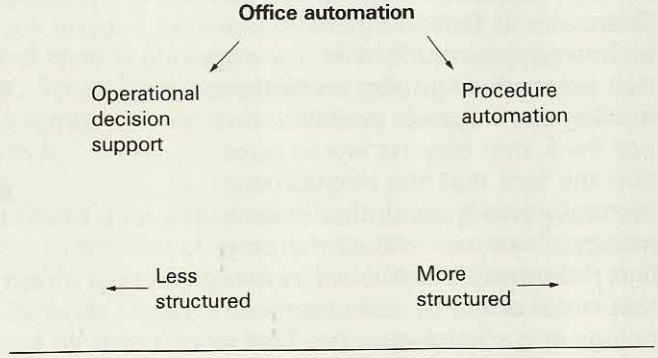
To summarise that point, the organisational implications that they found was that the level of worker alienation was closely related to the level of mechanisation, and that workers in mechanised environments have relatively high levels of alienation compared to automated environments.

So far, I have talked about this mechanisation that is a stage of expansion, where we tend to go in and install devices in offices. That is something that we have to do. The message that I am

trying to get to you is that that is not the end; in many ways that is the beginning. After that, I think that we will move towards a formalisation of office automation where we start to exploit that technology that exists, by integrating it from a functional standpoint, from a business standpoint, and automating certain procedures. So I see office automation as going in these two directions.



Where structure exists you want to exploit it. That is why we are all here. That is what computers are for. Computers do the same thing very fast. A number of papers that were presented at conferences in the US a few years ago started out by submitting that offices were inherently unstructured. I submit that is not really true. If you go into an office and spend one day there, you walk out saying, "This place is a real zoo." There is apparently random activity, no real repetitive patterns. But if you spend six months you start to find very definite patterns. What we find in office procedures is that they have much longer time constants than many of the transaction-based systems that we are used to dealing with in data processing. But there is structure in an office and, where structure exists we really want to exploit it.



Often we will find that this structure does not exist. What managers do is very judgmental in many cases. Where structure does not exist, then we look towards operational decision support; that is how you support an individual in carrying out his job. But the first question to ask is what pieces of that job can be done automatically.

In the maturity stage the real issue is one of work redesign. This is something that Paul Strassman in Xerox has expressed very well in a number of articles, which I would recommend as well worth reading. He focuses on this issue of work redesign; that is that the technology really does allow us to organise differently. The last speaker brought up the issue of the office in the home and the social implications. I agree with that. People go to work in many cases to socialise. I do not mean that in a negative sense, it is a major benefit of working in an office. You get to work and talk with other people. Technology does give us the opportunity to have highly distributed offices.

For example, in the United States there is a real opportunity to have geographical distribution of offices: to have offices in our suburbs. We have the opportunity to bring more people into the work force. Many of my friends, in their early thirties, are married and have very small children. The wife would love to work but will not tolerate all of the sacrifices involved in going into the city to do that. They are very interested in having the office come to them in some sense.

"I'd love to work. Why don't you bring the office over here?" One bank in Chicago is doing that, using terminals in homes to carry out some work, and that has been fairly successful. The point is that we have an opportunity to organise differently, to have much more fluid organisations. J Galbraith who is an organisational design person at Wharton makes a comment that I like very much. He points out that "the only good organisation is a changing organisation; an organisation to be effective has to be continually adaptive." From using this technology, I believe that it really does provide an environment in which we can adapt from an organisational standpoint fairly rapidly.

Maturity

- Period of stabilization
- Unfreeze - change - refreeze
- Integration and assimilation of technology into organization
- Work redesign - use technology to do new things; not just same things differently.

How long does all this take? We hear a lot about the revolution of office automation. I think that if there is one word that I would like to throw out of the English language is "revolution". The problem is that there is a long pipeline between the supplier and the user. It is the suppliers who talk about "revolutions". From their standpoint I think they are correct. There can in fact be revolutions in technology, revolutions in the way that we produce goods, revolutions in what can be made available. I do not think that anyone would question the fact that the microprocessor really was a revolution in technology. From our end of the pipeline, however, there is no revolution in our ability to assimilate technology into an organisation. That is not a revolutionary process. So while we have revolutions in technological availability, we certainly do not have revolutions in our ability to assimilate that. While stage 2, this expansion stage, is technology driven, so what? It is very much organisationally constrained. If there have been five speakers today you have heard that five times, and you have probably heard it 500 times before.

How long an evolution?

- Stage 2:
  - technology driven,
  - organizationally constrained
- Stage 3:
  - now technology constrained

Stage 3, this formalisation stage, although it is now technology constrained, I do not doubt for one minute that by the time the technology is here, it too will be very much organisationally constrained.

Let me summarise by pointing out some distinctions that I think are important. One is the distinction between task and function. We must look at business problems and business functions, and pay attention to those as opposed to the lower level tasks that we put together in some sequence to carry out a job function.

Tool versus solution. If you give me a tool to help me solve my problem, I will thank you. If you solve my problem for me I will be forever grateful. Let us first look for solutions and then look for tools. The majority of the time we have to settle for tools, but where solutions are possible we ought to do that.

Mechanisation versus automation. I think I have beaten that point to death already. There is a difference. Most of what we talk about in offices is mechanisation. Generic versus specific. Just as with any system we ever built, we have an opportunity to build very specific systems or very generic systems, and we all know the pros and cons there. Most of what we are building today are relatively generic systems. We build word processing systems that are relatively of wide use, although I think that we are starting to see market segmentation. Even in the word processing industry, people are looking for a market niche by going after very specific industries. But in general, with most office automation systems, we talk about very generic solutions. At some point, I think you have to bite the bullet and ask, "What are we doing here? What is our job function?", and then see what we can do about that.

Some important distinctions

Task	vs.	Function
Tool	vs.	Solution
Mechanization	vs.	Automation
Generic	vs.	Specific
Isolation	vs.	Integration
Effectiveness	vs.	Efficiency

Isolation versus integration. I was at a conference a couple of years ago at MIT where we were talking about research issues and office automation. What are the research issues? I said, "To me, one of biggest research issues is integration." A director of one of the research centres asked, "What's the issue?" I was taken aback and the only response that I could give him was to say, "It's hard" It is hard. Taking a global view is always more difficult than taking a more local view. Sometimes we should not do it. There were some points made this morning that perhaps integration is another one of those rainbows that as an industry we go after, without ever wondering whether the goal was worth it.

Effectivenss versus efficiency. We have all heard a lot about this. If you view that in terms of this innovation that I talked about it is useful. In the first stages of innovation we tend to tackle efficiency problems. Give me a tool to help me do something more efficiently. It is only after that that we tackle the effectiveness problems. How do I make a manager more effective? How do I make myself more effective as a professional by using some of this technology?

What is new? As a data processing manager, I used to spend a lot of time saying, "Well what's new here?" Is there something fundamentally different? All the issues seem to be the same, that list that I just cited. Those are not new, they are issues that you face every day as information systems managers. What is new? There is less new than many people think, but there are some things.

What is new about office automation?

- Interleaving of structured and unstructured activities
- Extent and frequency of human intervention
- Comparative low volume
- Distributed environment
  - data
  - function
  - responsibility

One is the interleaving of structured and unstructured activities. If we look at the history of computing, we tend to tackle the most structured applications first. That makes sense. You pick something where you can win, and structure is very

important in computer systems. One of the useful questions to ask when you look at office applications is to say, "Wait a minute, here's an application I am talking about. Why wasn't this tackled with data processing technology?" It is useful in an organisation to look at the applications that you have chosen to computerise and those that you have not, and try to find some rationalisation. Why did I choose to work on these applications and not these? We come up with lots of different answers. One is structure, another is volume. Data processing people tend to go after big volume applications, and they should, because building data processing systems is very expensive. We tend to build expensive systems with high volume, and get low unit costs. In offices we have to be careful, because what we often end up doing is building expensive systems with low volumes, and getting very high unit costs. Many office applications have a comparatively low volume. That is something new to many data processing people.

Lastly, it is a very distributed environment. Offices, both in data function and responsibility, are very distributed. The relationship between office automation and data processing. That is a good question. The question that I was supposed to address throughout this talk was: what is the role of management services? It obviously rotates most importantly around that particular question. Office automation is clearly related to data processing. We are talking about computers. To me, office automation really implies the next level of distribution of computing capability into the organisation. I think that what we are talking about in office systems is taking computing capability and pushing it out one level further, into the user's area. That has been the history of computing, so that is nothing new. That is a natural extension of what has been going on in computers from day 1.

OA and DP

- Office automation is an extension of data processing
- Office automation is related to data processing
- Office automation implies the next level of distribution of computing capability into the organization

In fact I would ask you: "What are the distinctions between office automation, distributed data processing and small business computing?" These are probably, in reverse order, the last three major buzz words in the data processing industry in the United States. What is the difference? I do not think there is much of a difference. It is a different point of view. Small business computers are what we are installing; distributed data processing is how we are doing it, it is the technology, the way to wire these things together and make them talk to each other. Office automation is the "what". When we talk about distributed processing, where are we putting these computers? At least on my side of the ocean we are not putting them on the beaches, we are putting them in offices. Often we look at applications, particularly distributed data processing applications, and if the guy installing the application was wearing a different hat he would clearly call it an office automation application.

What are the distinctions between

- Office automation
- Distributed data processing
- Small business computing

I think they are very much the same thing. One of the things that has always concerned me about the whole distributed data processing area is that distributed data processing focuses on a technology instead of on solving problems; that is, it is a "how" as opposed to a "what". It is a vehicle, and we tend to get too wrapped up in vehicles for accomplishing something, rather than in the issues, the business problems that we are trying to solve. To me, coming from that standpoint, office automation is really the applications vehicle through which distributed data processing really comes of age and in which we really start to see large scale distribution of computing capability.

What is the role of management services? One question that is often asked is, "Who is going to lead this? Will it be management services? Will it be administrative services? Will it be communications people?" You can produce arguments in all three directions, and I am sure that there are many individuals in all of those areas who are actively working in office automation areas today. When you talk about management services or data processing, you get two very distinct opinions about the proper role of office automation. One is that management services is the obvious group to lead the office evolution. People counter that with the statement, "You must be kidding?" So those are two diverse views.

Let me try to point out the issues. Why should management services lead this effort? Most importantly, information systems people have a history of managing change. That is what we do. As a DP manager when I really had failures, when I went back and looked at them it was not a technology failure, it was that nobody really told me that I was the vehicle by which major organisational changes were being implemented in the organisation. I was just the guy stuck doing it. I was asked to install a payroll personnel system, and no one told me in doing it we were changing 80% of the personnel policies and codifying benefit policies that had never been written down before. That is a small detail. We are change agents, which is something that we must keep in mind. That is really what we do. Every time we install a computer system we are installing change. Office automation is more of the same.

Why management services should lead office automation effort

- History of managing change
- Understanding of systems
- Understanding of technologies
- Understanding of integration issues
- Understanding of scope and opportunity
- Obvious next step

I think that we are learning. A good point was made this morning that today is not the same as the mid-'70s. Data processing people are maturing; they are getting more credibility. There is a long way to go, but I think that they are recognised as people who understand systems and how to manage change. Clearly they are the ones who understand the technology. Today, office automation is very much technology based. It is hard to talk about office automation without talking about bits and bytes, bandwidth and all the other neat words. It is very difficult for people without some technology background to engage in dialogue with office automation vendors.

Data processing people have an understanding of integration. We understand how important integration is, but we are not very sure about whether we should be doing it and at what level we should be doing it. But we do know that it is something that you have to think about at every step of the way. I think that is a bit different.

Information systems people have an understanding of the scope and the opportunity. As

I talk to people in these different areas, it is the data processing people who understand that we are dealing with computer systems and lots of them, and that there is really an opportunity to integrate data processing and office systems.

It is the obvious next step. For all of you empire builders out there, here it is. Everybody knows that. Someone suggested that this provides an opportunity for an information systems manager to get a much broader exposure to the organisation, and that this would be a very good step into other career opportunities in management. It clearly is a next step.

Why management services people should not lead the office automation effort. We really do not understand offices very well. That is something that administrative services people will point out to me in an instant: "You guys don't understand offices." Although I do not say it to them, my response is, "But neither do you." Data processing people do not have much credibility. Although that is changing one place where we really do lack some credibility is at clerical levels. A lot of clerks think that — a term often used in the United States — we are all a bunch of space cadets, off in our own world; and many times they are right.

Why management services should not lead office automation effort

- Poor understanding of 'office'
- Little or no credibility
- Poor understanding of organizational issues
- Lack of sensitivity to behavioral issues
- Technology driven, not problem driven

We do have a poor understanding of organisational issues. We talk about it so much because we are all looking for answers. You come to a conference like this looking for answers, and no one gives you any because, in my opinion, no one knows any of the answers. But it is true that we have less of an understanding of organisational issues, particularly massive organisational issues, than other individuals in the organisation do.

We have a lack of sensitivity to behavioural issues. That is probably true. We are technology people and much as we talk about social issues and behavioural issues, all of us really want to get back to our terminal, say nice things and get nice things said in return. We do have a lack of sensitivity to behavioural issues. I think that comes with the breed. It does not mean that it cannot be learned and that those issues cannot be addressed. I think that data managers really are trying to address that and to get much more in tune with the times.

A major criticism and one that I think is absolutely appropriate is that information systems people are technology driven and not problem driven. Man, is that true! We love to play with new toys. I have a personal computer at home. I love to play with it. I look for things to do with it. I will spend hours at my computer, forcing it to do something that my friend next door could do in ten minutes by hand. I suspect there are too many people like me out there.

I go back to this issue of immaturity. When a child is challenged to do something, of course he does it. "I dare you". That is the way that we tend to be with technology. As soon as the technology is available we look for ways to use it. It is a two-edged sword. Obviously we cannot ignore the technology, it is the major constraint on what we can do; but the one issue that stands out to me most often in information systems is that we are not problem driven. We do not start out with the objective of solving a business problem, we start out with the premise of, "I have the cake in terms of the technology. I am looking for somebody to eat it."

There are some challenges here to what I will call the formalisation of office automation. One

is an emphasis on function, which follows from what I just said. An emphasis on function and functional integration, which I separate from technological integration, which I happen to think is also very important. But we really have to pay attention to the business problem that we are trying to solve and to how these things all fit together.

Challenges to formalization of office automation

1. Emphasis on function
2. Functional integration
3. Active, not passive systems
4. Match tool to problem
5. Human engineering
6. Productivity measurement

Also, we have to go to active systems. I said earlier that most office automation systems today are very passive. In some cases computers make great tools as passive systems. Look at the area of information storage and retrieval. Information storage and retrieval systems are very passive. You walk up and ask the system a question and it gives you an answer. If you do not ask it a question it does not say anything. Why are those things of value? They are of value simply because the databases that are stored in them are of huge, huge volumes, and the computer can look at them a lot more quickly than we can. Passive systems can be very valuable when you are dealing with extremely large volume. That is why large-scale information storage and retrieval systems are so important.

But office systems tend not to have that volume. An office is a very active organisation. An example that a friend of mine uses is that we really want to build office systems that act like very good administrative assistants. That is a good model. He goes on to say that a good administrative assistant, by example, is someone who walks into your boss's office at 9 in the morning with his Wall Street Journal and has one of the articles circled in red. He says to him, "You really ought to read this. You wrote three memos to your boss last week convincing him that this would never happen. Here are the three memos." That is very active participation. A good administrative assistant is valuable because he is very active. He is scanning the environment for things that might affect you. In office systems we tend to build electronic file cabinets which are very passive.

When I was at the Wharton School at the University of Pennsylvania, in 1975 and 1976 we were very interested in office automation and we built a number of tools; text editors, electronic mail system, electronic filing system. These were used not only by the academics, the hackers, but also by the administrative staff throughout the school. The system was also used to publish the Wharton School's magazine. We built a number of tools into it and they met with quite a bit of success. We were sitting around at 3 in the morning, eating pizza, like all good computer people do, saying, "What can we build next?" Someone said, "We ought to build a calendar management system." That seemed like a great idea. Everyone was talking about calendar management systems, and it was very easy to see how you would build such a system. So we did. It was a very nice calendar management system, very much like the ones that I read about that people are building today. You could store in the computer fixed appointments, such as "I teach every Monday at 9," variable appointments and specific appointments. You could also store reminders to buy your wife a birthday present, or make a dentist's appointment. You could look at your calendar a month at a time, or a day at a time, or a microsecond at a time, if you wanted: you name it and we would display it.

We built this system. One thing that we did at Wharton was very unusual: we documented these things. Very rare. It was the only time that I was ever forced to do that. That was why I left and went to MIT, they had more sense there. What was interesting was that no one used

this tool. Absolutely nobody. Why not? It had absolutely no benefit over my pocket calendar, absolutely none. It was just a passive file cabinet. It did nothing more for me than my calendar. That is not to say that it could not. We learnt a very good lesson there, because there are clearly some very accurate things that such a system can do. But you have to do those things to be of value.

Another lesson is that you cannot build computer systems that are as good as your paper systems and expect people to jump on your bandwagon. They have got to be substantially better. If you want people to walk up that learning curve, there had better be something at the end. When you get to this real paper analogue, "Let's build computer systems that do what paper does", one of the dangers that you face is that you build systems that are about as good as your paper systems. You cannot expect people to go too far in doing that.

Matching the tool to the problem. Let me start by relating an experience to you that was a good lesson for me. I visited a large bank in Boston which was making very wide use of word processing systems. They had Wang shared-logic systems. I first visited the word processing centre. It was very nice. It was like something out of a magazine ad, with big plants everywhere and desks all over the place. It was very well run and when you wanted to generate correspondence you would use the telephone system and it would come out on a tape. An operator would take the tape, and you know what happens from there. Four days later the user would get his letter back because it was lost in the mail.

But I went up from there up to the legal department, which also had a Wang shared-logic system. I said, "I guess you use your word processing system for word processing", which is typical of the things that I say when I meet people. She said, "No, we don't do that, we have a word processing centre." I said, "That's very interesting. What do you do with your word processing system?" She said, "I'll show you", and she was thrilled to sit me down, for literally two hours, and show me the things that she was doing with her word processing system. I wrote a little memo to the research group and said, "Basically, their Wang word processing system is an IBM 1401 with green phosphur", that is they select, they sort and they print. The applications that they were doing were something like the following. As a legal department they had tons of paper files, contracts and things like that which had to be stored and they always had trouble finding them. So they created an index, a document that had the identifier of the document, IBM contract, what file it was in, and what for. So a line of text might say, "Butler Cox contract; file cabinet 47; drawer2". When anybody was looking for something they would sit down and search the document. They would edit that document and say, "Search for Butler Cox". Two seconds later it would come up, highlighted, and they would have an answer. It is what we call information storage and retrieval. If I had used those words to them, of course, they would have been scared away.

Another application was billing codes. It is a self-liquidating department on a cost basis, an attorney working on a matter that has to be billed out to a department has to know the billing code. You can imagine the kind of system they have for that. I walked out of there as an ex-370/168 manager and said, "These people are crazy, they're using word processing to do data processing problems." Then I wondered for a minute what would have happened if they had gone to their data processing department with their itty bitty problems. You all know what would have happened. "Terminal? Ah, CICS. Six months. We use a database management system, this is clearly an IMS application." We would have estimated that it would take two years, which means that it would probably have taken four.

Those people did not have to do any programming whatsoever. They created a document and they searched a document. It did not bother them if they did not find the right answer the first time. That is something that nobody in this room would tolerate. If you ask for the Butler Cox contract, it had better come back on the screen with the Butler Cox contract that we are looking for. In their case if there was more than one, they searched the document and found the first

one, said, "That's not the one I want", and they hit "continue". They eventually found the one they wanted and it would take all of three seconds. The lesson to learn there is that you match the tool to the problem. This is one of the biggest dangers of people like us getting involved in office automation. We have spent years building elephant guns. Elephant guns do not work too well killing fleas. You get the flea but you get lots of other things coming down on top of it.

That is true. It is true that you have to match the tool to the problem. Another major impact is that there is a tremendous education process going on on the part of users in using these systems. Whereas the manager of that legal department used to view the computer system as his black box which did these crazy things, now he understands the process and what computers can do. That puts him in a much better position. As word processing becomes more and more widespread, one of the impacts that people do not appreciate is that it is serving as a massive education tool about computers. The bad side of it is that the computers that you are learning about are 1401s. Select, sort and print.

Human engineering is very important and was dealt with much better than I could do. One of the points that we lose sight of and which was driven home to me with my own personal computer is the multiplier effect. I have a personal computer that works very well. One of the problems that it has is that it is not very well designed from a human engineering standpoint. The key that is struck most frequently on any keyboard is probably the return key. My personal computer has a return key. Unfortunately, right next to it is a little key marked "reset". When you hit "reset" everything you have done goes away. You say, "But you really shouldn't hit 'reset'." I say, "I know I shouldn't, but I have done it 20 times in the past month." You wonder what is the impact of that when there are half a million of them installed in the United States. The issue in office automation is the multiplier effect. We are not talking about one person using a system, talking about "the user" as if there was one, we are talking about thousands of users in an organisation. Consider the multiplier effect of bad human engineering on productivity when you have thousands of people using such a system. It is a staggering problem.

Productivity measurement. One of the major challenges in office systems will be productivity measurement in the white collar area. What is it and how do you measure it? This has finally been recognised in the United States as an extremely serious problem, and it is something that will get an increasing amount of attention.

A few weeks ago I had the pleasure of speaking to a group at Westinghouse, which has formed a Productivity Improvement Committee. It is a group of very senior people charged with understanding and figuring out what the hell Westinghouse is going to do to improve productivity throughout the corporation. They have measured productivity and they have reinforced the statistics that we have all heard. In their case, factory productivity has been increasing 5% to 6% a year, office productivity has been increasing less than 0.5% a year — which is hardly worth talking about. The real challenge is how do you measure productivity: the issue of I did not do it 20% faster, I did it 20% better.

One of our real problems is that, very appropriately, most of us have to justify projects on an ROI basis, but the way that we go about measuring return on investment will create some problems in office systems where many of the benefits are of an added value nature. I made someone more effective. ROI decisions revolve around efficiency, not so much around effectiveness.

The skills that management service groups need if they choose to tackle this. Office systems analysis. In the US, there is a number of corporations and increasing rapidly, corporations that have formed office automation groups. A relatively common title today in the US within MIS departments is Manager of Office Automation. Within that organisation there is now a title of Office Systems Analyst. That is this person or those persons who are supposed to know

something about how offices work. I think that title will become a very common one. My personal opinion is that office automation will become a specialisation within MIS, just as data base management or teleprocessing has become.

New management services skills

- Office systems analysis
- Human engineering
- Associated office automation technologies
- Better implementation and training skills
- Better organizational skills

Human engineering, something that we really have to learn. Unfortunately, the more that I hear about human engineering the more I come to the conclusion that human engineering is largely applied commonsense. That is scary, because most of us do not have any. There are lots of technologies in office automation. Someone has to learn about them. Reprographics, micrographics. These are the things that most data processing organisations do not know very much about. You really have to know about these things, because when you are called in to look at office systems you have to look at all the alternatives.

We need better implementation and training skills. Just as in most data processing systems, the key to success is installing it properly, implementing it, introducing into the organisation. Many great technical systems fail because they are not introduced properly. But that is not new. That applies to all the systems that you have been building for the last ten years.

Lastly, better organisational skills. I go back to the question: who will lead the evolution of office systems? I guess I have a simple mind and I say "that group which expands the scope of its mission most rapidly". Will that group be management services? That is a decision that you people have to make.

SESSION F

A MANAGEMENT SERVICES DIRECTOR'S PERCEPTION OF THE FUTURE ROLE OF MANAGEMENT SERVICES

Peter Burman,
BICC Limited

Peter Burman was educated at Manchester University, England, where he obtained a Bachelor of Science Degree. In the 1950s he was employed by Imperial Chemical Industries Limited and subsequently worked as a management consultant. He then, in 1955, joined British Insulated Callender's Cables Limited as Chief Work Study Engineer. In 1964 he was promoted to Manager, Work Study and Training Services and in 1966 was promoted to his present position of General Manager of the newly created Central Productivity Services Department, now Group Management Services.

In 1973 Mr Burman was appointed Director of Balfour Beatty Limited (Traction and General Division). Mr Burman was a Fellow Foundationer of the Institute of Work Study (now the Institute of Management Services). He is also a Founder Member of the Methods-Time Measurement Association of the United Kingdom, of which he is now President, having been Chairman for many years. In 1972 Mr Burman was elected President of the International MTM Directorate, after having been Director for Membership of this particular body for some years past. He is a Fellow of the British Institute of Management.

When I first accepted this invitation from Butler Cox & Partners to speak on this subject, it was in the safe and secure knowledge that the appointment was far into the future and that the subject matter appeared relatively simple. Unfortunately, as the date has come nearer and nearer and I have addressed myself more and more closely to the particular issue, I have to tell you that I have been increasingly dismayed by the realisation that the subject is of monumental complexity.

However, I have decided to try to approach the subject in what I hope is a sensible and structured fashion, and to try to identify as many facts, opinions and projections on the various issues as I can; to try to analyse these and put them in order, with the overall objective of trying to lead us to a sensible, general conclusion — if indeed that is possible.

On the basis that white-hot technology never has been — and I hope never will be — a substitute for organised commonsense, it appears to me to be necessary, first, to introduce the subject by trying to establish as clearly as possible what the present position is and to introduce and make clear the appropriate definitions. As you may know, one of the first rules is to try to define precisely what your problem is.

I will then go on to try to identify some of the various main factors which must be involved in any attempt to predict the future. In doing that, I will need to draw heavily on past experience and try to project on the basis of my own knowledge of the subject, from reading, from attending conferences like this, and from the many enjoyable debates and discussions that I have had with colleagues from other companies.

The task is a little simplified by the fact that most of you come from large organisations, as I do myself. Most of you already will be familiar with management services functions generally. But to clarify the term — and I think that yesterday showed to some extent that there was a need to do so — we should consider what it has meant in the past, what it means in most companies today, and, having indicated how the subject has evolved over the last 20 years or so, this may help us to project further into the future.

The term "management services", has been used over the last couple of decades to describe a very wide range of situations, ranging from the simple application of time study, method study, work measurement, payment-by-result schemes and so on. Indeed, the current body that calls itself the Institute of Management Services specialises in these particular management techniques, with a dash of O & M to leaven the mixture. It ranges from that comparatively simple situation to departments containing services of a highly technical nature, ranging from computing in all its forms, through telecommunications. And latterly, in many cases, it is beginning to incorporate electronic office equipment and areas associated with that.

When I wrote this paper I had a feeling that many members of the audience might well define management services as basically applicable to the computing area. Indeed, the first paper yesterday tended to underline this impression, and the first question asked after the paper yesterday underscored it yet again.

Management services to many people means computing. I suspect that further, it means computing with a heavy central mainframe bias, and possibly with some telecommunications responsibility also. May I suggest to you that in strictly logical semantic terms perhaps management services ought to include all the contemporary aids and services to management. Not just computing and telecommunications, but management consulting, certainly cost accounting, legal, secretarial, research services and so on. But I must say that I know of none who even attempt to cover such a wide range.

Perhaps it is more sensible to consider the issue in pragmatic rather than semantic terms, and to try to categorise these various management support roles and gather them together where they have a common underlying thread. I am going to suggest to you that, in my view, management services exist as an aid and support to management in the pursuit of management's basic aims. Indeed, one can give a good deal of hard thought to trying to determine what are the basic aims of management.

In order to simplify the discussion, I would suggest that they are twofold. First — the primary aim of most operating managements — to keep the business running smoothly. Usually all other aims are subordinate to that one. Assuming that that aim is satisfied, the second point is continually to seek to improve the performance and the profitability of the business. These are two very different things.

So the management services function should contain those facilities, those black arts which can assist these two basic aims. If you accept that, I think that you must also accept the point of view that perspective is singularly important in this context.

Let me give an example. Computers broadly can be defined as tools of management. You can regard them again in two ways. Firstly, as tools which will help you to automate clerical work and, secondly, as tools which will help you to reduce the cost of goods sold. It is a vast oversimplification, but the dividing line is fairly clear conceptually.

I suggest that whichever you plump for will influence heavily your organisation structure. If your

Board regards computing basically as a way of automating clerical functions, then it would seem logical to allocate the responsibility for computing to the chief accountant, perhaps the company secretary, possibly the finance director, basically upon the logic that it is these gentlemen who control most of the administrative staff, most of the people whose work will be automated.

If you go for the second alternative, perhaps it is more logical to locate the function to be responsible to whoever in your organisation has the remit to seek greater efficiency or higher productivity — if you like, the management technique specialists.

It may be more acceptable to you if I focus the discussion by explaining the particular situation in my own group of companies, within BICC Limited.

That is the basic issue. What is this animal that we are looking at and trying to understand better? The slide says:

> "BICC Limited is the world's largest organisation with complete facilities for research, manufacture and contracting in the transmission/distribution of electric energy for power and communications."

British Insulated Callenders Cables Limited

Worlds largest organisation with complete facilities for ...

... Research, Manufacture and Contracting.

in Transmission & Distribution

of Electric Energy

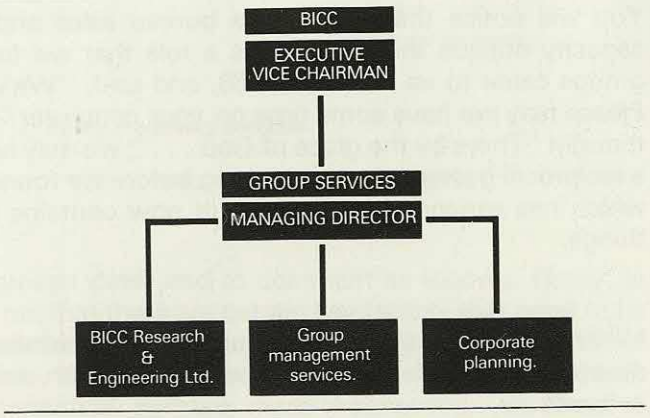
for Power and Communication

To give you some idea of size, our current turnover is somewhere around the £1,000 million a year mark, which places us about 30th in the league table of company size in the UK.

BICC World-wide

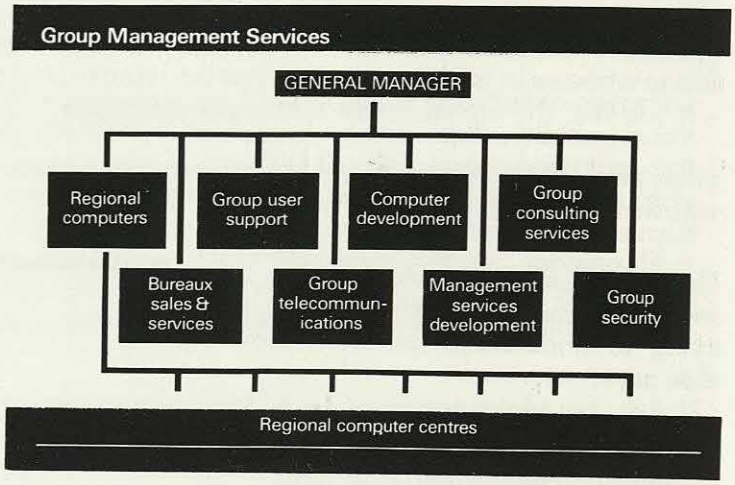
ELECTRICAL	METALS	CONSTRUCTION	AND .....
Wire	Refining	Civil engineers	Plastics
Power Cables	Fabrication	Electrical installation	Pipelines
Telecom. Cables	Smelting	Building	Plant hire
Capacitors	Recovery	Tunnelling	Machinery
Accessories	Magnetics	Structural	
Connectors			
Insulants			

This slide attempts to list the main areas of activity, the one connected with electrical transmission, with metals, and also with construction. There is a fourth group which deals with our international affairs, which are extremely large. So it is a big outfit, and it is widely diverse in its activities.



This slide is intended to give you some idea of where management services sits in the organisation. We have a group services managing director responsible to an executive vice-chairman, and his remit covers research and engineering, corporate planning and group management services.

To focus even further on the management services part, this is a schematic representation of my department. Again, briefly to size it for you, it employs just over 200 people and has an expenditure budget of about £5 million a year currently, most of which represents investment in central mainframes.



Starting from the left, we have regional computers in regional computer centres. It was one of our early policy decisions, beginning in 1966 when this department was first put together, that we discouraged our individual sites from having their own computers.

It may be of interest to you to report that at least 15 operating units wanted to have their own computers in 1966; and would indeed have had them if past practice is any guide, if we had not formed this policy. Instead, we put together a number of regional computer bureaux, geographically placed throughout the UK, near clusters of operating units, and our policy briefly said:

> "You may have free will to identify and to develop any particular computer application. In doing that, you can employ your own systems and programming people. You can go to outside consultants or you can use our internal consultants in computer development or group user support. The choice is yours. But once you have identified and developed the application, then it is to be run on one of the central mainframes . . ."

It will be of further interest to you that all those regional bureaux centres were set up within work sites. Of course, in those days it was virtually all batch computing. Since that time we have amended the policy and decided to coalesce the seven or eight regional centres into two or three large, remote, highly svcure centres, operating on a "telecomms" basis, for reasons of security that I am sure I do not need to explain to you.

You will notice that we have a bureau sales and services function; that is to sell surplus capacity outside the group. It is a role that we fell into by accident, when some very large groups came to us in 1966/67/68, and said, "We've made an awful mess of our computing. Please may we have some time on your computer?" We said, "Delighted", if only because we thought "There by the grace of God . . ."; we may be in the same position ourselves and require a reciprocal gesture. It was not long before we found that we were in a very profitable business which has expanded and grown. It now contains bureau packages and all kinds of exciting things.

Moving to the right we have group consulting services, and beneath that management services development. Both of these are concerned with management consultancy, basically in-group, in-house.

The group telecommunications function is a comparatively recent one. Some five years ago it became apparent to us that there were considerable savings to be made and a good deal of advantage to be gained in the group having its own private telephone network. So we put this to the Board and, after a good deal of discussion and explanation, they agreed. We hope — God and the Post Office willing — to open this system in February next year.

The logic behind it is simple and twofold: firstly, to transfer telephone traffic from the expensive, public switched telephone network to private wires, which are very much cheaper. And secondly, to rationalise our private wire system, by large super group trunks down the UK with three transit switches, top, bottom and middle, so that traffic does not go expensively across country, but goes in at the top, down the trunk and out at the bottom. The savings are very respectable, with the additional advantage that we can use the network for telex, data transmission, telemetry, all kinds of things as a bonus, at no extra cost.

You may be surprised to see group security there. That is a fairly recent adjunct and it is a very small department to help improve security in the group.

So in BICC Limited management services is concerned with the pursuit of business efficiency through the use and application of the various management techniques of work study, operational research, O & M, and so on. As you have seen, there are also substantial operating services supplying computing, telecommunications and other facilities to the group. There are, additionally, important policy, training and advisory services. Under computer development and management services development, we have these policy-making advisory roles. These are the chaps who tell us what we should be doing in two, three, four, five years' time. They are responsible for helping us to form the policy and for training and educating people in these policies.

In historical terms, the department began with one man in 1957, and the remit at that time was to introduce modern work study practices into the group. From that base we expanded slowly and steadily into management training. We set up the group's management training function — later handed over to personnel as a going concern — general management consultancy work, and the amalgamation with computing took place in 1966. The amalgamation took place for two reasons: firstly, because of this basic conviction that computing had a profound contribution to make in improving business efficiency; and secondly, for the perhaps more mundane reason that nobody else wanted it, and I happened to be around at the time.

Operating services:	Computing Telecommunications Office equipment Etc.
Business efficiency:	Systems and programming Organisation and methods Work study Operational research Etc.
Policy & advisory services:	

Let me attempt to analyse these areas in greater detail and to comment as follows. Firstly, in terms of the operating services it seems to me that there are certain key factors that need to be addressed. In dealing with computing, telecommunications and, latterly, electronic office equipment, there are a number of basic issues. You need to provide the best technical solution, whilst keeping a very firm eye on the economics. Perhaps more importantly, you need to

evaluate very carefully the issues of present and future compatibility with existing and proposed major group information systems. This must be one of the central advisory type of responsibilities that I mentioned earlier.

In the operating services themselves, there are obviously a number of important features. In cost terms, the argument of economies of scale clearly is one that one uses in terms of centralised hardware. It is a very topical question, and one that I am sure that is taxing most of you at the moment. Two pertinent points are that, in my view, the proposals that are put up for decentralised equipment are frequently supported by costings that are less than comprehensive, because one of the great features of the centre versus the periphery situation is that in the centre one is under a continuous, blinding spotlight. As Joe Louis once said of one of his opponents, "He can run, but he can't hide." Whereas, in the periphery, the operating units, it is easier to hide your mistakes. Post mortems in my experience rarely occur in the same way and with the same force as they do in the centre of the company.

Additionally, one has the issue of utilisation. My central mainframes run seven days a week, three shifts. A local mini might get four or five hours during the prime shift only. That is another factor that does not always receive the attention that it should. You will be fully aware that in this area of the minicomputer, the whole market has been upset by certain recent happenings. Specifically I am referring to the erosion of mainframe prices, the chain reaction that was started by Amdahl and Itel, and the pressure that that put on IBM, which has flashed through to ICL and other manufacturers, resulting in a very sharp improvement in the cost/performance mainframe situation.

It is not surprising that this had led the major computing companies to attempt to widen their marketing repertoires, if only to preserve margins and to keep up volume. More and more, I believe that we are seeing a situation where suppliers are endeavouring to deal directly with operating and line managements, and more and more trying to circumvent the central computer professional. It is a scene with which I am sure you are familiar. This development will undoubtedly have a considerable effect upon the strategy of large groups like mine, where the pressures of sometimes extravagant claims by mini manufacturers, when amplified by the siren call of autonomy, could well lead to the breakdown of what were originally well thought out corporate strategies, which recognised the need for decentralistion of hardware with changing technology, but which also clearly recognised the danger of a planned retreat becoming a rout. If this happens, the consequences will be very expensive and a lot of control and balance will be lost in the process.

Clearly, in the central operating services areas things need to be managed well, and perhaps more importantly, things need to be seen to be managed well. It will never be admitted, let me assure you of that, but it needs to be seen. My personal view is that operating managements should be seeking the benefits of computerisation primarily, and should not be seeking to have their own computers, unless the central service is clearly inefficient, or unless, perhaps local facilities would have a very clear cost advantage. Again I mean a clear cost advantage to the group, not a cost advantage in monopoly accounting terms to the operating unit. Because if the group already has central mainframe capacity standing spare, it is surely the economics of the madhouse to bring in a mini in an operating unit and take work off the centre.

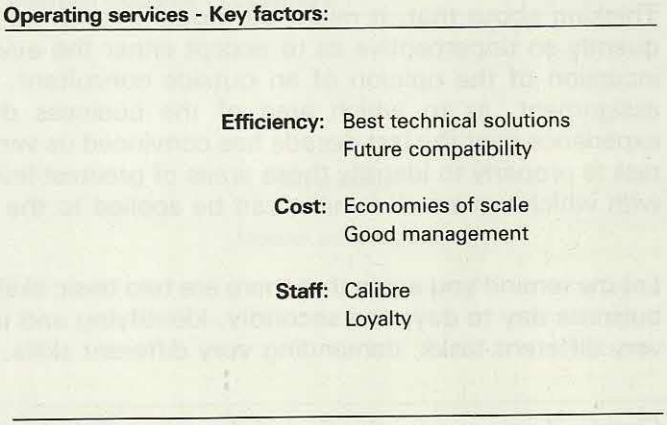
So a further policy decision made in BICC was that people could and should have local hardware and local facilities, but on the condition that it was to process profitable local applications, and that they should not take work off a central mainframe in justification.

One of the earlier features of our computing policy was to say that we would have one supplier of mainframes. On the whole I think that was an excellent decision. I am sure that it saved a lot

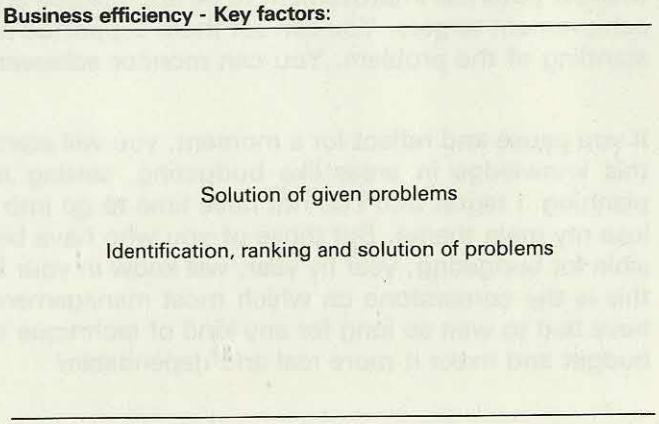
of trouble and a lot of problems. In the case of minis, we viewed the field as best we might, centrally, and provided a restricted range of choice. We said "We believe you can have any one of these three, but nothing outside those three, simply because we cannot keep enough expertise in the centre to cope with more than a restricted range." We also believe that in the centre we alone possessed the knowledge and the expertise to decide which three were best. The three may change from time to time, but I am sure that you understand the principle.

Let me turn away from computing for a moment to look at one of these other major aspects of management services: the pursuit of business efficiency, clearly a service to management. The objective is to assist management in pursuing the particular aims that they may have at any one point in time. These aims can change. It may be capital employed performance at one point. It may be cash flow at another one. Implications may be a need to adjust stocks, to control the workforce more tightly, and so on. But the basic objectives remain to make the business, in context, fitter, better, perhaps larger, through the skills of new venturing, business research, and so on.

Briefly, these three roles are in my view what management services should be supplying to business management today. These are the purposes. The factors affecting these purposes in the operating services section are based firstly on the thesis that this is the most efficient and cost effective way of supplying the services, partly because of economies of scale and partly because of the need centrally to locate the necessary highly skilled personnel, to provide the job opportunities for them to ensure that they stay with your company.



It may be of interest to you to go a little more deeply into this and to make the point, which is not always generally understood, that in seeking business efficiency you have two options. You have a decision to make between them in most cases. It is a decision to be made between the solution of given problems as diagnosed and understood and presented by your operating management, as opposed to the alternative approach which, in the case of my group, has frequently proved to be of far greater benefit. That is the independent analysis of a business, leading to the identification and the ranking, and subsequently the solution of the real and the important business problem.



In my book, this distinction is quite vital and it seems to have been recognised in practical terms only in comparatively recent years, because conventionally operating managements have

tended to call in the management services professional or the consultant — as and when they believed that they perceived the need — to address those areas which management thought were the problems. This might have been partly influenced by the double split that I mentioned earlier: the twin problems of keeping the business going, and secondly, of looking for improvement. I suspect that in many cases where operating management provided the given problem, and brought in the technique specialist, it was for the first, rather than the second reason.

This major error has been compounded by the management technique professionals, who have tended to wander about a company or around industry a bit like contemporary Lancelots seeking the Holy Grail, all looking hard for problems that their techniques would apply to. Whether or not the solution of these particular problems was of any value to the business they rarely considered. So I think that we have had the perspective all wrong.

Against this, we have developed particular business analysis skills in BICC in the last 10 or 12 years, and these have enabled us to identify the real problems, the ones where the greatest leverage is; to be able to rank them after a full and detailed analysis of the business as a whole. I believe this leads frequently to orders of magnitude and importance being demonstrated which had in no way been properly understood previously by operating management.

Thinking about that, it might be thought rather surprising that operating management is frequently so unperceptive as to accept either the evidence of their own prejudices or even the incursion of the opinion of an outside consultant, who frequently has one eye on the next assignment, as to which area of the business deserves study in the first instance. Our experience over the last decade has convinced us very firmly that by far and away the most vital task is properly to identify these areas of greatest leverage, where the management techniques with which we are all familiar can be applied to the greatest advantage.

Let me remind you again that there are two basic skill areas in management: Firstly, running the business day to day; and secondly, identifying and implementing improvement potential. Two very different tasks, demanding very different skills. The second being frequently ignored.

Clearly, if you pursue this line of thought a little further, another dimension in this approach is that once you have identified, analysed, and ranked problem areas, the knowledge that you have gained in the process frequently permits a sufficiently deep understanding of the situation to allow potential improvement to be appreciated and quantified. If that is the case, you can set achievement targets. You can set them supported and buttressed by a deep and factual understanding of the problem. You can monitor achievement towards these targets.

If you pause and reflect for a moment, you will start to appreciate the profound significance of this knowledge in areas like budgeting, setting management objectives, and in corporate planning. I regret that I do not have time to go into this subject more deeply, otherwise I shall lose my main theme. But those of you who have been running large departments and responsible for budgeting, year by year, will know in your heart of hearts what the weakness are. Yet this is the cornerstone on which most management economics are based. Why is it that we have had to wait so long for any kind of technique that will permit us better to understand the budget and make it more real and dependable?

Another dimension is whether these services are operated on a request basis. Does the manager ask for them? Or are they imposed by a more senior management? There is no doubt which is the more efficient. It is the senior chap who sees the panorama better and who knows what the real needs are better, but in terms of acceptability I think it has to be on a request basis.

Another aspect is the ability to set potential and monitor achievement. I have spoken on that and I will not dwell on it further. Let me move on to the next point. With any central service operation you need a decision about whether you are going to charge fees for your services, or whether they are going to be given free and without obligation. This is worth debating for a few moments.

Business efficiency - Key factors:

Operate on request

Be imposed

In the first instance, if you charge fees you have a pretty powerful defence when times get hard and the managing director comes along and says, "Cut it in half." Your answer is simple: "Yes sir, if you wish. But the group must have these services and it is clear from a survey of alternative sources that I am supplying it at half the going rate outside, with the additional advantage that the knowledge obtained by my chaps is retained in the business."

Business efficiency - Key factors:

Set potential

Monitor achievement

If you charge, you bring into play powerful emotive forces. In all the groups that I know of, a fate worse than death for any operating manager is to pay money into the centre. He will do anything rather than fund the wicked centre. Therefore, you had better be good, because if you are not first class you will hear about it.

Business efficiency - Key factors:

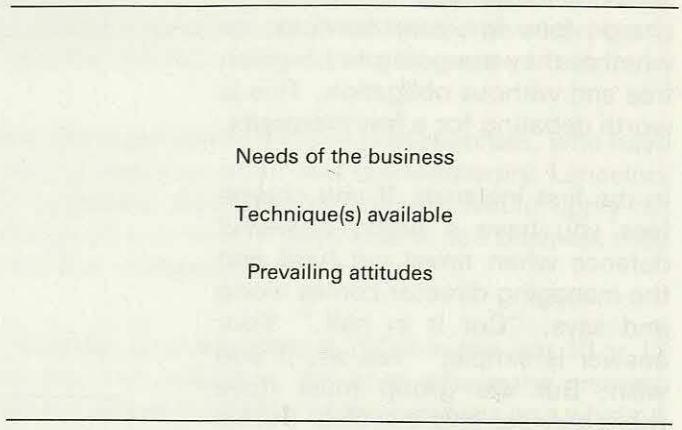
Charge fees

Free service

You tend to get better calibre projects, because the operating manager will be a sight more careful about how he spends his money. Accepting that outside agencies sometimes have the merit of detachment, if you are on a charging footing, then at least any arguments that you have about the future of your department do tend to be on a more sensibly structured basis in what is certainly an emotional area.

It goes without saying that you need to have a clear understanding of the needs of the business. You have to have the appropriate techniques available. Last but by no means least, you have to pay a good deal of attention to attitudes. It is no blinding flash of the obvious to say that the

underlying prevailing attitudes of government, of management, of trade unions, and the associated workforce, are fundamentally important to the present and the future role of management services.



Government has the task of setting the general business environment for the economy. This is the water in which we all swim. For many years now, Western government as a whole — not just our own — has been seized with a delicious schizophrenia: they cannot decide between full employment and inflation. They have been hovering between the two for almost as long as I can remember. Because it does seem that full employment equates with high inflation, and control of the money supply to bring down inflation leads to the kinds of problems that we are seeing now, with businesses being squeezed, and lending rates shooting up. Personal taxation policies drastically affect the attitudes of senior management particularly. The masses of what I will call "socially-oriented legislation" that the last government delighted in pumping through the system at an enormous rate is another considerable burden to the poor line-manager who is trying to run his business at a profit.

I think that most managers are not ogres. They are sensible and decent people. They want to be efficient. They would like to run a good ship. They want to have a profitable company. But they are also highly intelligent pragmatists for the most part. They are very much inclined to balance risk against reward as it affects themselves and their own careers. If the society in which they work rewards management poorly, if it does not place a high value on initiative, if the power of the trade unions is such that managers feel their personal security is likely to be threatened, these are very important factors that you have to take into account. Without wanting to be thought to be making political points, it is obvious that the trade unions themselves, certainly in recent years, have been judged by many observers to have shown very unreal economic attitudes. Often they refuse to permit change. They set their faces against technological improvements. The poor workforce, the people down at the coal face, find themselves suffering from a combination of weak leadership, a Duke of York style management at one end, the extreme militant trade union shop steward at the other, and they have their own difficulties in coming to terms with the requirements of change.

Let us now try to look ahead. In the intermediate- to longer-term, say 10 years or so, the potential rate of change in technological terms at least is obviously great. It is so great than one can pose only very general questions about the shape and the form of our society. It is this shape and this form that will shape the role of management services.

Some of the factors that spring to mind straight away are the rapid advances in computing, perhaps even more rapid in communication, automation, convergence. It seems likely that fewer people will be employed on productive work, shifting to the service industries, maybe fewer people employed altogether. We certainly see signs of that. Earlier retirement perhaps, and perhaps shorter working weeks. There will certainly be one European currency in the foreseeable future if the Treaty of Rome means anything. It is no great stretch of the imagination, at least to an audience like this one, to picture a society that operates entirely without cash anyway. You can imagine the sort of far-reaching effects it will have on accounting, banking, insurance, and so on.

I believe that it is true to say that a lot of the management services role depends for its fuelling on the drive to change, the drive to improve, and the response to business challenges generally. One has to admit that it is at least a possibility that as social differences and uncertainties engendered by these differences tend to diminish and fade, the search for efficiency and profitability may became less important to society as a whole. There may not be the same need.

The services themselves will expand and grow in the short term. There is a lot of scope in computing and telecomms. One hears many views, for example, that today's computer and telecomms professionals will become comparable in status to the biblical hewers of wood and drawers of water, rather than the highly-paid and highly-regarded professionals that they are today; that is, once the newness has worn off and the thing has become decentralised.

In the shorter term, I have observed frequently in recent years, sadly too frequently, and sometimes in some very big groups, that the management services function has become less than pragmatic in its attitudes and its approach. I do not know why they have been driven this way: it may be just sheer frustration. There could be a number of reasons. But I have seen them become first interested, and then, subsequently, obsessed by those fringe areas which one might describe as socially or academically interesting. I hope that no one will take offence if I cite the behavioural sciences as a possible example.

Having seen their fate overtake them — in pretty short order in some cases — I have to form the overwhelming conclusion, and one that I will leave with you, that if management services is to survive the next 10 years or so, it must be primarily concerned with the mundane task of making businesses more efficient and more profitable, to satisfy the direct needs of operating management.

One way of helping this aim is for us to seek to employ more people in management services who are trained in general business skills, even if it is at the expense of some of the high-quality technicians that we have. Business now sees the overwhelming requirement to be hard-nosed, to be cost effective in the operating services which it consumes. I believe that management services has to respond to this by being competent and by giving excellent value for money. If you do not, I believe that your fate will overtake you very quickly.

The longer term is much more difficult to forecast. I commented earlier that in large groups at least, management services ought literally to include all the services and aids to management, if only because the skills represented are complementary and interactive. Clearly, only under a common organisation structure do you have the possibility of the best teamwork.

The management services, however you define them, could and should support each other in order to give the greatest aid to operating management. But clearly human beings being what they are, there will be human and organisational problems, probably so great as to make this concept unworkable. I am sure that we have all had experience of the rivalries and jealousies between staff departments. I can remember some 23 years ago, at an occasion like this, hearing a very senior practitioner in the O & M field refer to work study as the "razor gang". Well, he is entitled to his view and I am sure that there were contrary opinions expressed. But this is the kind of problem which, if we are not very careful, we will run across.

In computer hardware terms, like it or not, there will inevitably be progressive decentralisation of hardware. I believe that the most important thing that we have to do is to make sure that when such decentralisation takes place, it is controlled sensibly and does not lead to disorder, fragmentation and expensive lack of control.

These techniques, once introduced by a centre, tend to become absorbed by and practised by operating units. It certainly happened to us in the case of the work study function. In the centre which introduced it there is little left, but the operating units have it and use it well. But I am

quite sure that the current move towards decentralised computing will be very painful for a lot of us, and that in many cases there will be an expensive loss of control.

In the final analysis, it seems likely that the centre of large companies will retain a reduced number of the highest calibre of forward thinking technologists, who will guide the group generally, setting policy and standards, and who will advise and consult with operating units. I believe, too, that the centre will retain senior, general problem-solving expertise, because management will always have problems, logistic and other kinds, which they cannot deal with, or which management do not have time to deal with, because they are too busy running the business.

Much of the hardware will end up in the hands of the end user who will probably understand it about as well as most housewives understand the cars they drive so well. But they do not need to understand it, as long as they use it intelligently and sensibly.

I hope that I have not confused you too much. It seems appropriate to end by telling the doubtless apocryphal story concerning the late Lord Birkenhead, who you may recall was a most eminent QC. In court one day he had a particularly difficult judge to deal with. It is said that the judge addressed himself to Lord Birkenhead from the Bench with the words, "I have studied your brief, sir, a good many times but I regret that I find that I am still none the wiser". To this, Birkenhead is alleged to have replied, "That may well be so, but I am equally confident that your Lordship must be a good deal better informed."

SESSION G

MANAGING THE CRISES IN DATA PROCESSING

David Robinson,
Nolan, Norton & Company Inc.

Mr Robinson is a management consultant specialising in performance reviews and planning studies for data processing organisations. As a manager for Nolan, Norton & Company Inc., Mr Robinson's specific areas of expertise include:

- *DP strategy formulation*
- *Long-range planning for data processing*
- *Audits of EDP organisations*
- *Hardware planning*
- *Software development standards*

Mr Robinson was educated at Princeton and Harvard Universities. His career includes a period in the US Navy, in a large DP installation and also some years with Arthur Andersen.

In the latter position he was concerned with a number of data processing projects.

The title of my talk, which is "Managing the Crises in Data Processing" is the result of one of the last editorial passes made at the article that George Cox referenced, which was published in the Harvard Business Review this spring. The article is about the work that was originated by Dick Nolan and that forms the basis for most of our company's work, which is called the Stages hypotheses for understanding and managing data processing growth, and that is what I will talk about this morning.

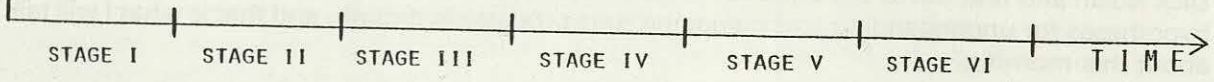
I will talk about two things: what is the Stages hypotheses, for those of you who either have never heard of it or have heard of earlier versions and might be interested in what is different about this article; and, assuming that you understand that, what in the world you can do with that knowledge in helping to manage the management services function. So I will try to address those two broad points this morning, first to walk you through what the Stages is and where it comes from, then some approaches to taking that framework and applying it to the management and planning of the management services function, specifically the data processing end.

What is the Stages theory? At this point we are fairly comfortable with the statement that it is an accepted theory for the assimilation of information technology in organisations. That is based on what has been done with the work since the origination of Dick Nolan's work in 1969, and I will talk about that. The theory was originally published in 1973, with the most well known article published in the Harvard Business Review. Starting in about 1975, Dick Nolan began to expand the original four stage framework to six. We have a lot of empirical data on the stages. We have applied our own company's work in detail in over 50 large organisations. That number may be old now, it is probably more. IBM did a study a couple of years ago in which they did some analysis of data that they have on their customers worldwide. The sample was about 6,000 companies and it validated both the original four stage hypothesis and the restatement to

six. All of that is described in the article of March 1979, which delineates two eras in the development of what we eventually call the Data Resource function, the computer management era which I suspect that most of you are in or emerging out of, and the Data Resource management era which most of us are moving into, with trembling feet.

THE STAGE THEORY IS THE ACCEPTED ORGANIZATION THEORY FOR THE ASSIMILATION OF INFORMATION TECHNOLOGY INTO ORGANIZATIONS

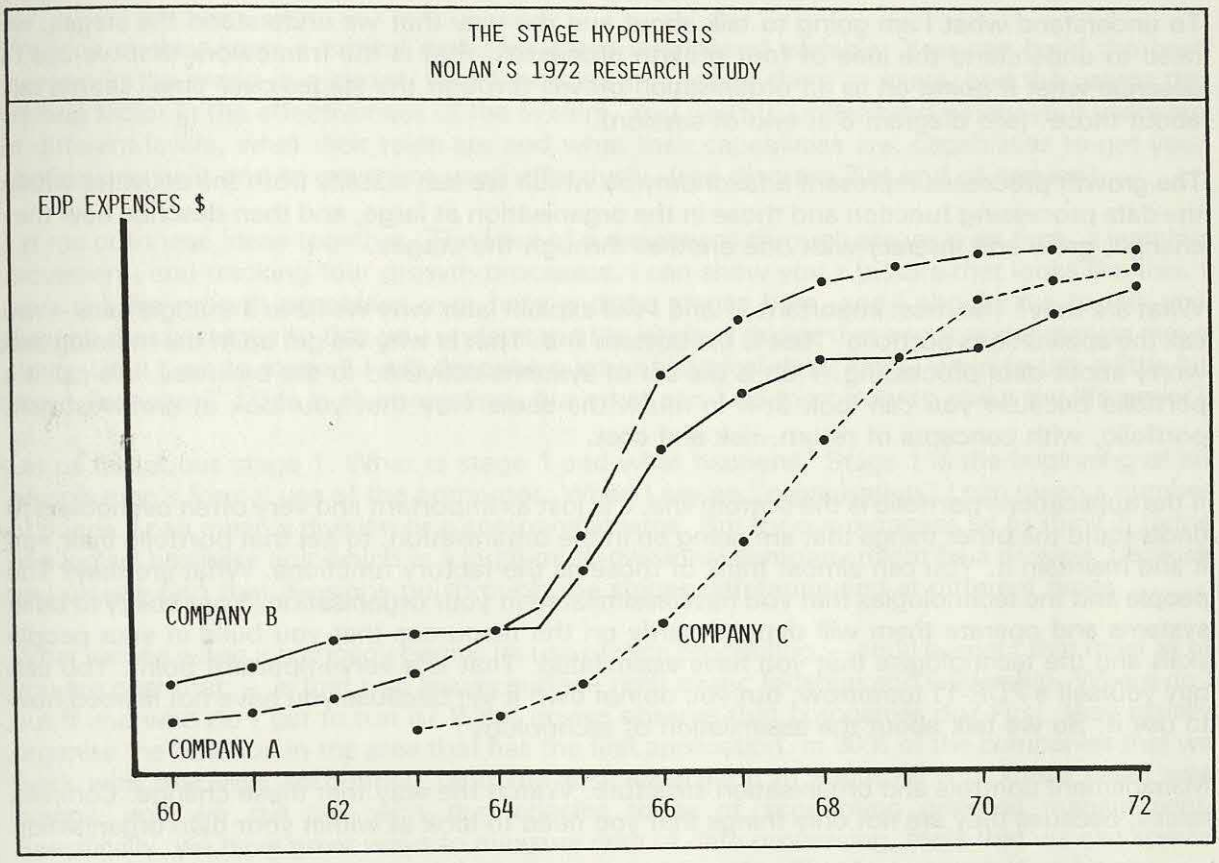
- CASE RESEARCH ORIGINS IN 1969 BY RICHARD L. NOLAN AT HARVARD BUSINESS SCHOOL.
- EXPANDED FROM 4 TO 6 STAGES IN 1975 BY R.L. NOLAN
- SIX STAGES SUPPORTED BY IBM STUDY OF 6,000 CUSTOMERS -- WALTER CARLSEN, IFIP'S CONFERENCE -- AUGUST 1977.
- R.L. NOLAN'S MARCH-APRIL 1979 HBR ARTICLE DELINEATES COMPUTER MANAGEMENT ERA (STAGES I, II, & III) AND DATA RESOURCE MANAGEMENT ERA (STAGES IV, V, & VI).



Where does the Stages hypothesis come from and what does it say? When Dick Nolan arrived at Harvard in the early 1970s, he had come out of work with the Defense Department in the US and with some large companies in data processing. He was educated originally in industrial engineering. He arrived at Harvard with a problem: why in the world does something which technologically seems to be so manageable get screwed up so often in organisations? Why were the disasters of the 1960s there and how might we try to prevent them in the future?

So he asked the university for some time off, went on sabbatical and did some case studies of three large companies, to try to understand what was going on in the assimilation of technology and their growth and use of that technology. What you see on this chart are the original curves that he drew when he decided to plot the absolute dollar expenditures on data processing over time. When he stepped back, what he saw were S shaped curves; and, having come from an industrial engineering management discipline, he said that S shaped curves are usually associated with some kind of learning. What he postulated, then went in more deeply to understand and what we have been able to verify, is that the expenditure curves articulate underlying organisational learning about the use of information technology. Today, we express that with the Stages hypothesis which recognises and in which we can measure two broad eras spanning and divided into six stages of organisational learning about the use of data processing. (see diagram 4 at end of session).

Dick Nolan originally postulated the first era. If you go back to 1973 you will see an article about four stages. If you ever listened to Dick talking in those days, he would talk about the four



stages; he would talk through stages 1, 2 and 3; then he would get to stage 4 and get off it as fast as he could, because we did not know what it was. It was described as "maturity". We have been able to do some work and gather some data and we have a pretty good idea now of what stage 4 is. We have expanded that to look at a six-stage framework, the first three stages revolving around understanding the use of computer technology, the latter three stages revolving around understanding Data Resource technology or what might in some journals be called the "information management era". Most organisations are either concerned with, or about to be concerned with the transition from one of these to the other; and I will talk about that today. (see diagram 5 at end of session).

Let me give you some orientation to the Stage hypothesis. There are some key principles. One is that the budget patterns that we observe in organisations — and we see them over and over again — are growth curves.

If you track the data processing expenditure budget over time, in most organisations you will find it will come out as an S shaped curve articulating underlying learning forces.

We are talking about organisational learning, not just within the data processing function but within the organisation as a whole. What does the company learn about data processing? It is very important, because the way that companies manage today is largely based on what they have learned in the past about how data processing functions. You will find that different companies manage differently based on their past experiences, which are important to understand. It is a very important point. We have found that you cannot skip a stage. If you know where you are and you conclude that you would like to be further along, you can manage

through the stages productively; we have not found that experience-based learning can be skipped.

To understand what I am going to talk about and the way that we understand the stages, we need to understand the idea of four growth processes, that is the framework that we use to describe what it going on as an organisation moves through the stages over time. Let me talk about those. (see diagram 6 at end of session).

The growth processes represent a taxonomy by which we can classify both the activities within the data processing function and those in the organisation at large, and then describe how they change, grow and interact with one another through the stages.

What are they? The most important — and I will explain later why we have a triangle here — we call the applications portfolio. That is the bottom line. That is why we get up in the morning and worry about data processing. That is the set of systems delivered to the business. We call it a portfolio because you can look at it in much the same way that you look at an investment portfolio, with concepts of return, risk and cost.

If the applications portfolio is the bottom line, it is just as important and very often overlooked to understand the other things that are going on in the organisation, to get that portfolio built, run it and maintain it. You can almost think of those as the factory functions. What are they? The people and the technologies that you have assimilated in your organisation. Your ability to build systems and operate them will depend partly on the resources that you build in your people skills and the technologies that you have assimilated. That is a very important point. You can buy yourself a PDP-11 tomorrow, but you do not own it yet because you have not learned how to use it. So we talk about the assimilation of technology.

Management controls and organisation structure. Watch the way that these change. Complex issues, because they are not only things that you need to look at within your own organisation

What is the job of stage 2? What is going on typically in stage 2? What changes? For one thing, the applications portfolio stops being a creature of the initial functional area where data processing was organised; and you suddenly see data processing moving out very fast; if it started in accounting, into marketing; into manufacturing; into distribution. The technical personnel either need to augment their skills very fast to learn about these new user organisations that they are automating, or you see the data processing organisation suddenly bring people in from the user areas, sending them to programming school and turning them into data processing people.

Organisation and control: none. Controls: none. Usually very lax in stage 2. Nobody has ever needed them. Why should we have a project management system? That just slows things down. That is for those guys over in the other company that are plodders. We have not needed it to date. User awareness. Users who were essentially "hands off" users in stage 1, who benignly accepted the system, become superficially enthusiastic in stage 2. "Sure, come on in. Automate my marketing system. I'm not paying for it anyway."

The job of stage 2 is to get that initial multi-functional base of applications built. Today we still see some organisations in stage 2. We still see some in early to mid-stage 2. If you operate out of the central unit of a large, multi-divisional company, especially one that is international, I suspect that you still have some units of your company that are back in the beginning of stage 2, even though your Centre may be quite advanced.

I think that today the most important issue for organisations in that period is the technology because in the 1970s, after a period of relatively stable technology development, dominated by the mainframe manufacturers, as you talked about a lot yesterday, things have gotten wild

but you need to talk about concepts such as the ones that Peter referred to this morning: the role of corporate versus divisional activities; where do controls lie; who has the ball; how do they change through the stages and how ought they to change?

We look at the users; a critical and very often overlooked variable. You can build the best systems in the world in a closet, take them out and deliver them to users, and the user is the limiting factor in the effectiveness of the system. You need to understand where your users are at different levels, what their roles are and what their capabilities are: capabilities to get your applications built and to get them used effectively. (see diagram 7 at end of session).

Let me put these ideas together. The idea of a movement through stages over time, a learning movement, and tracking four growth processes. I can show you a picture that looks like this. I have put the growth processes over here and the stages here, and I should like to talk you through the six stages so that you understand the kinds of things that occur as companies move along. Until I get to stage 4 I will describe a lot of historical data; then I want to talk a little bit about "so what?": this is all interesting, but what can I do tomorrow to make my life easier?

Let us talk about stage 1. What is stage 1 and what happens? Stage 1 is the beginning of an organisation's formal use of the computer. When I say an "organisation" I can mean a number of things. I can mean a division or a company at large. But for our purposes let us think in terms of a logical business unit which in a large multi-divisional company might be a division, because you usually find that divisions go through the stages differently and at different times.

What we see when a company begins its use of data processing — and I suspect that most all of you are past that — is that two issues surface right away: location and leadership. Where do I put it and who do I get to run it? What do we observe that companies do? First, they usually organise the function in the area that has the first application. In 80% of the companies that we work with that was accounting, and the first application in about 80% of those cases was payroll; and we still live with the legacies today of accounting oriented management. Specifically, we have great ways to measure cost of data processing, tools that we can spread all over the wall, and absolutely lousy measures of benefit. That is an accounting legacy.

Location. If you want to track that, take a company that either started in manufacturing or marketing: a company that starts data processing in marketing manages today entirely differently than one that started in accounting.

Who do we get back in stage 1? We get a technician; we get someone who can install the machine, program it and operate it; a small group of people. At the time that most organisations went through stage 1 — which for companies of your size I suspect was in the mid to late 1960s — what we also had was learners. The first application is usually a success. There is a fixed level of expenditure. We bought the machine; we bought the people; we built the application; we did the post audit; and, lo and behold, we saved the 50 heads we set out to save. Usually that is the case.

Now a couple of things happen as a result of that. One, the data processing technicians feel pretty good. "We can do it". The organisation looks at what they observe and what do they see? "Hey, those guys over in accounting have a fairly successful system." So somebody, usually the data processing organisation, says, "Let's do another one." Maybe the second one is an accounts payable system, and that works pretty well. "Let's do a third." Somewhere in the first one to three years what you see is the organisation suddenly move out, very sharply, from that initial low profile, single organisation, fixed expenditure posture, and enter what we call stage 2.

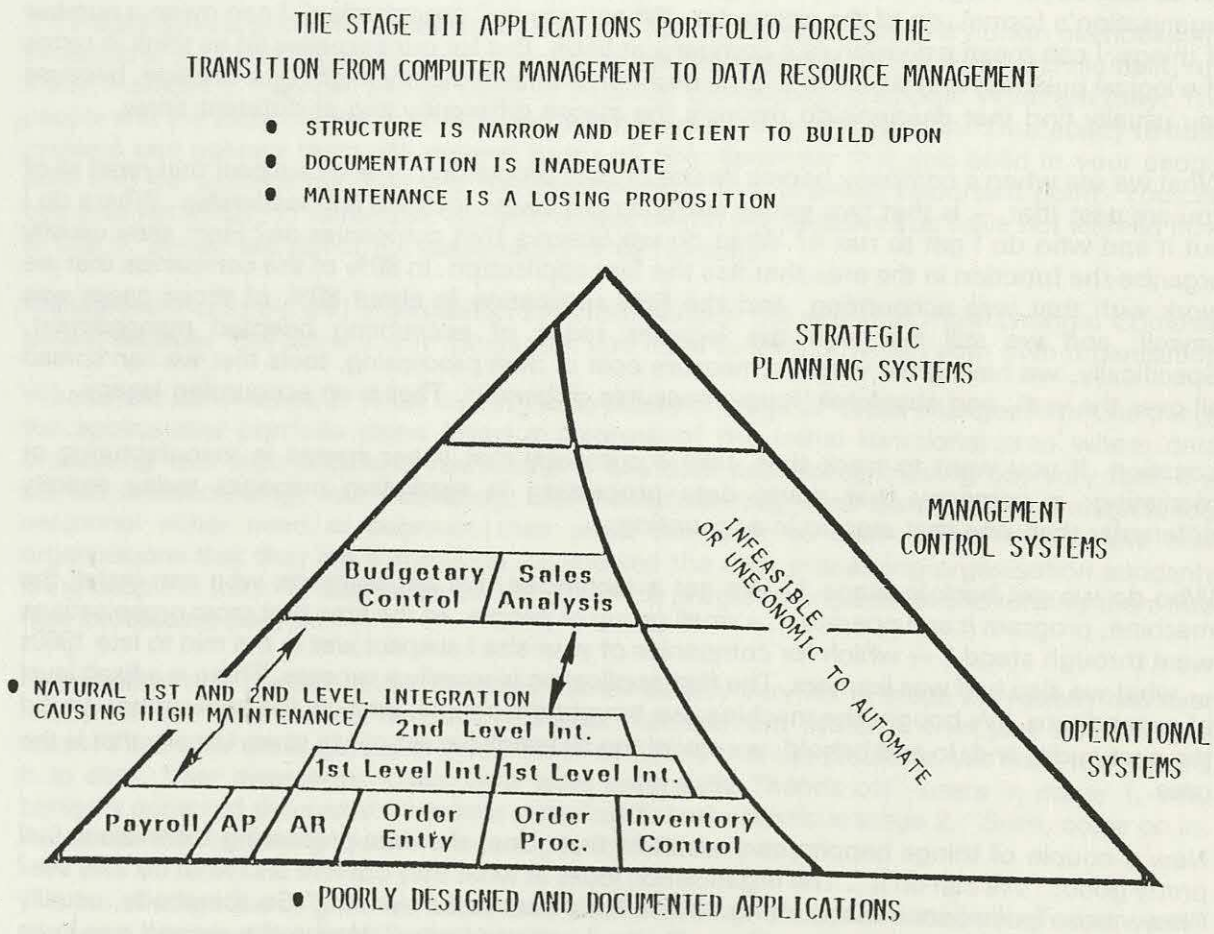
Stage 2 is characterised by a lot of very rapid applications development across many functions of the company, with very loose controls. What we observe is that expenditures begin to rise very fast, compounding during stage 2 at the rate of 20% to 40% a year.

again. What we will see technical organisations doing is not understanding their function in stage 2.

The function is to get that base of applications built; but very often a lot of energy gets devoted to fooling with the technology by organisations that have not really cut their teeth yet on it.

What goes wrong here? What goes wrong was that organisations which are supposed to be building basic, fundamental systems to benefit the business get lost in the technology. I will submit that in early stage 2 that is the prime danger that an organisation faces today. That is not to issue an argument against minicomputers or modern technology, but as a management services director I would want to be fairly sure that primary efforts were focused on getting the business benefit out the door before fooling with the technology.

In a typical organisation, and probably in most of yours, that learning in stage 2 is either still going on or you are completing it. Let us look at what happens as stage 2 continues. Here is a schematic representation of the applications portfolio. First, let me explain what the triangle means so that you will understand what the picture is supposed to represent.



If you walk into a business, forget automation for a minute, what you will see is business systems. You will see business systems supporting different levels of management, planning systems for senior management, control systems for resource measurement, allocation for middle management, and operational systems that support the daily operation of the business. Now at a point in time, given the technology and the economics of that technology, there is some set of those business systems that you can look at and say that they are either infeasible or uneconomic to automate. You either do not know how to do it, or you know how to do it but

you do not think that it would pay. The part that is left is conversely the set of business functions that offer a cost effective and feasible potential for automation. To re-state that, if you build a system in there you get a positive return and you expect that you can get it done. We call that the Applications Portfolio. That is the target; that is the set of business functions that you pursue with automation.

If you go back to stage 1, what you find is that initial first system or set of systems, payroll, accounts payable first being constructed. Then as the organisation moves into stage 2, what we will see is a very rapid proliferation spreading right across the functions of the company, very fast, accounts receivable, order entry, order processing, inventory control, shipment scheduling — systems being dropped in very fast.

Who is building them? Highly competent, well-trained, super-experienced, 1979 professionals? No: learners. With what kind of controls? None; especially when you look at some of the older systems. What happens towards the end of stage 2? Somebody comes along and says, "Hey, we've got payroll and accounts payable built. We could probably put those together and do some budgetary control, and get an expense reporting system." Do you go back and re-write payroll and accounts payable because they were not originally designed to be put together? No. You put in some integration: first level integration, and then second level integration; and you start getting into something called maintenance.

Nobody figured when these things were being developed that they would ever start getting tied together and move up into higher level reporting requirements, but you go ahead and do it. Gradually, if you measure maintenance in a stage 2 organisation, you can see that it will rise to as high as 80% of the total development resource by the end of stage 2, sometimes 100%.

What happens towards the end of stage 2 is that this thing begins to fall apart. Why? These systems are getting old. It is almost impossible to maintain them for their original function, much less keep them tied together. You begin to see characteristic syndromes. A user sees a relatively simple functional enhancement. "We are paying you to put all this data into the order entry system, and we would just like a simple report on order status." Typically the answer that comes back is "Yes, we can do that. We need about $100,000 and a year." The user's typical response is frustration and mistrust. Nobody ever figured that there was going to be something called maintenance.

We see this over and over again, in organisations which get to the point where the portfolio begins to bury them. What is interesting is that while you and the management services function or your data processing people know exactly what is killing you, your management does not. They do not understand. All they know is that costs are going up and value is going down. It is even more fun when you tell that what you really want to do is stop giving them new things for two or three years and re-build the whole thing. Nobody ever thought that was going to happen.

What typically happens at this point? What happens is that management decides to exert formal control for the first time.

When that happens — and it is typically driven by the inability of the data processing organisation to continue to deliver value out of the portfolio — you see an organisation move into stage 3. (see diagram 7 at end of the session).

Stage 3 is marked by the formal introduction of control over data processing by the external organisation. It can be caused by the kind of dynamics that I have described. Sometimes it will be caused by a company that decides that it is no longer a growth company, it is now an asset management company and the internal changes in style that that produces. But what you see and what we measure is that suddenly someone up there says, "Aha, I'm a rational manager, I

don't understand what I'm getting out of you any more. Every time I ask you say words like DOS and MVS to me. So I'm going to shut you down." If you think about it, any manager who cannot understand the value ought to do that; that is his rational response. It is all he can do, responsibility: shut you down. What we see is that 20% to 40% budget growth being arbitrarily clamped down.

Very often that is associated with a management change in data processing. Dick Nolan did some work on that one year, when several individuals that he was working with were suddenly and summarily fired. When you finally organisationally figure out how deep the hole is and the fact that you are at the end of the line and you cannot maintain the systems any more, you will have to buy your way out and while you are doing that you are not going to get much that is new, usually somebody has got to get slammed for that; and in some cases that is the data processing manager.

Stage 3 is characterised and we call it the control stage, because that is what you see. You see charge out introduced, very often. You see project management systems introduced. You see formal planning usually introduced for the first time. Lots of control under typically a no-growth mandate or a low-growth mandate; and management usually find that they cannot shut it down all the way. But stage 3 is initially characterised by a proliferation of control.

There is a transition point. If you can stop looking back and start looking forward, no matter where you are in that framework, then you might be able to do two things: first, manage your learning process and, secondly, condition your management about what to expect. Very often our role in companies, which is initially viewed as threatening by the data processing organisation, will turn out to be viewed as very healthy; because we are able to explain to management why the DP organisation operates as it does.

The thing that continually frustrates audiences is that you cannot completely avoid the learning problem. That is what we mean when we say that we cannot skip a stage. It is especially frustrating to clients, because they will say, "You are consultants, you are not supposed to give us that kind of an answer." But that is the truth. One of the tricks is to understand your limitations when you plan so that your plans are realistic. If you have realistic plans, you have some hope of achieving them.

I will talk about some ways to do that, but the general answer is to understand where you are, and then not only do a lot of planning about what you want to build but a lot about how you want to build it.

QUESTION FROM THE FLOOR: Do all parts of companies go through the stages at the same time?

It depends on how they are organised. A company which delivers operating and software services out of a central group will tend to drive its divisions through the stages together, because the group tends to impose uniform learning. In a relatively decentralised multi-divisional, or at least one that has the applications groups in the divisions, you will find them all over the place. You will find the shapes of their curves very different. You will also find that the basic management style of the division governs the way that they go through the stages, not the data processing style. Divisions that manage with noise have noisy data processing installations, and divisions that manage well and are reasonably mature, as a rule have reasonably mature, well-understood data processing functions. But yes, you do see different curves; you see different rates of growth.

Stage 1 typically lasts one to three years. About the longest stage 2 that we have seen is about eight years in a company. You can get them as short as three years. I saw one that was three years long in a government agency, which tried to go from zero automation to a fully integrated

data base management information system, growing their own data base system at the same time. Their stage 2 lasted three years before it was shut down. I should say that it shut itself down.

Organisations also enter stage 3 differently, some with a bang and a whimper, and some fairly quietly and in an organised way. There are organisations which manage their way into it without a management change and without a lot of chaos, but those vary and typically the ferocity of stage 2 tends to govern the entry into stage 3 and how extreme it is.

Something changes in stage 3. Initially you have a control orientation, an obsession with controls. There is a transition point, and when organisations hit that transition point also varies widely. But let me talk about what happens and the basic shift that I suspect that many of you who find your histories familiar may find yourselves approaching.

The initial theme of stage 3 is control. Whoa: stop: manage for a change. Something else is going on, and it is usually understood much better by the data processing function than by management. It is this: you cannot really get anywhere or get very much further in delivering function until you re-build the portfolio; and it will be variably messy, depending on what has happened in the past. But the worst ones are really bad.

If you are a data processing manager, you know in your heart of hearts that you have got to re-build it. One of your jobs in stage 3 is to figure out how to do that without communicating the deadly message, which is: "Give me three years and don't ask me for anything. Let me grow and I'll take you to Nirvana." But what the data processing organisation knows is that the portfolio has to be completely restructured. Why? Because we are not looking at systems here, we are looking at functions. If you cast one of your systems that has a name like MAPS or WEASEL on to that, you will find its functions showing up all over the applications portfolio. Your systems do not look like the business any more. They do not mirror the information flows.

When the data processing organisation starts to re-build either with an active re-building programme that is sanctioned, or in a very quiet re-building programme, it looks around for a technology and sees data base and data communications technology as an enabling technology to get this done. There is a way to get the re-built systems re-built in a way that may allow you to avoid the problems of the past.

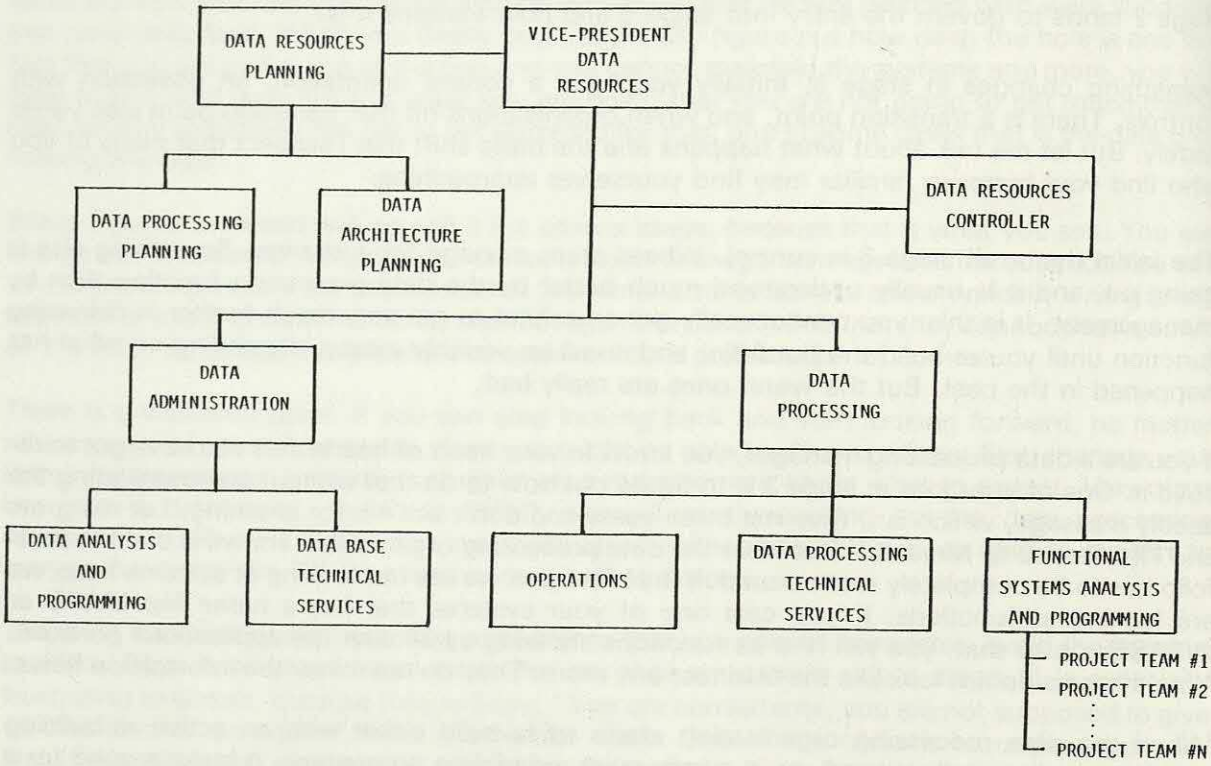
So you begin. What you will see is an initiation of data base systems being dropped in during stage 3. What you will see the data processing organisation do is to propose something like this. We will manage a new way. We will have a data base administration function. Very often you will see a planning study conducted which identifies functionally oriented data bases that will be created and built over a five-year period, along with applications dropping out of them; and an organisation which identifies something variably called data administration or data base administration, and maybe so sophisticated as to look at data resource planning. That is usually written up in a White Paper, and one or more of these people are hired and off you go.

What happens? What we see happening is that that first data base system does not quite go as well as we thought it would. You are beginning to automate your order processing system. That seems to be a good first data base system for many companies, especially if it is integrated into manufacturing. You start the first system, and suddenly it gets harder and longer. What is going on? New technology. Any learning resident in the organisation about how to do backward pointers and DBD gens? No. Any learning in the user organisation about the broader problem that is implied in that organisation chart, which is how we jointly manage interfunctional data? No.

What you see is that suddenly that broad concept gets overwhelmed, but the organisation goes

on and starts building new systems, re-writing the applications portfolio with data base technology. What do the users see while this is going on? You begin to see systems being built:

STAGE VI ORGANIZATION CHART TO IMPLEMENT DATA RESOURCE MANAGEMENT
APPEARS IN "WHITE PAPER" DURING STAGES III/IV



new order entry, order processing systems; maybe a new financial management system; inventory control production scheduling, possibly tied to order entry.

Let us go back to what the users have been seeing in stage 3. What have they been getting? Nothing. Management said, "Shut it down. Go slow." What else has happened during stage 3, which can last five years or more up to the transition point? Users have been learning. They have been held accountable to their costs. They have been co-opted into a project management approach and taught how to participate. They have been learning. What begins to pop out of the door? Screens start to appear in the company; real, valuable function; ad hoc query capabilities begin appearing so that these functions appear that very often are not structured, but are better lent to unstructered data analysis, begin to be served. What we are seeing in some very large companies is that where the introduction of data base technology and a movement into the data resource era begins in the technical function, with what we call the technology push, suddenly you get a reversal and management turns around and starts pulling. And when they pull, they pull hard. Because now you have your manufacturing manager in there, who maybe has three to five years to make his name in that function, who is a little younger and has been through a different education, both formally and in the company, sees function and begins to understand, through his people and his organisation, that this is a valuable technology. Very often, if the company is an asset management company, an invaluable technology; and he must have it. He comes down to the organisation and says, "Give it to me. I want that system and I want it fast. And I'll pay for it." He goes to the boss and says, "I'll pay for it." What we are seeing in that environment, in companies that are beginning to

enter that period, is a re-emergence of the old stage 2 growth rate — 20% to 40% a year. This signals the beginning of Stage 4. (see diagram 11 at end of session).

There are a couple of ways to get through stage 4. You can either be as data processing function pull, yanked, whether you like it or not, whether you can manage it or not, or you can try to stay on top of it. A lot of that depends on whether you got yourself ready back in stage 3 to hang on, because that manager who has that three to five year period to make his name does not want to hear you say No. If you say No he will go to the vendor or the service bureau: to hell with you. Or he will find a way to get your organisation to take off.

And how successful is it for you to say No? You have been down there, buried in stage 3, and suddenly somebody comes and says, "Make me a hero," and what do you say? "Well, honestly, I — er — I really can't help you." You do not say that. So you do it. But you do it fast and the issue of stage 4 is that in fact that happens fast and it is not a control period.

When you come out of that you find that by late stage 4 you have automated pockets of data base systems. While those pockets have a better architecture than the mess you had back in stage 2, lo and behold, there is a need to do some integration.

Something else emerges that is an issue in stage 3, but we are calling it a stage 5 issue in the way that it can be handled: it is shared data. That is a buzz term. It really means substantive identification of redundant, jointly managed data between functional units. You remember that back in stage 3 we were going to manage shared data. We had an organisation set up to do it. We hired somebody called a data base administrator. We said, "Go out and get rid of the redundancy. Get us a single bata base." That data base administrator goes out and picks something pretty generic to the company, such as a part number. Let me try to standardise the part numbers, so I will go to see engineering first. They have a part number that looks one way, and I will go across and now talk to manufacturing. Well, the part number is slightly different. You find that you have seven part numbering structures. You go to your company and ask how many charts of accounts you have, and you find out that you have two or three.

In stage 3 the organisation has not learned how to share information yet, and so the process of creating a truly shared, detached data structure is very frustrating for organisations in stage 3. By stage 5, the process that has been learned by some of the multi-functional work done in the data base automation — and we are projecting because there are not many organisations that have moved into stage 5 yet — ought to be ready to begin attacking that. Along with that, we would predict the growth rate to begin slowing as the applications portfolio is retrofitted.

What we think stage 6 will look like is an era in which the data resource management function will have matured and that the process that began all the way back in stage 1 in the 1960s of beginning to make users accountable for the way that they use data processing, will have finally matured. It certainly has not today.

What the Stages theory is all about is the problems that organisations face in applying technology to get those benefits. That is why we continually focus on the technology. Because organisations continually run into problems in making the technology work — organisational problems. It is an organisation learning process. Part of the latter stages, especially the early part, is learning about the hard technology; but the latter part of stage 4 will primarily be obsessed with learning about how in the world do we go about building multi-functional data base systems. That is a management problem. It may be technically oriented, but it is certainly a management problem, not a hard, technical problem. The two interact. That is why we talk about a shift from a computer management era to a data management era, because the unlearned problem is how do you manage information, how do you manage data? But the technology is still today — How many times during the last day and half has the word "distributed" processing been mentioned? I bet you that, if I had time, I could solicit definitions from

you and get at least 10 out of the audience. Nobody knows what it is yet, but we are going to go out and spend money on it in different ways and the technology just tends to drive.

QUESTION FROM THE FLOOR: What did you mean earlier by a "noisy" stage 2?

When I mean noisy the things that I was trying to characterise are the differences between organisations that tend to manage with a lot of inter-functional conflict, which I would

BY STAGE VI USER AND DP "ACCOUNTABILITY" WILL HAVE MATURED

- USERS WILL BE ACCOUNTABLE FOR THE USE OF INFORMATION TECHNOLOGY SUPPORTING THEIR BUSINESS FUNCTIONS
  - OPERATIONAL FUNCTIONS - ORDER ENTRY . . .
  - CONTROL FUNCTIONS - BUDGETING . . .
  - PLANNING FUNCTIONS - WAREHOUSE LOCATION . . .
- DP WILL BE ACCOUNTABLE FOR THE SOURCING OF DATA ELEMENTS
  - CUSTOMER
  - MATERIALS
  - PART NUMBERS

A N D

- THE VALUE-ADDED PROCESSING OF DATA RESOURCES,
  - FINANCIAL STATEMENTS
  - CONTROL REPORTS
  - INVENTORY STATUS

characterise as noise, and those that tend not to do so. My experience has been that those who manage with more conflict in their general management structure also seem to have more conflict with their data processing organisations. If you look at a multi-divisional company from the top, if you can find the logical management unit, a relatively homogeneous management organisation that also has a data processing supply unit, then we will tend to find not a central mixing, but a relatively clear and identifiable staging. Some of the user areas will be in different stages, but you can still see a progression and you can measure it.

What we are projecting is an era in which the data processing function will be accountable as the data manager, sourcing data and adding value by processing; and that the act of really figuring out how to use information and how to apply data will have substantively transferred to the user functions.

I said that I was going to talk about two things today. One is what does the Stages theory say, and I have tried to walk you through that, get you oriented to the idea of four growth processes. The other is what do you do about it. What can you do?

In the article, Dick Nolan lays out five guidelines for action, some of which, and certainly the first three, apply to an organisation anywhere in the stages; all five of which apply to an organisation which sees itself approaching the transition from computer management to data resource management. Let me talk about those.

First, we would say that you need to recognise and accept the fundamental transition, that you are coming out of a period that looks a lot like the first three stages that I have described; and

FIVE SUMMARY GUIDELINES FOR MANAGEMENT ACTION (R.L. NOLAN, HBR, MARCH 1979)

GUIDELINE #1: RECOGNIZE THE FUNDAMENTAL ORGANIZATION TRANSITION FROM COMPUTER MANAGEMENT (STAGES I-III) TO DATA RESOURCE MANAGEMENT (STAGES IV-VI)

GUIDELINE #2: RECOGNIZE THE IMPORTANCE OF THE ENABLING TECHNOLOGIES

- DATA BASE
- DATA COMMUNICATIONS
- MINI/MICRO PROCESSOR

GUIDELINE #3: IDENTIFY THE STAGES OF THE COMPANY'S OPERATING UNITS TO DEVELOP APPROPRIATE DP STRATEGIES FOR EACH UNIT AND A COMPANY DP STRATEGY

GUIDELINE #4: DEVELOP A MULTI-LEVEL DATA RESOURCE MANAGEMENT PLAN -- THE "BLUEPRINT"

GUIDELINE #5: CONVERT THE "BLUEPRINT" TO A PLANNING PROCESS BY MAKING THE SENIOR MANAGEMENT STEERING COMMITTEE WORK

that you believe that you are in fact transitioning into a data management oriented period; and also recognise the importance of the enabling technologies. Here you will see that I am talking about a broad spectrum of enabling technologies, not just data base technology but data communications, microprocessors and distributed processing. Certainly a centralised philosophy is not implied.

The technologies, however, are enabling a movement which would not have been possible five, seven or 10 years ago, for most companies. That is the importance; that we have reached a point where we can talk about not just theories but the ability to put them into practice.

The one that I want to talk about is to know where you are, because it is pretty important if you are to manage forward, if you are to try to mange the way you go through the stages, or try to avoid or minimise some of those problems, that you start with an understanding of where you are. Let us talk about that. What you want to do is to try to understand the position of each of the four growth processes. They will not typically go through the stages uniformly, the way that I described it. That is one of the things that you need to understand. Where is my company; where are my business units; and within each of those, where are the growth processes? Because they will be in different positions and you do different things. (see diagram 16 at end of session).

Let us talk about understanding where you are. The applications portfolio: you can measure the bottom line; you can construct a representation of your business functions. I have described the portfolio as the cost effective potential for use of automation in support of the business function. You can measure it. In the article, Dick provides some benchmarks for measuring it. We typically see most of these functions, say 80%, with some level of automation by the end of stage 2. Not totally automated but some first attempt at automation. That pretty well correlates with the whole idea of having completed that first wave of automation.

What good does that do you? For one thing, you can understand not what systems you have, but the way your systems support the business — two entirely different things. Managers are always presented with systems lists; and system names do not say very much about what systems do for the business. The applications portfolio recasts systems and shows how they support the business: an important thing to present. If you know where you are, you can communicate what you have done for the business. You can also begin to correlate your plans against the business. You can map what you are planning to do and what kind of coverage your plans would give you, against the unfilled areas, the gaps. You can understand either what you are delivering as a data processing manager or what you are getting as a user manager, and begin to set some strategies. I will talk a little about how to use this kind of framework for setting strategies.

You can measure your applications portfolio. You will see some benchmarks for doing that in the article. There is a representative manufacturing applications portfolio in the article. When we build one of these we tailor it very closely to the business that has been studied.

But that is not enough, that is just part of the understanding of where you are. It is critical that you understand where that portfolio is. If you are back in stage 1, then you have a lot of work to do. You can probably concentrate your strategy on delivering function to the business. But if you have put a lot of that function in, then you may have a strategic decision: can I maintain it for another five years or am I at the point where I really have to go back and reinvest and restructure? You better know that, so that you do not just charge through the stages blindly.

QUESTION FROM THE FLOOR: I have not talked about packaged software which can allow you to move through the stages faster without the associated maintenance problems, provided that you do not tamper with them too much. Two very important caveats at the end of that.

I do not think that you ever get by without the associated maintenance problems. A system can remain functionally current only so long. The organisation changes, and the system either changes or does not with the organisation. The life of any piece of software, whether it is a package or a home-grown piece of software, when it is installed, if it is installed, will still vary with rate of change of the business function it supports.

On what software does for you in going through the stages, in certain cases you can get function in faster with packaged software. There are many organisations which have entered upon that plan and discovered that it was no faster and no cheaper. You must know what you are doing. That presupposed a mature organisation, which understands the pitfalls of packaged software.

I think that in some cases you can use packaged software wisely; I am not convinced that it is universally true that it shortens your path through the stages. Certainly it can cause you, at the end of stage 2, to have a much less compatible applications portfolio than you might have if you had used the same relative technology standards all the way through your development of it. You may get to stage 3 faster, and hate yourself more in the morning; that is possible.

QUESTION FROM THE FLOOR: Don't we know better how to avoid these pitfalls today?

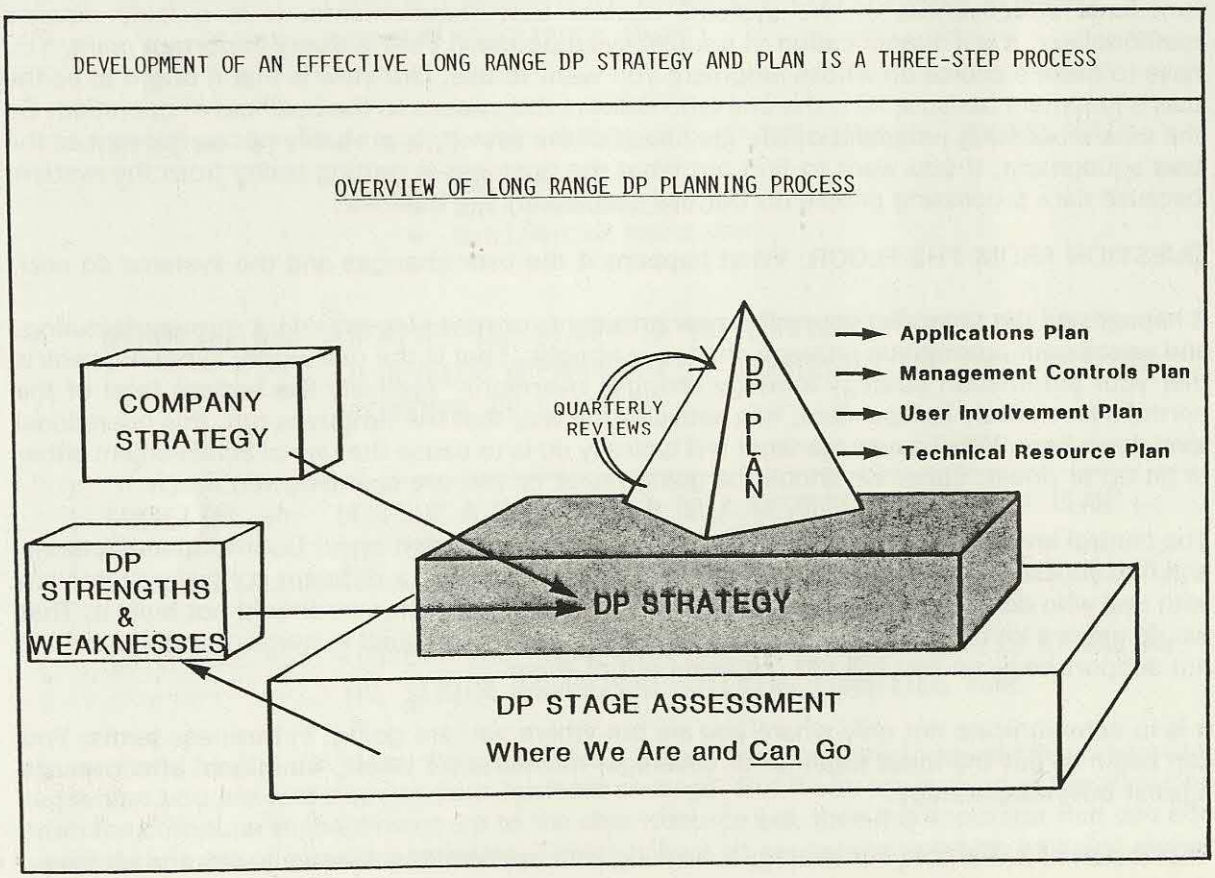
It is certainly true that the knowledge base is expanding today over what it was in 1958, and that

we know a lot more today than we did then. We see a lot more organisations more willing to use project management. We tend to see more cases where more prudent management techniques are used in stage 2. However, the technology has also taken another leap in complexity, so while everybody is getting better at it, the task is also getting more complex. That is what I was trying to say about the current danger of stage 2. It is not the same stage 2 that we all walked through with our 7090s and 1401s, it is a different ball game.

If you know where the portfolio is and you have some sense of where you want to take it, then what is critical is that you understand how you can get there. What resources do you bring to that task? Will they limit you or will they facilitate that strategy? You need to look at your people and the technologies that you have in place.

What is important is that you look at technology not as some abstraction that you must have in place, but as a tool focused against your strategies; and that you then look at what you know and you either make choices on how to improve your learning in the use of a needed technology or constrain your plan backwards to account for what you cannot accomplish.

In the same way you should understand what kind of control do I have in place? What do I need? Do I have project management well in hand and well assimilated? Do my users really know what it means to be a user project manager, or do I just have that box on my project management chart? Is charge out understood? Is it working well? Or is it a surrogate for a lot of problems? Are we organised right for what we have to do? Where in the world are my users? Am I about to try to install a complex, on line, manufacturing oriented system, with my manufacturing manager who says, "Sure, let's put it up over the weekend." There is a lot of risk there. What capabilities do the users have and how fast do my systems plans push them? It is critical step 1 that you know where you are. Knowing where you are gives you tools to set effective strategies.



That is why we look at the planning task as being broken up into three pieces. The first is the stage assessment. Where am I? Let me understand my strengths and weaknesses in each of the growth processes. Where is my applications portfolio? How does that match the task I have? Where are the other growth processes? Do I either need to pull back from my plan or invest in the delivery mechanisms? If so, what do I need to do? How can I best align my information strategy with my business strategy?

Let me talk a little about those two issues of how you align or how you can use some of these ideas better to align your plans with the business, or at least communicate how well you have

aligned them to your management, and make some closure on the idea of setting a strategy involving all the growth processes.

You can correlate your business strategy with your applications portfolio, because the latter is a picture of your business and not of your systems. That makes it a tool for you to use in communicating both where you are headed with your systems and where you have been in business terms.

You can draw a very detailed applications portfolio like the ones that I showed earlier, and you can classify each of those 70 or so functions into a relevant correlation with your business strategy; either a high correlation, medium, or low; and then measure where you are today. Where are your most effective systems?

QUESTION FROM THE FLOOR: In carrying out a similar look at their own situation, how do you actually measure coverage of systems?

Through the users. There are techniques. What we do is to use techniques that assess the functional effectiveness of the systems against user requirements. It is a fairly detailed methodology. It is a quantification of a subjective judgment. That is a very important point. You have to make a choice on whose judgment you want to use. Our view is that it ought to be the user's judgment because he is the one who delivers the system to the business in operation. So the data processing judgment of the greatness of the system is probably not as relevant as the user's judgment, if you want to find out what the business is getting today from the system, because data processing people do not use systems in the business.

QUESTION FROM THE FLOOR: What happens if the user changes and the systems do not?

It happens all the time. Get yourself a new president, or new vice-president of manufacturing, and watch your automation strategy change overnight. That is the real world. What happens is that your automation strategy strategy changes overnight. Typically the bottom level of the portfolio is relatively independent, it is native to the way that the functions run, this operational level down here. What a new manager will typically do is to cause the rate of achievement either to go up or down. Either we should be going faster or you are spending too much.

The control level here is very heavily dependent on management style. Go into manufacturing and find yourself a manager who believes in MRP and you have a different control system than with one who does not. I would say that until your manager does, you should not build it. That would upset a lot of people, but I do not think that you should build systems that the users will not support because you will not get value out of them.

It is to communicate not only where you are but where you are going, in business terms. You can begin to put the ideas together of coverage, maintenance levels, functional effectiveness against business strategy.

That is part of it. Part of your strategy is aligning your applications directions with the business.

I will submit to you that you are probably not well in touch with changes in that, and yet you commit yourselves to three to five year activities from which you may suddenly have to wrench yourself away. You need to get the strategy directions of senior management and the trench activities of your data processing organisation into line. That is not typically well done when you are holding up a list of 75 systems. You need to do it at some higher level, some more digestible, direction setting level. (see diagram 16 at end of session).

The other thing that I have been talking about is making sure that these growth processes are well aligned with that strategy. Do we have enough time to learn and assimilate the technologies that we are going to use? Do we have the right controls?

Users. Are you thrusting an automation programme on to a user organisation and is it capable of participating and helping you to build that? To what extent? What have your users learned about data processing? What will they support over time? It is important that you know those things, and then either act to infuse resources here, or pull back or modify your plans. Why? Because you want feasible plans. You want something that is achievable and that you have reasonable confidence will succeed, not something that just does a great job of describing all the wonderful ways that you could automate your business. So you need to be focused and achievable.

FIVE SUMMARY GUIDELINES FOR MANAGEMENT ACTION (R.L. NOLAN, HBR, MARCH 1979)

GUIDELINE #1: RECOGNIZE THE FUNDAMENTAL ORGANIZATION TRANSITION FROM COMPUTER MANAGEMENT (STAGES I-III) TO DATA RESOURCE MANAGEMENT (STAGES IV-VI)

GUIDELINE #2: RECOGNIZE THE IMPORTANCE OF THE ENABLING TECHNOLOGIES

- DATA BASE
- DATA COMMUNICATIONS
- MINI/MICRO PROCESSOR

GUIDELINE #3: IDENTIFY THE STAGES OF THE COMPANY'S OPERATING UNITS TO DEVELOP APPROPRIATE DP STRATEGIES FOR EACH UNIT AND A COMPANY DP STRATEGY

GUIDELINE #4: DEVELOP A MULTI-LEVEL DATA RESOURCE MANAGEMENT PLAN -- THE "BLUEPRINT"

GUIDELINE #5: CONVERT THE "BLUEPRINT" TO A PLANNING PROCESS BY MAKING THE SENIOR MANAGEMENT STEERING COMMITTEE WORK

Let me come back. I would say that guidelines 1-3 apply to a company in any stage, understanding where you are and aligning your business strategy. But if you are looking at the transition from the computer management era to the data resource era, then it is important that you also understand a set of planning activities. This gets back to something to which I alluded earlier:

how do you integrate your data management planning with your planning for the application of the various technologies and which ones you choose?

You need to develop a multi-level data resource management plan. What does that mean? If you watch the way that companies typically enter planning, it usually starts with capacity planning. Something happens like this. You suddenly find that you are running out of capacity. You go up to your management and say, "We're out of capacity. We need more memory and a bigger CPU." Management says, "That's fine. How long will it last?" Three years, not going to be back to see you in three years. Promise. And a year later, you are back and you are out of gas. The boss says, "I thought you weren't going to come back for another three years." "Yes, we thought so too, but we're back: it's those users out there." So your management says, "Don't surprise me again," and you start putting in configuration planning. What do you do? You start spinning out least square regression lines of your CPU seconds so that you can predict when you will run out of capacity. Not very business oriented, but it is a start. Many organisations start their planning that way.

They continue that and then continue working top down from the business, trying to do the kinds of things that we have talked about, correlating their business plan with their applications plan. What I really described to you is an activity that we would characterise as an applications plan, measuring where you are in each process and setting your strategy. Then if you see yourself moving into the data resource era, having completed this knowing that you are there, then it is important to start a data resource plan. Start understanding your data flows; where the natural data flows are in the organisation. Do they move up and down from division to corporate, or do they move just within your divisions? Do they move across your divisions laterally and, if so, why? How will they change? We will submit that you need to have that plan in place before you start this, because your network and hardware configuration strategy ought to be made with the knowledge of where your natural information flows are.

Tony, that gets back to your comment. The technology that you employ will be heavily influenced both by the task and by the information flows that you are trying to automate and reorganise in the applications portfolio. That may well lead you to a distributed processing strategy or to a highly centralised strategy, depending on your understanding of where those flows are, what your capabilities are, and the control philosophy that you want to implement. The disasters of the 1980s will probably come from organisations that move into distributed systems from a technical perspective without understanding the information flows that they are trying to automate and the business support task that is in front of them. Your job is to try to get the linkage made between technical and business planning as well as you can.

Finally, the fifth guideline in the article: steering committees. That is an obscene word in many organisations. It is very frustrating for consultants who like steering committees because in 50% of the cases that you think there ought to be one, it was tried five years ago, failed, and the client tells you, "We've done that already and it doesn't work." The fact is that this is an organisational process. The data processing function is, in all of its activities, a service function performing what, before it got there, was a part of the manager's function. Its expenditures at any level are shared. Its directions are typically made in the face of priority constraints. You need an organisational mechanism that is able to guide these activities; and, over and over again, that is going to be one or more steering committees. And you need to make them work. You need to make them work by making sure that you do not ask your senior management committee to set maintenance budgets and making sure that, if you have various tasks, you have appropriate structures. But you need to understand that, fundamentally, this is an organisational phenomenon, and a joint one. You need mechanisms that get joint business decisions made in a proper structure.

I have thrown a lot at you. I am at the end of my formal presentation, so I will stop here and take any remaining questions.

QUESTION FROM THE FLOOR: Aren't there endless S curves in front of us? What will happen in three years when we get to stage 5?

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If you go back to the earliest companies that got into stage 1, in 1956 and 1957, it has taken us 20 to 25 years to get to the middle of stage 3. I am not sure — I do not know whether or not Dick would agree with me — what comes after stage 6; but I am pretty sure that we have an equivalent period of time between now and then to get there. I do not know how to project what happens 15 to 20 years from now. You may not concur with that, but my response to you is that I do not think it is at all a three-year phenomenon, it is more like a 15 or 20 year phenomenon that we are looking at. One must understand that what you primarily will be doing in what we describe as stages 4, 5 and 6, is understanding how to automate the natural information flows of the business and that there will probably be, in what I am describing as a 15 to 20 year period, a lot of technologies applied to that that we do not even understand yet, as there have been in the last 20 years of automation. We certainly consider the mainframe technology today as being very standard, but it looks a heck of a lot different from the 7090s that I was brought up on.

The fact is that the task is using the enabling technologies available in the automation of the information flows. We would see that as not being a three-year horizon, but much longer. I agree with you that the technologies are changing, and it is certainly to the advantage of the vendors to make that as confusing an arena as they possibly can. Your task it to recognise the confusion of the arena and find ways to ask yourself why, prior to the introduction of the technology in the organisation; and also to understand that you just cannot be all-knowing. So commit yourself intelligently and live with the problems you get.

I do not know if that directly answers your question. I would not concur that it is a three-year cycle. There may well be some other set of stages, but we would not believe that we even need to think about them in a foreseeable time frame.

QUESTION FROM THE FLOOR: Does office automation fit the stages?

I think that we see it as part of the information flows and something that we are trying to understand just as hard as everybody else. I am not sure that office automation, which is another word that I put in the same class as distributed processing, is a technology so much as a concept that uses technologies. The first accounts payable system was an office automation project if you happened to be in the accounts payable department at the time. We would view it as part of the portfolio. We are starting in our company some active investment in trying to understand how the stages in office automation get together. I guess that my answer at this point would be that we believe that it is a natural extension of the way that you automate the information flows, but at another level, because those aspects of office automation that are generic are somewhat different than those that have been business support applications, in my view.

That is a very confusing answer, because I think that it is a very confusing topic and I do not have any cute answers for you. I do think that it is part of the data resource period. I tend to think that it will be part of that upward push, but I do not have a cute answer on how it sorts in.

INFORMATION TECHNOLOGY IS ABSORBED INTO AN ORGANIZATION IN STAGES

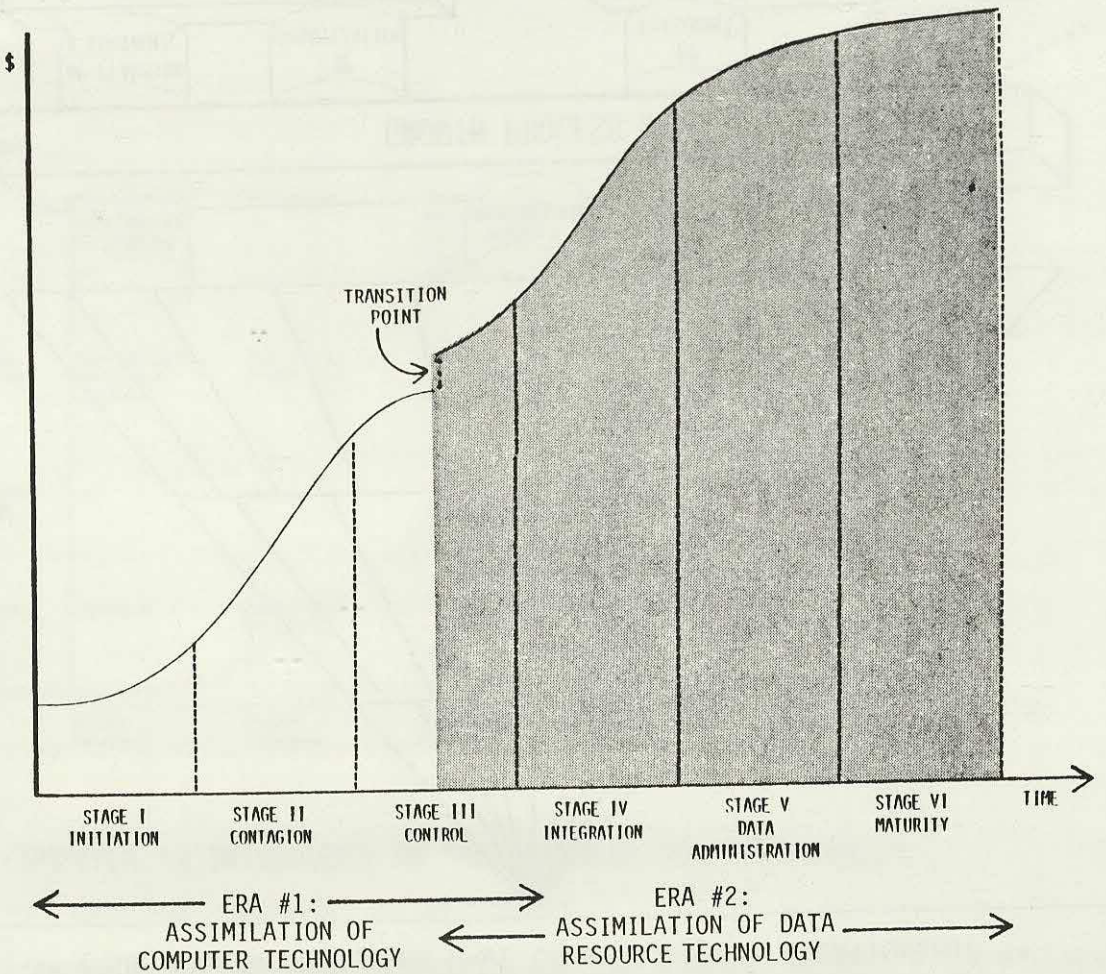


DIAGRAM 4

DIAGRAM 6

BUILDING A DP STRATEGY FROM THE GROUND UP

** FOUR GROWTH PROCESSES HAVE CAUSE & EFFECT RELATIONSHIP **

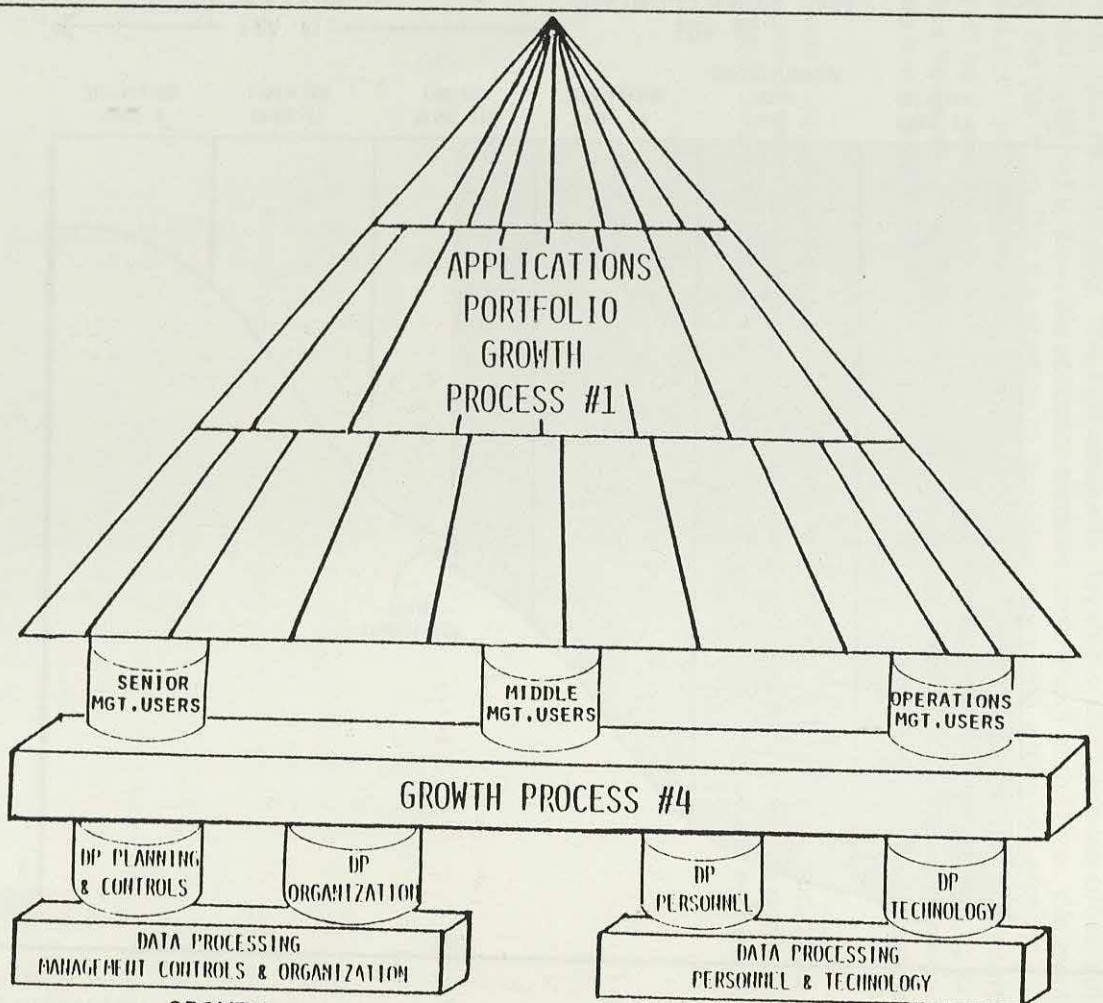
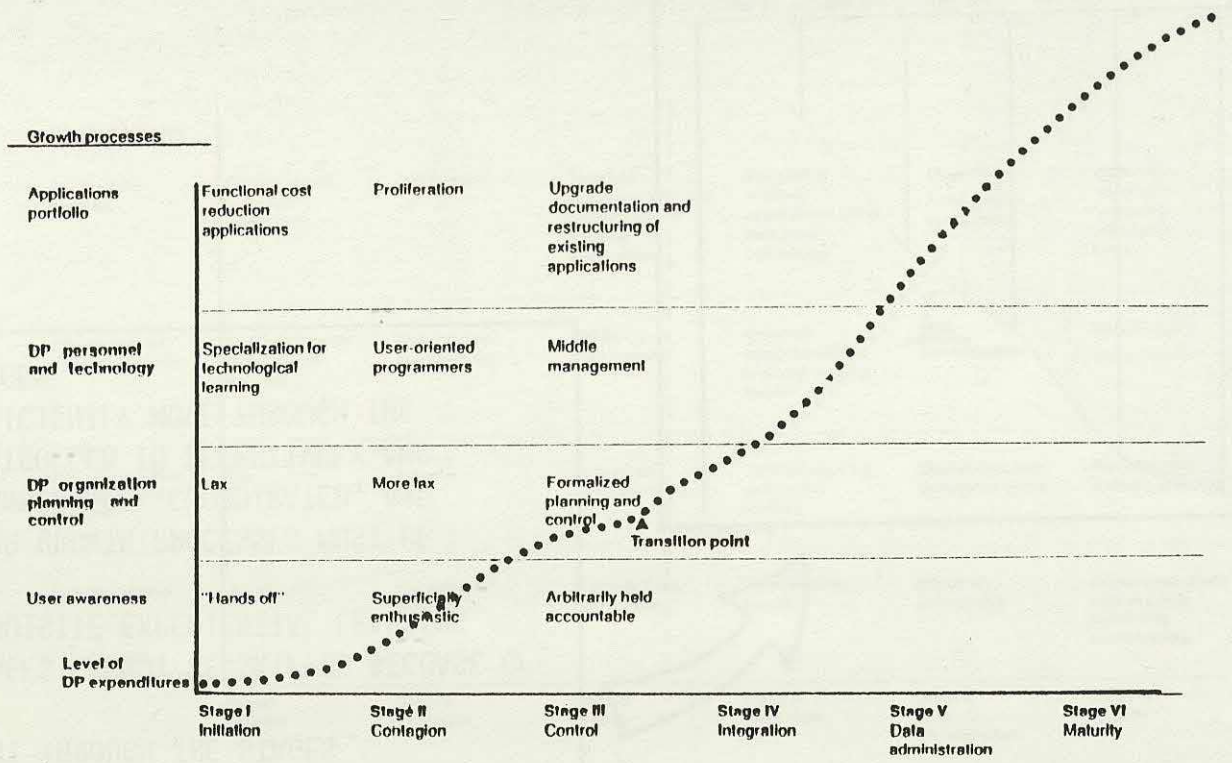


DIAGRAM 7

THE COMPUTER MANAGEMENT ERA: STAGE I, II, AND III



- COMPUTER IS INTRODUCED TO THE ORGANIZATION TECHNICALLY
- "TECHNICIAN SYNDROME" IS PREVALENT
- CONTROLS AND MANAGEMENT DISCIPLINE ARE NOTABLY ABSENT - HIGH SLACK
- APPLICATIONS DEVELOPED BY "LEARNERS" PROLIFERATE AT THE OPERATIONAL LEVEL

KEY PREMISES OF STAGE THEORY

- DP BUDGETS PATTERNS ARE GROWTH CURVES
- ORGANIZATIONAL LEARNING PERMITS MOVEMENT THROUGH THE STAGES
- STAGES CANNOT BE SKIPPED BECUASE OF REQUISITE EXPERIENTIAL LEARNING
- FOUR GROWTH PROCESSES MUST BE PLANNED FOR, COORDINATED, AND CONTROLLED TO EFFECTIVELY AND EFFICIENTLY MOVE THROUGH THE STAGES

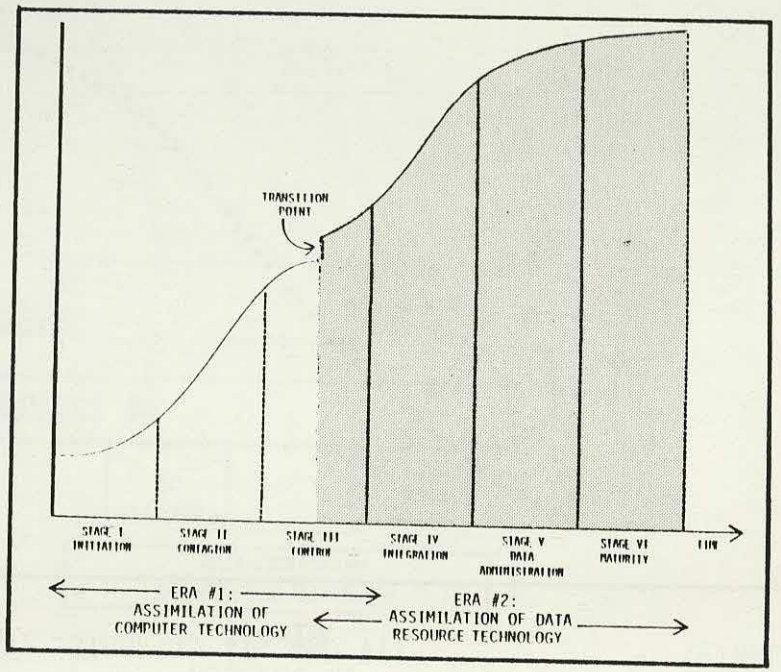
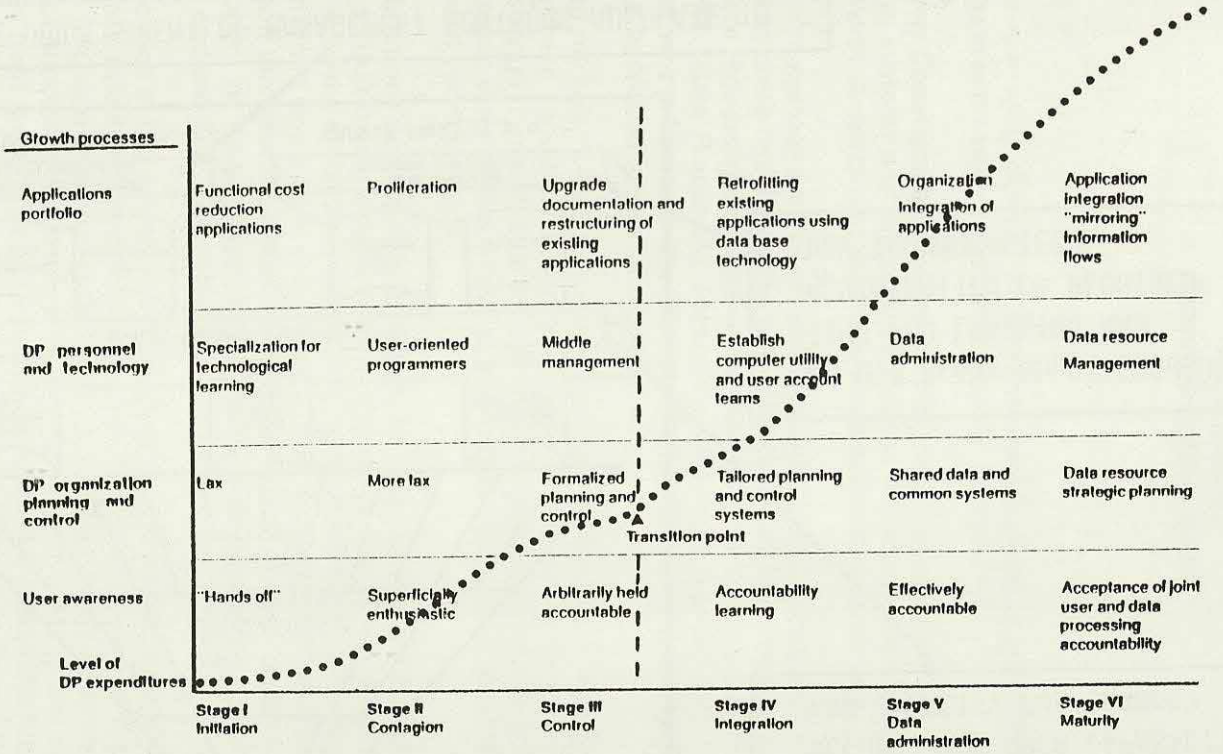


DIAGRAM 5

DIAGRAM 11

THE DATA RESOURCE MANAGEMENT ERA: STAGE IV, V, AND VI



- ENABLING DATA BASE/DATA COMMUNICATION TECHNOLOGY INTRODUCED AND MASTERED
- APPLICATIONS PORTFOLIO IS RETROFITTED FOR DATA RESOURCE MANAGEMENT
- PLANNING AND CONTROL SYSTEMS BECOME DATA ORIENTED

BUILDING A DP STRATEGY FROM THE GROUND UP
** FOUR GROWTH PROCESSES HAVE CAUSE AND EFFECT RELATIONSHIP **
DOES THE PACE OF OUR DP PLAN ACCOUNT FOR USER CAPABILITIES AND CAPACITY FOR CHANGE?
DO OUR PLANS ALLOW ENOUGH TIME FOR LEARNING AND ASSIMILATION OF REQUIRED NEW TECHNOLOGIES?
ARE OUR CURRENT DP MANAGEMENT CONTROLS ADEQUATE TO SUPPORT OUR APPLICATIONS PLANS?
APPLICATIONS PORTFOLIO GROWTH PROCESS #1
SENIOR MANAGEMENT USERS
MIDDLE MGMT USERS
OPERATIONS MGMT. USERS
USERS GROWTH PROCESS # 2
DP PLANNING & CONTROLS
DP ORGANIZATION
DP PERSONNEL
DP TECHNOLOGY
GROWTH PROCESS # 3
DATA PROCESSING MANAGEMENT CONTROLS AND ORGANIZATION
DATA PROCESSING PERSONNEL & TECHNOLOGY
GROWTH PROCESS # 4

DIAGRAM 16

SESSION H

THE FUTURE DATA PROCESSING MANAGER

Nigel Laurie,
Communication Audit

Nigel Laurie is managing director of Communication Audit, a consultancy firm specialising in human communication with a special interest in computing.

Before founding Communication Audit in 1977 Nigel Laurie spent nearly seven years with IBM (UK) Limited in systems and management posts. His previous experience includes lecturing in the UK and North America and business management in publishing.

He has written numerous articles on communication and computing, is a frequent conference speaker and has presented executive seminars for the British Institute of Management and the Institute of Data Processing Management (of whose Council he is a member). He was a judge in the 1979 IDPM "Data Processing Manager of the Year Award" and the article on which his paper is based was a finalist in the National Computing Centre competition for the best article on computing published in the UK in 1978.

I have entitled my talk "The Future Data Processing Manager". It is sometimes said by people that perhaps there should be a question mark on the end to indicate the fact that the role is undergoing change. I myself do not want to put a question mark there because I think it takes a rather pessimistic view of the whole scene. There are a lot of grounds for optimism and for looking forward very positively.

In thinking about one's future role, probably the best place to start is in defining where we are at present. To do that it may help to look briefly at the history of computing. Many people have told it, often in terms of the technology. We have talked about generations of technology: first, second, third, third and a half, and so forth, until that terminology becomes a little redundant. Dave Robinson this morning talked about it in terms of stages. He talked in terms of the things that will happen, or have already happened in data processing, so that one can take one's temperature and see just how close one is to health and nirvana.

I am going to look at the development of computing from the point of view of the DP manager himself. I really asked one basic question, which is perhaps one of the most important for an executive to ask, and that is simply: What do we have to do to be successful? What are the conditions for success in our area, or our function or our job, or our role? The answer to that question may itself suggest how we ought to define the role in the future, and the things that we ought to do. It is those questions to which I will address myself this afternoon.

You may think of conditions of success as hurdles that you have to jump, the things that you have to do. In data processing we have certainly seen changes occurring in this field. It may help to see not six stages but, from the point of view of conditions of success, at least three.

We can look at computing under three headings. First, there were the early days; then there was the application era; and tomorrow — one of our favourite words in this industry — other things will be required of us. Quite clearly, different installations and different organisations

will be at different points on this development path. But, broadly speaking, in the early days the data processing manager, who was usually a technician, was a very special kind of hero as measured in terms of the amount of effort he expended in getting some not very reliable technology to operate at all. His job was to make low-level code work, to get something working. I remember during my early days in IBM, coming across data processing managers in quite large installations, who were very proud — understandably — that they could read a hex dump as fast as most of us could read English. It was quite a virtuoso performance to watch. Those men were the pioneers. They are still running data processing departments, but they are meeting new conditions of success.

Conditions of success

The early days	The application era	Tomorrow
The pioneers	The technocrats	Ability to cope with . convergence . divergence . loss of mystique . user driven systems . infrastructure computing

Many of us are still in the application era, which is broadly the late '60s and the '70s, where success is defined for the DP manager at least not in terms of making code work, which can more and more be taken for granted, but in terms of getting an application working, and of turning specifications into useful user function. So the condition of success this time is the delivery of function, the development of useful applications, for whose technical efficiency much can be taken for granted.

There is no question that there was a great deal of success at that time, and there still is much success. There were very tangible achievements. The word "tangible" is most important. You could point to a saving sometimes in staff, sometimes in stock levels, sometimes in debtor days. But all these were measurable, highly tangible and beyond argument, and there was a lot of kudos in them.

Not surprisingly, when one has success, hope tends to follow; expectations rise and, rather like the French students in 1968 who had as one of their banners "Be realistic: demand the impossible", that seemed to become the slogan for some users as well. The total management information system became a banner to go under and, as summer follows spring, disillusionment tended to follow, and for very understandable reasons. People hoped for too much, too soon.

As a result of that phase, data processing is much stronger for the experience, for having tackled some very tough questions about the value of what it was doing and the long-term effectiveness of it. Increasingly, applications are more and more effective. But if we look at tomorrow, I think that there are quite new conditions of success being superimposed on to the ones that we already have to deal with. We have to cope with quite new factors on the scene. Many of them have been commented on in discussion.

Some of them spring from the development in technology and the growth of networks. They make the whole thing more complex to manage. We have more users in more places, and more types of users. No longer middle management, or clerks, or senior managers, but white collar professionals and shop floor workers and so on — a very wide range of users. The term "the end user" is no longer meaningful when we talk about data processing.

We also have systems that are more complex. If I have a mental image of this scene, it is the

very simple one that every user manual worth its salt these days has a map in chapter 1, to indicate the scope and the geographical range that the system covers.

Convergence is often pointed out as the key factor in this trend, and to be sure it is very important, technically speaking. But if we are looking at it from a management point of view, no less significant is the opposite, which is divergence — the breaking apart of things, the distribution of function, of processing and control. The consequence of convergence is actually divergence. That is something that we have to attend to from a management point of view. We must be able to manage the technological convergence and, if you like, the divergence of many of our managerial functions.

With that is going a loss of mystique. The mystique has gone out of the business. It is no longer something that is thought of as a high priesthood; in fact we may be suffering the fate of the priests of the Temple in ancient Egypt, who managed very large mainframes made of solid stone on which were inscribed the key messages for the culture. When papyrus came along we had a lot of minis and portable systems, and the monopoly of control of information had gone. We are in the same situation now; it is just that the technology is a little more complicated.

As the mystique goes, I think that we will find that convenience computing will be as common as convenience copying. Once it catches on it tends to develop new uses for itself. If we have a picture in this field it is of the user interface — it used to be the machine room serving hatch which could be opened or shut from inside. These days it is the keyboard, at the user's desk or beside him or her, on the job. The interface has moved out to the user, rather than being something under the operation department's control.

We also have the fact that computing is a consumer product. This is a result in part of price falls and the dynamics of marketing computers, and the need to keep turnover up as margins are cut back. One of the most significant pieces of evidence that I have seen in recent years is APL being advertised next to brandy and cigars in an in-flight magazine. I am sure that this was aimed at more than DP managers alone. You can also buy computers in Tottenham Court Road, along with many other things. Television journalists have latched on to computing and the micro as a new area in which to build visibility. The principle of stacking from high and selling them cheap is something that has moved from groceries to high technology.

As a result of all this, I think that users increasingly will be in the driving seat. They will be driving systems because although they depend upon the computer, it will embed itself more and more in their daily work. This is not simply clerical work. As a result they will be driving and taking initiatives in relation to the systems that they operate. The result of all this is what I have called "infrastructure computing". If we have one image of the computer centre as being a building, a room, or a floor, as it often is in a company, that is a picture that has to change. We have to see the computer system — if we call it that any more — as a network, or a nervous system, or a ring main, or a utility, which is something that runs right through the organisation and has a function similar to those other utilities like electric power and light and so on.

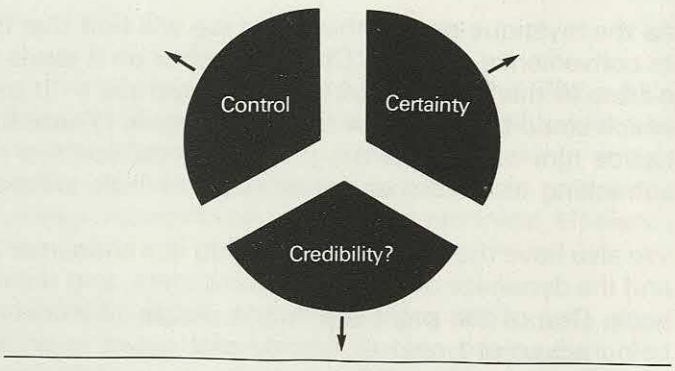
So the DPM is no longer managing the processing of data. He is no longer just a data processing manager, he really manages an infrastructure which supports two things. One is the provision of a key resource which is information. The other is the performance of a very vital activity, which is communication throughout the organisation. So the successful DPM in future will meet the conditions of success that now face him and will no longer say, "We can put it on the computer for you", which might almost seem paternalistic. He will say, and say it quite a few times, "We can make it easy for you to use the system effectively, to meet your needs and solve your problems", which implies, at the very least, a concept of sharing control.

It matters a great deal that the DPM is successful in future. It is not simply an inconsequential matter whether the function flourishes or whether it dies away, as some people think is quite

possible, because we are not just talking about managing some technology, we are talking about the management of a quite crucial resource which has often lain neglected, and that is information or data. It is no less important than physical energy. If that has not been fully appreciated in organisations, it is a measure of the lack of attention that it has been given, rather than a measure of the truth that information does not really matter.

Exploiting that resource is absolutely crucial to economic performance in almost any large organisation. In some cases, it may even be crucial to its survival. Yet, just when this matters so much, the DPM is under quite severe threats from a number of trends that are working against him. I do not mean just the fact that the mystique has been eroded, because we will probably reckon that to be a healthy sign in the longer term. But there are three quite distinct threats which face us now.

They are a threat to our control, a loss of control. A threat to our certainty in the way we do our job, carry out our function. A possible threat to our credibility or standing within the organisation that we serve.



If we look at the loss of control, at one time when physically the computer centre was isolated and insulated by mystique and jargon and an incomprehension among very many people outside, control was a natural part of the DPM's repertoire. But it is increasingly difficult to maintain that control. Many elements in the system are not under the DP manager's control, even though they are part of the DP system. The most obvious one is the communication lines that link up a network. Even though in DP we may be held responsible, at least *de facto*, for their failure, we are dependent upon somebody else for the supply and resurrection of them.

If we look at the use made of systems, we can provide systems, we can advise on how they are to be used, but very often, with an end-user system, it is the end user who decides what he is going to do with it. We cannot always control who will use the system. We can control, through security, whether only authorised people get on to that system. That is a first step, but it does not guarantee that everybody who gets on with authorisation is competent. It does not guarantee effective use.

We cannot control all the impacts of the systems that we put in. They may make jobs fascinating. They may change jobs quite radically. They may impoverish jobs in some cases. Those are not necessarily things that we can anticipate or control.

But most significant is the field of expenditure. As the prices fall, more and more people can acquire their own equipment because the price falls below the approval threshold within many organisations. So when most people find their authorisation limit increased with inflation, that in fact is working against the interests of the organisation so far as computing is concerned. So there is a loss of control over the acquisition of computing equipment. That creates fundamental problems in the longer term for our organisations.

We may say that the DP function might face a form of death, not by a thousand cuts in expenditure, but by a thousand users doing their own thing. So loss of control is a very severe

threat and it is attacking the central function in some very vulnerable areas. But with that goes an attack on our certainty, our confidence about what we are doing. Because if we look at the applications that have been established they may have delivered tangible savings of the kind that we could point at, but it is harder and harder to achieve those kinds of measurable savings. Many of the systems benefit "knowledge" workers as well as more senior management. You do not measure an improvement in their productivity in the traditional ways of head counts and numbers. After all, how do you measure the output of a corporate planner? Is it the number of plans? Is it the number of meetings that he attends? It really boils down to decisions and advice, and the quality rather than the quantity of them. An improvement in productivity in that area is not something that you can actually measure. It might be something that you can look back on, but it is very hard to put it on the bottom line. Increasingly, as data processing extends in its usage, the users will be those people for whom gains can be achieved but cannot always be easily measured. We do not have yardsticks. That lack will make certainty of savings, of benefits, and of cost effectiveness increasingly hard to establish, not only with users but among ourselves as well.

The value of computer systems to those users will depend upon two things. It will depend on those staff themselves in two ways. One is the fact that information in the end is in the eye of the user. The user sometimes cannot predict what he will find useful until he has actually got it. Sometimes you cannot tell what kind of information will solve a problem until you actually see it in front of you and are able to realise its significance.

The other way in which we depend upon those users to ensure success or effectiveness of systems is that they must themselves be willing to exploit the system effectively. They may be able, but if they are not willing, there is not a great deal that we can do about it.

So we have a quite severe threat to our certainty of cost effectiveness in many application areas. It is something for which there are no well established yardsticks. Those two together pose a threat to standing in the organisation, or reputation, or credibility, whatever word we want to use. The threat is intensified by the trend towards distributed processing. There is a rush to technology among many users. They are being approached direct by vendors and so on. They are seeing a lot about computers and micros through the media. Generally the idea of getting your own system appeals to users. We have a revolution of rising expectations to deal with. Users are less tolerant and more critical of what DP can or will do for them when they compare that with what apparently is available from outside. That tends to threaten the standing.

So, too, does the power of the worker. Although we may be managing the second industrial revolution or the post-industrial revolution, this one is very different from the first in that this time labour is organised, to put it very bluntly. Not only is it organised but it is very interested in this subject and is probably doing as much research on it as a great many organisations which are trying to use it. As well as doing research, labour is powerful and is able to resist change.

A management services manager once put it very eloquently. He said, "When we try to design a new system we are really trying to walk on eggs these days in our company, because there are so many pressures on us, and if we misjudge one of them the whole system could fail." One of those was the industrial relations dimension.

These are all threats. They may be seen negatively, but they do suggest an era of considerable opportunity for the DP manager, because the value of information, the fact that it is a resource, is something that is gradually becoming recognised. The DPM is in a position to try to set about building information systems which are cost effective, integrated and accepted within the organisation.

To achieve this, we really have to see ourselves not as an executive with a function, but as a multi-function executive, doing four things: managing a service, managing a resource, managing an infrastructure, and managing an investment. I say that in spite of the fact that prices may in some respects be falling; as Dave Robinson so rightly pointed out, expenditure is rising.

A multi-function executive ...

Service

Resource

Infrastructure

Investment

The service manager has to manage the provision of those services which support the key activities of the organisation and the key result areas. But it must also be a service that, as well as supporting the important activities, is judged by the users themselves to be acceptable and effective. The user's subjective judgment is an objectively important fact.

A multi-function executive ...

... under pressure

Service
- effective?

Resource
- exploited?

Infrastructure
- impacts?

Investment
- pay off?

As well as managing a service we are managing a resource, and that resource is information. Somebody — and I think it is the DPM — has got to acquire it, conserve it, and then make it available, so that it does serve the corporate and the functional objectives right across the organisation, without reaching the privacy and the security constraints that the organisation and the public may lay down.

We also have to manage the infrastructure. There we are leading with technology. We must select it, acquire it, operate it and make it work. It is not just computing but also communication technologies — what Daniel Bell from Harvard has called "compunnication". Switchboards, electronic mail, information retrieval, word processing, as well as just traditional data processing. They must be made to perform reliably, and so managed that when they cause changes, as they surely will, those changes are (a) productive and (b) accepted by the people who are affected by them.

Finally, we have got to manage an investment which is a very high one, not just in hardware but also in software, which need to be seen as capital investments and need to be written off over so many years, and also in very costly and scarce staff. One has to manage that investment — and this is where it is significant — on behalf of the organisation as a whole, even though many of the services are being given on a local basis. And somehow, one has to do all four at once. It is rather like juggling with knives in the dark, as a North African proverb has it.

In doing it we have to deal with four crucial pressures or hazards. We must overcome the obstacles to making that service truly effective. We must make sure that the resource is fully exploited across the organisation. We must try to manage the impacts of that infrastructure as it changes the organisation in many ways. We must resist the pressures that may make it difficult to get a pay-off from the corporate investment in the whole thing.

I have mentioned one of the pressures on making the service effective, which is the difficulty of measuring its effectiveness. There is also the clash between the users who want local control to do their own thing, believing that micros and minis are bringing a new kind of democracy into this field — which I think is a false illusion — and the need to have an integrated corporate approach so that we can plan a strategy to make the investment pay off. So, making that service effective is not particularly easy.

We must also make sure that the resource can be exploited; and for that we must have an integrated, or at least a compatible range of systems in our organisation, when users often want to go down their own particular road. If we cannot have it, then we have to write it off. If we want an integrated system, start again — and I know of organisations that are doing that right now, rewriting all their systems on to database. Otherwise, abandon the objective, which is not something that one would want to sell to the board.

When we look at the infrastructure, we have got to manage those impacts and make sure that they are accepted and that they are as useful and as constructive as can be. We deal here not just with the knowledgeable user, but with a much broader public which will be affected by the impacts. The prime fact about technological change in relation to the broader public, which includes employees, is that public reaction comes before public understanding. That is not a criticism of public understanding, it is a fact of life, and there is nothing that we can do about it. So we will get reactions before we get full understanding. We must prepare the ground for that so that that reaction is as well informed and as sympathetic as it can be.

You cannot make technology and technological change pay off inside an organisation unless the impacts of them are accepted. That is a fact of industrial life. It may help us in doing that to break down the impacts into categories, individual ones on tasks themselves, the work we do, the satisfaction that we get out of it. There was some concern about the health impact of VDUs, for instance. There may be concern on individuals about their employability in future, such as typesetters in Fleet Street. Those are individual impacts, but sometimes they have a structural dimension which is a second category. They may eliminate certain types of jobs. That creates structural unemployment. That can cause quite severe dislocations in the economy. It may alter pay relativities. I am sure that everyone in this room has embraced that problem, in trying to get DP salary scales accepted by job evaluation departments elsewhere in the organisation. In my experience it often has to be "frigged" to meet the market pressures.

Thirdly, there are the social impacts: unemployment on a larger scale, and the possibility of public disaffection from data processing. We have seen this in the United States where consumer groups are resisting the introduction of computer-controlled checkout terminals. Possibly even the impacts of computer-controlled systems where life itself is safeguarded by the computer. In all these cases, whatever the true reason for the impact and the result, the organisation will be held responsible, because it is visible, it is in the public eye. I think that the buck will pass across the organisation on to the data processing manager's desk.

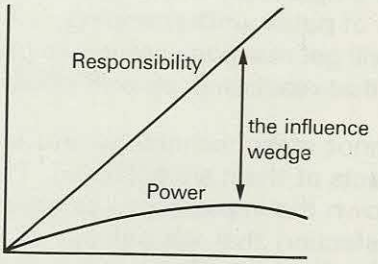
If we doubt it, if we look at the argument and the debate over privacy, so often DP has been made the fall guy without any justification whatsoever. So we are facing a number of pressures. The final one is making the investment itself pay off. We have the drive to fragmentation which threatens the investment. We have the shortage of staff which limits our ability to exploit it. It may mean that as users exploit the technology for tomorrow's applications, our own staff are stuck doing maintenance, which is really yesterday's work and does not take us very far forward. In some installations maintenance can be a very high percentage, at least 70% in many cases.

But there is one last notion which is very important and very severe which affects investment. It is the "small is beautiful" notion, which has reached the boardrooms of industry. For instance, this question was put to the new chairman of Shell on his appointment, two or three years ago: What factors are crucial to the success of Shell? His answer covered three elements, but there

was one very significant one from our point of view. Thinking small, because it was pointless to go on trying to optimise manufacturing plants by making them larger, when small groups of workers have the power to halt the whole operation.

If we replace manufacturing plants with data processing installations, that thinking is quite widespread now at senior levels in the UK. It is a recognition of the reality of industrial relations and the vulnerability of organisations which depend upon data processing. It does create an instinctive reluctance to put all the eggs in one basket, to depend upon an integrated or central system because it is seen to be so vulnerable. It is an element of thinking which can be hard to dislodge or deal with.

I think that is the situation that we are in in data processing. These aspects pose quite new threats and quite new conditions of success that have to be met. There are a number of things that we can do to meet them. The first is to swim with the tide and to recognise the reality, which we might sum up in this way. This is a kind of management services, corporate planning graph, where there is a gap between the power that we used to have and the responsibility that we have to the organisation to make the most of the opportunities with which this current situation presents us, and to help the organisation to exploit the information resource. The responsibility is increasing, because the technology makes more things possible. But at the same time it puts certain things into our situation where we lose power. We must bridge that gap and fill that wedge by increasing influence, perhaps much more than by direct control. The monopoly has gone. The mystique has gone. The monopoly of knowledge has gone. We have to influence by persuasion, by a display of quite distinctive competence that is possessed nowhere else in the organisation. In short, we have to go from management by control to management through communication.



Quite clearly, one's position on that graph will vary with the size of the installation that one is running, its maturity, the history of the organisation, the organisational structure, and so on, but I think that broad trend will be found to apply.

Having accepted the position, there is a very strong card that one can play. Some people call it synergy. I call it the value of the critical mass. If we can get two people together, they are worth four dispersed throughout the organisation. Some people might say that if you had a hundred people together they are not worth two hundred dispersed throughout the organisation. That is where we introduce overheads. But I think that the critical mass is a strong card to play for data processing. It has two aspects. One is the expertise, and the other centres round the proposition that central data

$2^1 = 2^2$

management makes sense for the organisation. If we can manage data centrally, then we can get far more out of it than its use to the organisation if its control is dispersed across the organisation.

If we can manage it centrally, we can get the return from the investment in technology and skills. We can also get the strategic decisions right about the technology that we will use to manage that data resource. But we have to deal with the "small is beautiful" notion, which possibly makes that an unattractive proposition. This is because the critical mass is misunderstood. One has to say that central management is not the same as the central location of data itself. Management rather than location is the determining factor. We can have local autonomy provided that it is under a central strategy.

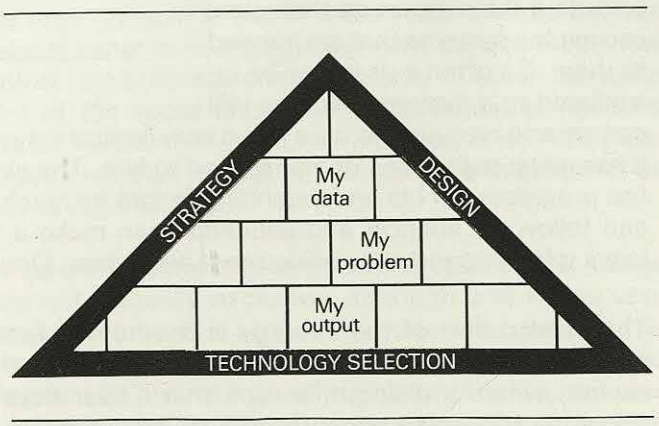
The second caveat about the critical mass is that sometimes we must have the courage to look rather reactionary and conservative in the face of those users who really press for what they would call independence or autonomy, but what is really anarchy; because they will go down not their own road but down a dead end, with a technological white elephant. They could well find themselves coming back to you, complaining about your allowing them to go down there in the first place. There could be a lot of chaos, and even resentment, as users say, "Why didn't you tell us?" That they would not listen because they had been talked to rather persuasively by someone from outside is another matter. They will not necessarily remember that.

However, one has got to win over those users to the idea of a critical mass as something to build up and conserve. To do that, one has to give them benefits in terms of user service, so that they see the value of the central management. To do that, we should aim to build on strengths. There are some things that DP is very good at, and I think that we should observe the old management principle of making the most of what we have.

There is a trend to giving users tools for solving problems, and networks and distributed processing make that increasingly possible and feasible. It gives us in DP an opportunity to focus on the things that only we can do. They are represented by the size of the triangle which are holding these bricks in place. Only DP can help to set the strategy and help to determine priorities with users and reconcile them; to indulge in trade-offs and achieve integration. Only DP is capable and competent in selecting technology so that it can be integrated later and say that this is the best technology for the job. Perhaps there, more than anywhere else, user ignorance is the Achilles heel.

Finally, DP is particularly good at designing systems where complex design skills are needed, with an awareness of how they are going to relate to other systems within the organisation. It is something that no user can possibly possess, because he is, quite literally, blinkered.

Users, on the other hand, are very good at talking about their data, "my data", "my problem", "my output". They know what they want in a report, they know what data they need to make the decisions, and they know what their problems are. They may not be able to conceptualise them, but they are very good at defining the symptoms. So their expertise and their strengths are ones that one ought to play on and to exploit as much as possible, for the benefit of the users themselves.



That amounts to saying that in a sense users might best be seen as bricklayers where the DP management function plays the role of the architect. Users can lay bricks. They can build their own part of a large wall or edifice, but only within the context of the architect's plan, only putting bricks where the plan allows. In that way we ensure that we end up with a building rather than a brick and cement camel.

To do that, we have to create in users an awareness of their responsibilities. We have to make the end user responsible, because as well as giving him some autonomy we cannot guarantee that he will achieve benefits because so many of them will be intangible as these systems reach higher in the organisation and reach to the knowledge workers. In short, we have to make the end user responsible.

There are two strategies for doing this. One works on what users think and the other on what they do. If we look at the strategy that works on what they think, in business what people think is as important as what is the case; opinions are as important as facts. User expectations must be sound. If they are unrealistic that is a fact in our decision making that we must cope with. It requires quite skilled and effective long-term communication with users to keep their expectations in line with reality. You have to combat what Dave Robinson called the *Readers' Digest* syndrome, and what I call the *Tomorrow's World* syndrome, where the user sees it on the box on a Thursday night, and comes in on Friday morning wanting to know why he cannot have a terminal that does what he saw last night. There is a lot of education in reality to do.

One has to recognise, however, to be fair to the user, that he is self-centred for the best of reasons. He has to be because his job demands results within his area rather than decision making about DP which is consistent with an overall strategy. So the user is paid to be unreasonable, in a way, about data processing. We have got to help, through communication, to adjust that user's outlook and his expectations so that he understands that data is not just his resource but a corporate resource, and he has a responsibility to conserve it for the organisation as a whole.

Making the end user responsible ...

Build sound expectations

Enable users to be responsible

- support
- human factors
- charging system

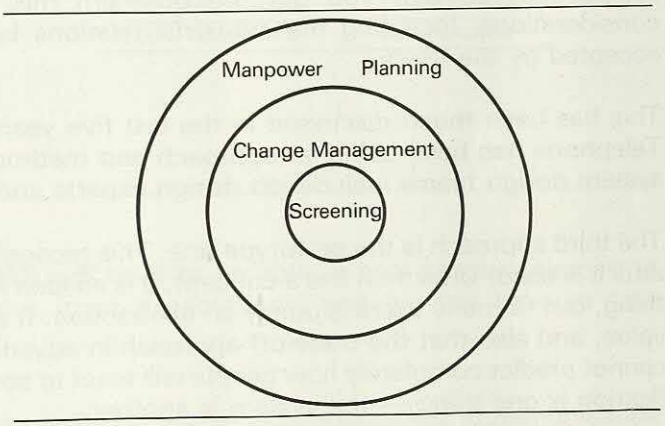
However, expectations are half the battle. The other half is enabling users to be responsible, giving them the tools, taking the approaches that allow it. One of those is providing the support so that users can exploit systems that are handed to them. So often a user may be introduced to a system which he will control and run, and he uses it in a very limited way. He fails to exploit its true potential because it has never really been demonstrated to him. The early education has been forgotten, and as he has progressed in his understanding in fact he reaches his level of competence far too early on, and follow up support and education can make a significant difference there. It pays to ask users what support they value most and when. One often gets some very interesting answers.

The second arm of the strategy is the human factors one which I am sure that Ken Eason discussed yesterday, where one designs systems that users not only can exploit but want to exploit; where a dialogue is such that a user does not want to ignore it. There the friendly system is one which encourages further exploration of its facilities. In that way a user benefits even more from it.

The third area is to make sure that when a user is charged, he can relate what he is paying for to what he is getting out of it. It is a matter of developing charging systems which allow the user to be responsible in the decisions that he makes about his expenditure. If he is overspending, he has got to be able to find out why he is overspending, so that he can make some rational decisions about his use of the system. And that requires charging systems that relate to his reality rather than a data processing one.

If we can do those things, we can engender user responsibility and realism and equip users to get good value. But that will not cover everything. There is another area of user attitudes which is directly addressed by the question of the impact of our infrastructure. It is significant that in the United States one of the fastest growing employment opportunities is the post of Public Affairs Director, or some such name. The reason is that the impacts of the corporation are seen to matter, are visible, and need to be managed. In DP we also have to deal with our impacts. Our public affairs are really the organisation's affairs. Our public is the users and the employees throughout the organisation. We need to think about those impacts no less than our organisation thinks about its impacts outside. We need a strategy which will win control of those impacts and win acceptance for them among users, and also among the rest of the employees; the impacts on the jobs and on the organisation, and also on the public outside, who in a sense are also end users of our system. In short, what we have to do is go into the change business and plan accordingly.

To do that, there are three areas for management. The one closest to home is the screening of systems. This is an ergonomics or human factors issue at the micro level. It is saying, "Let's look at printouts. Let's look at screen layouts, dialogue design, VDU clarity and safety, the comfort of the workstation. But let's screen the systems that we have in every detail to make sure that the human factors are right; that nobody could be switched off, turned away, demotivated by difficulties in that area." That is the most basic thing that we can do: screen the systems.



The second area looks a little more broadly at the thing. I call it change management. It deals with the systems that I am going to introduce, not just the ones going in tomorrow but the ones going in in two or three years' time. It involves bringing about the changes that those systems usher in in a controlled way, so that those new systems do not just take account of technical and business considerations — which are quite obviously crucial — but also take account of the social impacts and the industrial relations impacts, and ensure that they are planned for no less fully than the technical ones. We must have an approach which ensures that the systems that we put in can never be stigmatised as human treadmills or destructive factors in the organisation.

In designing those systems there are four considerations in change management, four things that one can do which will help. They are not mutually exclusive, although one would very rarely see them all together. One is reconnaisance; the second is trade-offs; the third is prototypes; and the fourth is human override. The reconnaisance is very simple; it involves going and seeing before one puts something in. I do not mean purely in terms of asking the user what the business problem is, defining a solution and installing it — that is traditional system design — I mean also doing a reconnaisance on what the attitudes of users are likely to be

to the new system, so that when the system is put in what people feel about it is understood just as fully as the business benefits that the system can give. One example in the United States was the National Bank of Detroit, which did an attitudes survey among tellers who will be using terminals while they also deal with customers in the branches. There obviously the attitudes of the user — the teller — were quite crucial. If the user was unhappy with the system, that would perhaps show itself in a different attitude towards the customer. So there was reconnaisance being used to try to map out in advance what possible difficulties there might be so that system design could be reconsidered.

Some Change Management considerations

- Reconnaissance
- Trade-offs
- Prototypes
- Human override

The second approach does not recognise that going and seeing is worthwhile — it builds that in. It recognises that there is no such thing as a free lunch. You will never get the system that pleases everybody 100%. Human factors may be desirable, but they will never be completely achievable; of if they are, you will have to pay for them in some other way. So one has an approach which trades off human factor benefits against business benefits. This, if you like, is mechanical efficiency against human satisfaction, so that you get the optimum mix for the group, bearing in mind all the considerations, including the industrial relations bargaining ones, and get a system that is accepted by the users.

This has been much discussed in the last five years over here, but in the United States Bell Telephone has been using an approach and methodology for this, for about 15 years, where system design teams include job design experts and human factors experts.

The third approach is the prototype one. This recognises that the system does not actually exist until it is used. Until then it is a concept, it is an idea which to us in data processing is a very real thing, but to many users is purely an abstraction. It admits that reconnaisance has very limited value, and also that the trade-off approach in advance may have a limited value, because you cannot predict completely how people will react to something which does not yet exist. A specification is one thing — the system is another.

If he has never tried it, the user cannot really tell whether or not he will like it.

As technology costs fall and systems become easier to develop, increasingly it will be feasible to develop prototypes. The philosophy of prototypes is one which says, "It is worth getting something up and working, because then we can get some real live reactions to a real life system." One can write the system in a very easy language first of all. It may not be efficient, but at least it gives us some function to play with. Or you can simulate the system using a computer-based training software, computer-assisted instruction and so forth, where again the user gets a simulation of his system, and you can see him using it on the job and you can get his real reactions.

The fourth approach, the human override one, says that although we have a feedback, we may have a control system in our computer system, we do depend upon the user not just for data but also for co-operation. It devolves to the user a measure of control — self-pacing and so forth — which thus allows a user to override perhaps the speed of the system or perhaps the sequence in which he tackles work.

This is not anarchy, it amounts to a form of increasing the user's responsibility. What matters is the user's performance overall, rather than the extent to which he follows the system on a rote basis. That is something that was discovered in mass production over 30 years ago. I think that it applies no less to those DP systems that are rather like production systems — on-line order entry and so forth — where the operator is really like an assembly line worker in many respects.

A final dimension of this arex of change management is manpower planning. That is not really the DP manager's job, it belongs somewhere in personnel. I think that is quite right. But someone has to feed into that manpower planning function an understanding of what DP will do to the organisation in the next five to ten years, and what it is planned to do in the DP strategy. One thing we do know is that it will be very hard to predict what kind of jobs will be required in the organisation using micros and computer technology ten years' hence. An understanding of that and how to cope with it is something that the DPM has to feed into manpower planning. It is also needed in the traditional sense within the DP department, where we need to work at developing the skills and the resources to cope with tomorrow's requirements. In the 1960s our main concern was efficiency. We needed people with pioneering skills. In the 1970s effectiveness was the criterion, the functional effect to users — and systems analysis, the ability to refine function and convert it into systems, was the key.

	Concern	Skill
1960s	Efficiency	
1970s	Effectiveness	Systems analysis
1980s	Acceptance	User analysis

In the 1980s acceptance will be the key concern. Will the system not just work and be cost effective, but will people be prepared to have it? We need to be able to design systems that are not just functionally effective and adequate, but which optimise the contribution of all the components, including the human user. We will have to be able to analyse our users — to understand their viewpoints, their attitudes, their expectations, and we will have to take account of those aspects in system design.

In the last few years there has been a quiet revolution within data processing. Communication skills have been improved quite radically. People are very good now at relating with users. There is still the jargon problem and there are some very fundamental communication gaps which do not come from a skills imbalance, but from more fundamental differences. None the less, there has been an improvement. But on its own it will not be enough to bridge that gap. Very frequently, what users and we in DP see when we look at a computer or a system is a quite different thing. The political environment, public discussion and the like suggest that computer technology is seen by ourselves as a saviour of the organisation, a help to economic performance and efficiency, to help to improve the organisation.

Perhaps to many users and also to many users-to-be in the years ahead, DP is seen as a job killer. You come out of stations in the south-east of England at eight in the morning, to find large posters asking if you have had your chips yet. That is a union recruitment poster. Increasingly those messages are being transmitted to our future users. We have got to have communication across that gap between DP and all the users, to get the truth in perspective and get users to understand the value of DP systems in every respect, both personally and corporately.

This will call for a communications strategy, a systematic approach to creating informed publics within our organisation, just as an organisation looks outwards to its own publics. In looking at a communications strategy, there are three things: one is the question of who our audiences are; the second is the questions that we ought to ask about them; and the third is the messages that we ought to get across.

Communication strategy building

Audiences	Questions	Messages
Users	What should they know?	Need for corporate strategy
Employees		Value of information
Managers	What do they know?	User responsibilities
The Board		Benefits of DP impacts
The Unions	How can we best get across?	Manpower policy

Looking at the audiences, I said that the end user does not exist any more. I have put "users" up there in the plural to cover the multitude of users at all levels and in every function. But there are also employees who may get to hear from users about systems, and are of course tomorrow's users, or next year's users. There are also managers who may make functional decisions about data processing or carry responsibility for data processing. They are also employees. Then there is the board which has a key role in endorsing and approving investments and strategies. There are also the unions, which of course overlap with employees, some managers and users, but are a separate force, not least in their interests and the fact that they are a trans-organisational body.

Those three questions should apply to all the user groups. We should ask for each of them: What should they know? In the ideal world what would they know about data processing? What would they understand? What would they accept? What would their image be of computing and computing technology?

Then it is worth asking: What do they know? What is the picture in their minds? Is it something that came out of *Tomorrow's World* or *Readers' Digest*? Is it something that came off a hoarding? Is it something that came by hearsay?

Thirdly, one can ask: How can we best get across the messages that we have got to get across to create the right climate in the organisation for DP to be accepted and effective?

There are five broad messages that have to be understood. The first is the need for a corporate strategy — the need to take a corporate view rather than a fragmented view of this whole area — in other words, the need to manage it centrally with a DP function.

The second message is that there has to be an understanding in the organisation of the value of information and its worth to the organisation; of the fact that it is a resource, that you can manage it and use it, and that often it is under-exploited, and represents an opportunity for the organisation, rather than a cost factor. I think that will become increasingly easy to do as expenditure in this area grows, because as expenditure grows so the questions of the value rise, and then one can point to the value of information. So that message will be highlighted in the ordinary course of events, but I think that it has to be got across.

The third message is the responsibility of users: the fact that although there is a central function needed, it does not mean that you abdicate or delegate upwards or inwards all responsibility for getting value and effectiveness out of DP

The fourth message is particularly crucial with employees and unions, those two who are not necessarily direct users but who have a very sharp political or personal interest — and that is the benefits of DP impacts. Some of those I have said are personal. Some are corporate. They may well keep the organisation in business. I know of at least one case where a database is reckoned to be the key to the current profitability of a company. Without it they simply would not be profitable. Getting that message across to employees is a key step in getting data processing impacts accepted.

The last message is that one has to communicate to the appropriate function, first, the need for manpower policy; and, having got it established, what it is to the rest of the organisation. Because trade unions are demanding and are negotiating technology agreements with organisations in this whole area, to ensure that there is a manpower policy to deal with the displacements that occur with new DP systems. It is not an area that an organisation can shy away from, because the absence of a manpower policy, perhaps more than anything else, will undermine most of the communication that one puts out about computing to an organisation as a whole. The question always comes up: "What does it mean to me? What about my job? What about my employment security?" The only answer is not: "Well, you'll be all right." It has to be, "We in this organisation have a policy for dealing with it." It has to be something that you can state, because that question will be asked.

Those are some of the things that one can do to deal with the conditions of success and the new challenges. If I were to sum it up, I might say that the future DP manager has a very considerable and bright future, provided that he updates the position guide; if, as George Cox said, he looks at the role and sees how it might be upgraded, expanded or developed.

The first thing in the position guide is that the future data processing manager swims with the tide. He accepts the reality of a declining power, but an increasing responsibility and opportunity for influence. Secondly, he plays the critical mass card which is a very important trump to play. He lets the users be bricklayers — he is prepared to delegate outwards, give out autonomy and make users responsible, so long as there is central control and management. He manages the impacts — he recognises that he is in the change business. He develops tomorrow's skills to ensure that he can make systems that are acceptable and viable in every sense. He builds a communications strategy so that, as well as today's users, he is also dealing with tomorrow's users and the next generation of users, because their attitudes are the ones that will ultimately affect him when he tries to develop a full-scale, integrated system.

The Future DP Manager: Position guide

- Swims with the tide
- Plays the critical mass card
- Lets users be bricklayers
- Makes users responsible
- Manages the impacts
- Develops tomorrow's skills
- Builds a communication strategy

There are a great many tasks. I think they are what, when I was in IBM, would have been called a "challenge", which is a euphemism for something you think twice about. It could be a very exciting prospect. If DP managers take it in, it involves risk but I think that the rewards will be very great.

SESSION I

THE RE-EMERGENCE OF O & M

Millard Collins,
International Business Machines Corporation

L. Millard Collins, Manager, Word Processing Education, Office Products Division, International Business Machines Corporation, was educated in Texas public schools and received his Bachelor and Master Degrees in Business Administration from North Texas State University.

In 1956 he became Manager, Educational Services, Office Products Division, in New York City, and in 1968 was promoted to the position of Manager, Education Marketing Programme, Office Products Division. In 1971 he was named Manager, Word Processing Education. In this capacity he participates in administrative and systems design programmes for improving the efficiency of business communications. He is responsible for analysing, researching and implementing educational programmes for word processing. This programme is for all levels of management, supervisors, and secretarial personnel. He has assisted in developing programmes in business, education, and governmental agencies.

He has participated in many business, government, and educational conferences as a speaker. During recent years he has worked closely with the American Management Association, chairing a number of seminars.

I was on the committee to name word processing in 1965, and may I clear the deck quickly by saying that if I were naming it today I would not call it word processing. I have been told for many years that organisation and methods has to be on the low end of the totem pole, and listening to your programme this week I would not want to leave that impression. I think that there needs to be a new look at the nerve centre outside the data processing camp with both groups, the office systems people, the data processing people and the administration services people looking together.

I know that the subject of change is rather like when I checked in the hotel here, the night before last, and I asked the young lady at the desk, "Do I register with you", and she said, "Not particularly!" I have had about 15 years of that "not particularly" put on at me by many management people, and many groups in the office. Most of you realise that in the States we had an edge start on you people in Great Britain in word processing. Coming, as I did, from teaching in three schools of business for ten years, teaching business and English, I felt that we made a mistake in giving a secretarial-oriented programme to start with, even though they were very key. In the States that seems to be the largest shortage of employees today. Where do you get qualified staff to do the traditional things that we have thought of in the office, from answering the telephone onwards?

I get stung every once in a while. It is humorous but it is pitiful. Someone says, "Have you changed the name of your company, Collins?" I say, "No, I don't think so." So we have about decided it is IBM hold. That is just trying to get a telephone call through. I feel that if the two programmes are detached, they are like the theatre ticket that says that if the stub is removed, it

is void. We have got to bring these two together. Early in the game, having six years of accounting, I discovered a long time ago that an enemy recognised is an enemy half defeated. We are half as old in office systems or word processing as the data processing brothers, but I think that we are more than half as good.

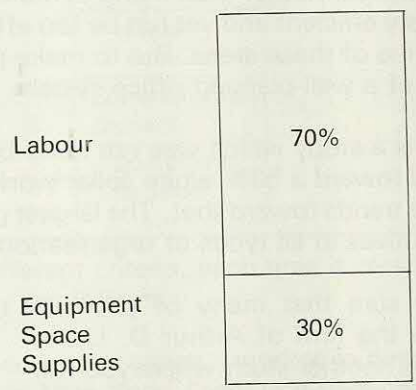
I am going to try to show you what we have done to clean up what we used to call "word processing" and what we now refer to as "office systems", leading into information processing and looking at the scales that are needed as well as the design of the system. Last, I should like to show you what we have done in showing to American businessmen (and I had the opportunity to show it to some of your banking people in London when I was here last February).

The serious problem and the reason for looking more in depth at every job in the office is our work force trends. Most of what the women were doing in America they no longer have to do. At the time that I finished university, a woman had basically four choices: she could become a nurse, teach school, work as a secretary, or be a housewife. I might add that I feel that none of those jobs is as secure as it used to be.

Work force trends
Office costs
Evolution of office systems
Principle requirements

Office costs are soaring. When I came out of the Air Force at the end of World War II, the cost of a single business letter was 76 cents. *Dardenell's* new cost, which will be announced in January, is $6.59 per letter. I get upset when I hear someone talk about the cost of running an office as relating to the cost of the business letter, because the cost of the letter is just the tip of the iceberg, as you know. In 1965, however, that was the only yardstick that people were throwing around as a measurement of office cost. Then we begin to use technology to relieve some of those problems, and nearly everyone who bought the equipment went through cost justification before the equipment was installed, had little regard for the acceptance curve on the part of the user or the operator as well as management, in a change that was evolving and known as "word processing". I think there is an evolution in the office. It is a transition. I do not think that it is there yet, but it is essential if we are to survive.

Office costs



Some of you may have had exposure to our Federal Government paper on work study that was done about two years ago, where $100 billion a year is spent around the US Federal Government. It was amazing that one university asked for a grant of $16,000 and it cost $20,000 to do the paper work to get the grant, so they gave up in the middle of it. That is not uncommon in many of our business agencies. I think of this office system being applicable to businesses of all

sizes, whether small, medium or large. There has just got to be a better way to do everything that we did yesterday in the office.

It can also be applied to government, business and educational institutions. I know that many of you feel that you are running the computer. Many of you are closely associated with that programme and you see some changes. I think that it is much better to manage by leadership than to manage by fear. I do not think that there is anything much to fear. The evolution will take place. When I use the word "principal" I am talking about users, whether those people are executive managers, project managers, or staff that need some type of administrative and document preparation. Watch me use that word, because I think that we are wrong to continue to refer to the terms "secretary" and "typing". I use "document preparation", and I wish I had the courage to have written the article, "When it comes to principal requirements, there are many more than answering the phone, doing the filing, and what have you." I think that records management is a vital part of your office systems. Many people are secure in their job in the United States because they do the filing. The four-drawer filing cabinet is duplicated in 15 different areas in the same department. And if the boss does not have confidence in his secretary, he keeps an additional file in his desk or his console, if they will let him get away with it.

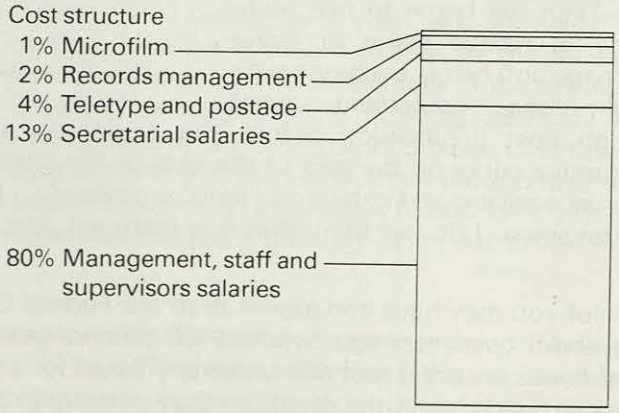
Your copying is just as important. So we are talking about the gamut of office systems, rather than just keyboarding, typing or document preparation. At first we did not look at the administrative tasks at all, but I think that they have to be looked at. So how can we meet the user's requirement as it relates to the office system arrangement, which I feel that all of you in this room will have a part in? The reason that I say that is because we are all in the information business.

Many people think that the equipment, the space, and the supplies is what is breaking our back. I cannot speak for the UK, but this is a figure from our US Department of Labour that I believe to be true: that the most expensive cost is in labour, what we pay our people and our executives. Rather than trying to make people more efficient in all areas, you could, in my book, be very efficient and yet not be too effective. The efficiency expert has a little problem surviving in some of these areas. But to make people more effective in that labour market should be the goal of a well-planned office system.

This is a study which was not done by my company. It was completed in 1978 and shows the trend toward a 50% white collar worker population in the US. I am sure that you people have some trends toward that. The largest growing group in the work force is in that area, supporting executives in all types of organisation.

I am sure that many of you will know the firm of Arthur D. Little. This is another study where you will notice that the cost of management, staff and supervisory salaries, and added to that the cost of what we commonly know as secretarial support to those people you have about a 93% cost in labour. I am not sure that I agree with all the others, but there are some good things to think about. This is what their study covered. I am only reporting the result.

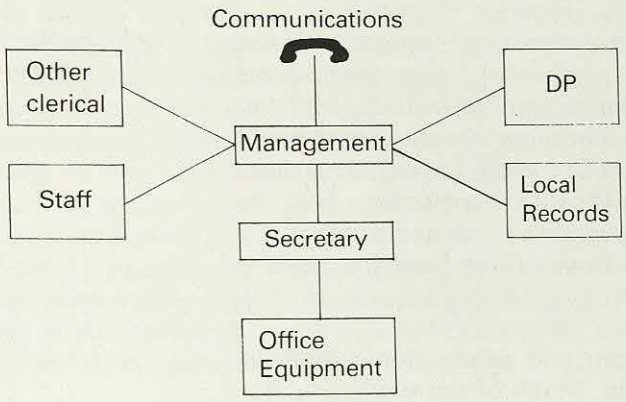
Office costs
Headquarters with 1500 employees
Cost structure



When we started word processing

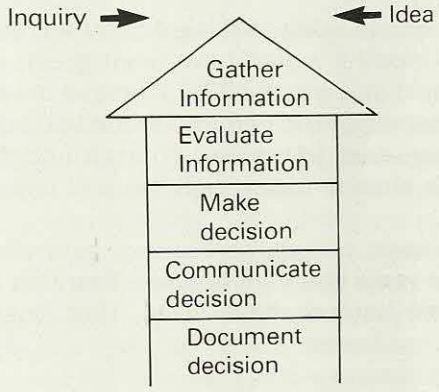
we looked at office equipment. We looked at the secretary and management. Today, we feel that if you are looking at the components of an office system, you must include your data processing local records, all of your clerical administrative people, and leave no one out, because there should be no unnecessary jobs if you do the job right. That means study techniques, many of which have not been dreamed up. We have many times tried to be too much to too many people. Now I am free to tell management people in any organisation, "You have to get totally involved, because you know more about your organisation than we will from the systems mode of a manufacturer or a consultant, because you live with it. You've been there." If you can get the communications going with the principals or the users, then you should be able to realise that communications is the link that will pull the whole thing together.

Components of an office system



I am not sure that this slide is labelled the way that it should be, but I finally gave up and compromised on it with three or four other people. It is perhaps a decision-making cycle, but most of the information that results in the outer part of the office or in your computer room is certainly the result of either an enquiry or someone's idea, to change the manufacturing, the engineering, or some type of research project, to market differently, or to render a service differently if you are in government. The bottleneck starts with the gathering of that information. That information is evaluated, maybe by different criteria, each time it comes up. The decision is made, and then the communication may be difficult.

Decision making cycle



Most of you probably have some relationship with your corporate office. I worked in corporate for a while, but I also worked in a division for 20 years, in New York. I saw that division grow from just a few hundred people to more than 2,000, and it became more difficult after the decision was made to get that decision communicated to 200 locations in the States. The document decision: when do we publish? Isn't it amazing how many people will not move until they get the results of an enquiry in writing on a piece of paper?

A few months ago I was asked to speak to the Records Management Group in America. They asked me to speak on Electronic Document Distribution and the Paperless Office. I did not like that title, so I wrote to the chairman and said, "I'd be glad to help you with your programme, but I'd like to talk about 'useless paper'." I think that is our challenge when it comes to that decision.

Let us take a look at where we started in all of this with word processing, which I have admitted

was not the total concept. Traditionally, it started here with the preparation of that document; by someone taking management's thoughts and ideas, reaction to an enquiry, and developing a document that we called "information". If we are to avoid duplication we have to look at information from the time that it comes in. We need to capture it all if you are to have a total integrated office, even in the next 20 years.

Word processing started with the text processors, the stand-alone machines and typewriters. I still believe that there is a place in some of your office work for maybe a more sophisticated typewriter, but do not overlook it. Just do not put a Rolls-Royce there if all you need is a van.

Word processing

Text processing

Typewriter and stand alone text processors

Custom production

System design

Centralization

Decentralization

Custom and production relates to design. Much of the work is customised. In the early days we just poured the same type of work into a customised environment we did for productivity, and many people promised 20% in six months. That is ridiculous when you consider we have had only a 4% increase in office productivity in the States over a 12-year span, from 1965 through 1977.

So it was unreal. I felt that if we had had respect for the learning curve, an acceptance curve of 5% in 18 months would have been great; maybe 10% the third yeard, and maybe 12%. But where would you get the 20% increase unless you had everything in line from the time that the idea hits people or the enquiry is received until the time of management's acceptance? And that is not always easy to achieve. I have found that many of the staff who support management will accept the change faster than the end user or the management people affected.

We have been talking here about centralised or decentralised operations. I can go back a number of years and I am not sure that that issue will ever be settled, but I believe that in office systems we have to have both. That does not mean fragmentation, it means planning to get there.

If you look at data processing, which to you people is a very simplistic approach, there is beginning to be a lapse. I have had the opportunity to work with some of Fortune's 500 companies. The oil companies are very receptive to this programme in the US, simply because mainly they are under a consent decree now from the Government and for the last two years they have not been able to destroy any paper at all. So they are building warehouses to put all this paper in. Who is going to look at it from the Federal Government? But that is not the question. It has to be stored, and it has to be retrieved. So microfilm, microfiche, computer runs, office information — all of these come together. Those things help to bring about a unified front for the project at hand. The retrieval, manipulation and the advanced text processing, or ATMS, which we have been able to use most effectively in a number of companies.

Let us take a look at this functional gap that we have been trying to fill for at least the last three or four years. I do not believe that we can have workstations out there in that environment that will do only one thing. It would be a herculean task to manage or to decide what you are going to do with them. Electronic document distribution is coming. I am not here to tell you that it is here today, but a number of people have been doing some form of communications as it relates to mail services and communication internally and externally for quite a while. The host communications — but then the added things that we can get in records processing, text

processing and the text records merge, and we cannot do that unless we can tap the database. Forms processing and document facsimile is not new to you people. So back again to the gathering of information. If we have it, let us not reinvent the wheel, let us use it.

Some of the administrative staffs occasionally say to me, "How do you get management to accept this?" You people realise that your travels may not be as extensive as many of the management and executives in your own organisation, but I really believe that when Gabriel blows his horn 95% of the people at the management level in American business will be in a meeting. If you people have a kinship for that I would ask you, "What do your staffs do when you are away?" I have just finished an extensive paper on how office systems can be the key opportunity for an organisation as it relates to time management and delegation. We have talked about delegation for a long time and I am not sure that many of us know how to do it. I find it difficult to remember that someone may be able to take care of a little task that you enjoy doing because you have a comfort zone. I have it myself. So you can say to yourself when you look at all of this, "Do we have our management people in each function doing what we hired them to do? What can we do in a combined mode that will give them more information, fresher information, at less cost and higher productivity, at least eventually?"

This will not be new to you, and I will not hit it too hard. We have got to understand the difference in these two environments, even though they have a lot in common. Word processing just happens. How many of you have driven to the office or ridden on the tube, and you had in mind exactly on a paper or a mental list exactly what you were going to do that day, and by noon you had done none of it and by 5 o'clock you still had done none of it? Is that true of you people, or do you get your work all done in eight hours the way you planned? Well, that is the office for you; that is what happens. Data processing is more structured; and in that structure they have a lot of information that the rest of us can use in the format that we need and want.

Centralised and decentralised in the office is remote from the user. I can remember when many of our people, even in my own organisation, hoped that the computer would never come closer than the pay cheque. The impact on the principals and your support people — if you do not like the term "secretaries" — is direct. It is indirect. These are changing. I am giving you a historical difference. I think that those differences get less and less each year. Maybe in another decade they will not be there at all. The principal oriented. The job oriented. Selected applications. All the work. We cannot pull away just document preparation, commonly known as "typing" or "keyboarding", and leave all those other administrative tasks out there, unnoticed. Because there may be a way that we can process the records and the files much more expeditiously than we have been doing.

The time required is from immediate to short, the other schedule. Secretary, clerical, skilled in data processing. I think that the general training there is changing, and it has to change because we are getting more sophistication out there all the time, and rightly so. The data processing, the time element. Do not forget that a few years ago most of us selling office equipment could walk out of your offices in about 45 minutes, two hours max., and I do not think we can do that any longer. If this equipment is going to go, it will take some training on the equipment, the procedures and the methodology, and a re-look at our organisation in order that methods and procedures will not be lost.

Most of you know that the old methods, or systems and procedures association that supported the computer for a number of years, changed its name to systems for management. I wrote an article a few years ago on "Many Ways to go in Designing an Office System", and I started with methods change, procedures change, and finally drawing to a systems change as it relates to all this. I do not think that it is a bad concept, even yet.

Management general but changing. Remember that these are historical. Specific management

in your data processing. The reason I did that chart was because I had to. Some of our customers — rightly so — were asking, "How do you stand with the two camps? What can we do to begin thinking about it?"

Two types of management and staff positions that we all know. You cannot design an office system that is identical for both of these. What you need in your legal department may not be at all what you need in your marketing department or in your personnel department. I think we did not know that for about six or eight years. I did, and so did some of the other systems people. But there was such a quest for something better than a regular typewriter, when the magnetic tape was announced. You have different requirements of these people. The sense of urgency has to be planned in maybe more than just the executive management, maybe functional management. But your project staff have more time and fewer interruptions and they can handle a different type of arrangement to get their work out and meet the expectations of management.

Types of management and staff position

Management	Project staff
Reactive	Specific time frame
Immediate requirement for information	Research time
Multiple positions	Dedicated job
Frequent interruptions	Few interruptions

The communications, the multi-function information processor. There are a number of these on the market. I can share your confusion. I am chairman of CBEMA's office systems standard, which is an international group looking at office standards. We need to, because some of our terminology is worse than our standards. I made some notes in the last two days. We have talked about text, text communication, data, graphics, OEM, mechanisation, office automation, word processing, data processing, office systems, information processing, distributed processing, networking, administrative services, management services, communication, records, telecommunications, facsimile, microfilm and microfiche. I gave up eventually, because I thought that was sufficient to add to the confusion. I think we must put a fence around this, and this is the way that we see the office system. We really feel that the future is in getting this information communicated to and from the sources.

At a telecommunication conference, a year ago, in December, in Los Angeles, a panel of six indicated that they had a lot of power in telecommunications, but getting it transmitted was the problem, and getting a response from what is transmitted is another problem. I believe that. These are simple steps, but I believe that management has to understand what the true concepts of word processing are today — versus a programme that was secretarially oriented in 1965 to 1970 — and structure the system to meet the user's requirements, that is if you do not like the word "principal". The reason we use "principal" is that that term means anyone that needs support in documents or administrative services, including work that comes out of your computer.

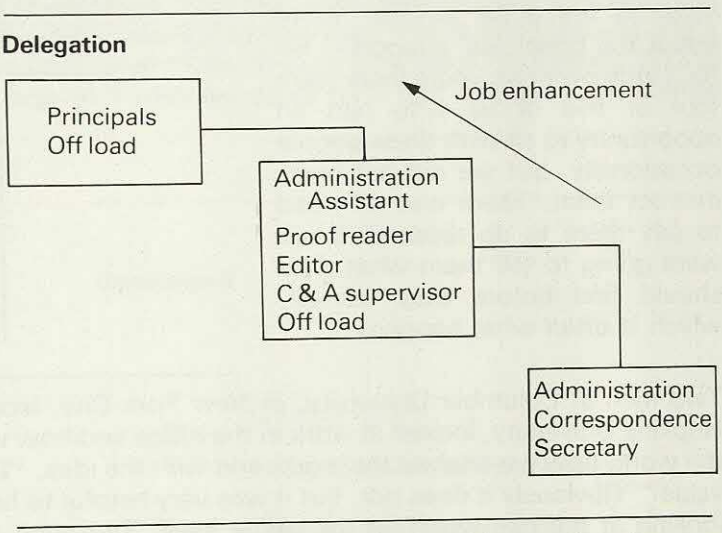
Identify local record application. Identify your communications application and distribution, and install the appropriate equipment. After that is done, then we are not hedging in on technology first. Your people are the most important resource that you have. Look at your present procedures and see what you can do to change them, then buy the equipment that will enable you to accomplish your mission. I do not think that is illogical.

I thought it might be well to define it. This is one that I worked on originally. Eight or nine years

ago, we had the word "concept" for improving. Finally, I decided that we should change this and call it a "program". I have slides, if I am presenting to government, for government communications, or if I am presenting to insurance or banking or education. The more I work with it, the more I think that "effectiveness" should be the strong word there.

If we look at the traditional office, every time we put on a new function, a new manager, we automatically put on a secretary or an administrative person to assist that person. That was not too bad in the US. I can remember working with students out of the university, where they would go to work at $85 to $125 a week, but some of them are going to work now at four, five or six times that figure. It is a little bit different scheme, right out of high school. I cannot tell you the difference in the qualifications of those people today, and the qualifications of the ones that we were paying $125 a week previously.

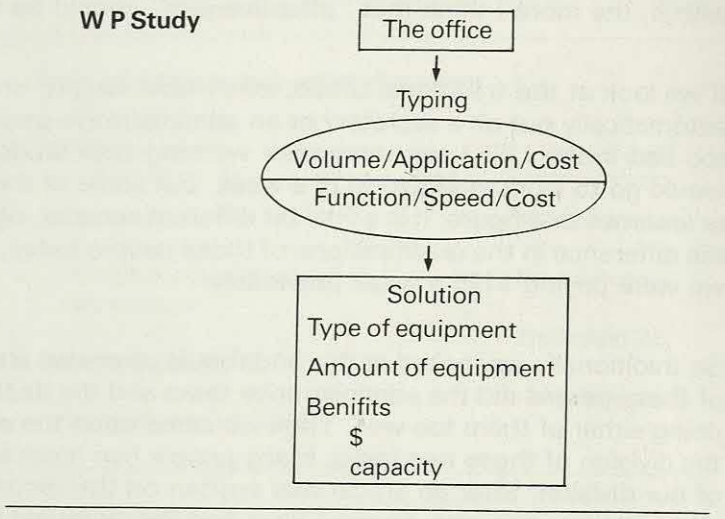
So traditionally we looked at this and that is where we started: we started where we were. Most of those people did the administrative tasks and the document preparation, and had no way of doing either of them too well. Then we came upon the evolution that maybe we should look at the division of those two tasks. Many people had heart attacks. I was called in to the president of our division, after an article was written on the second page of the *New York Times* about eight or nine years ago, saying "Boss and Secretary get Corporate Divorce". My president read that before I saw it. He called me in and asked, "What are we going to do about that?", and I said, "I don't know, I think it's about time." That was not the answer that my president wanted. But we did not do anything about trying to answer it, because the more you fight resistance to change the more you have to explain why you are fighting. This programme has evolved into what I will show you in design in a few minutes.



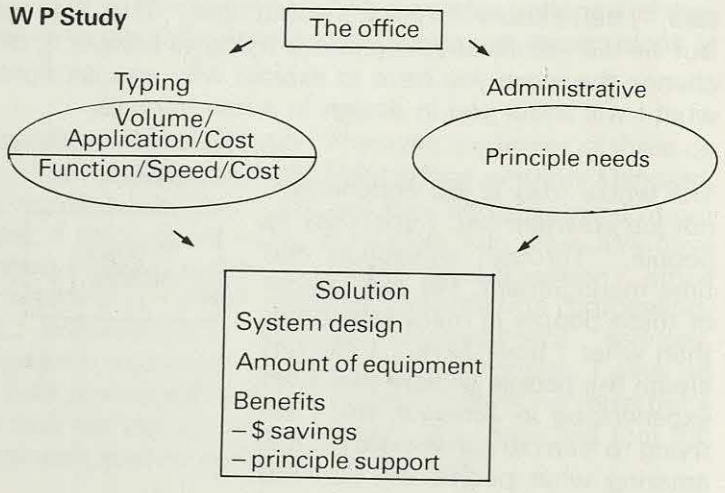
The whole idea is job enrichment, not job enlargement. I often say to people, "Through delegation and time management, we can use all of these people in many jobs other than what I have here." I did not create the people society that I am experiencing in America, but I am trying to learn to survive with it. It is amazing what people will demand today — union or non-union — of management. I guess that I was too fearful to voice that type of strong opinion when I started to work, but today we have a people society and management has to manage those people entirely differently. I am not sure what their expectations are, but I know that they are different from what most of us expected when we went to work. I do not think that we have lost the work ethic, I think that we have lost the courage to give people strong direction and control the activities, and let them know where they stand, both in the job and out of the job.

This thing got so hairy for us that we persuaded our management to go outside and do some research. Here is where we started. We looked at the office. We looked at the volume of typing and the application, the cost, the function, the speed. And the solution, believe it or not, was the type of equipment. We ran on that from 1965 to about 1971 or 1972, and the questions just were not answered because we placed that equipment at random access, and you cannot do that. It was no longer a $500 or $700 typewriter station, it became something else, with the future beginning to look as if it would be even more.

So we persuaded them that we should look at both sides — and that is what I mean about the word "typing", because too many people think that a typist is a copyist, emulating what has already been done with just a few editorial changes. I believe that a good person on a keyboard in document preparation has to be creative and think through the project. Many of those people would rather work on that side of the house in that responsibility than come over and work in the administrative side, where they meet the principal each day. It is amazing. We have never surveyed, through interviewing and talking with people, which type of work they would like best. We have had no difficulty in finding people who prefer to work in document preparation, whether it is in a cluster or in a centre.



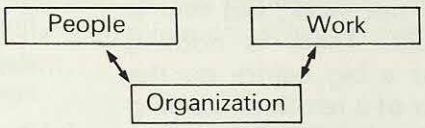
So from our researches, we started saying, "How do we design this system in the office? What is the amount of equipment you need? What is the dollar saving? What about the principals' support?" So for a little over two years there were four or five of us who had an opportunity to sit with these people occasionally, but we did not over-instruct them. There was no need to pay them to do research if we were going to tell them what they should find before they started, which is often what happens.



Two men at Columbia University, in New York City, looked at people. Dr Shepanus at John Hopkins University, looked at work in the office and how we divide that work; how we divide up the work, how we analyse the work; and with the idea, "Does work in the office have the same value?" Obviously it does not, but it was very helpful to have him come back after two years of looking at the real world, in the office itself. Two men from Cornell looked at what type of organisational structure you have to have in order to have a system function in the way it should. Rather than fragmenting our new concept, let us see what we can do to integrate it and build it into something that management will accept and the people participating will accept, without walking out.

I had at that time worked with about 15 large union shops. If they had a union they did not want to disturb it, and if they did not have a union they did not want to get a union. So it just became evident through this research — which was very helpful on the people side — that if you want to you can design any change you want without bringing in the union or the personnel people, but it is not wise to do it. I am a great insister today that the personnel people that are going to classify these jobs, or to take their classifications and make something of them in pay scales and opportunities, have to understand what you are doing in your office systems. That is true in

data processing also. Because what they are not up on, they are down on; they are against any change if they do not understand it. That is true of the union people as well as personnel.



Team A	Team B	Team C
Skills Aptitudes Perceptions Expectations	Who does what What is important What is being done v. what should be done	Design for matching people and tasks

Team A, the people team, looked at skills, aptitudes and perceptions, how people perceive their roles. What are the expectations of these people? Do they want out, or do they want an opportunity to go up, or do they want to sit where they are and take their average advancement in pay, if not in title or opportunity? The work people, who does what, what is important in the office, what is being done versus what should be done, which I think is a very key question. Then team C, design for combining people and work. How do you match them? How do you get them together? What type of organisation will they have an opportunity to be represented in? How do you get those people to move from being dedicated to you and me as support people, to working not for individuals but for the organisation? That is quite a change. The best method of effecting that change.

On the side over here we had a group of industrial engineers and psychologists that went out and looked at 34 installations, some of which were doing very well. Some were limping and a few had even decided to go back to the traditional mode. This all took place from about 1973 to late 1976. It was very interesting and helpful. I wish we could have had this when we started in 1965.

Conclusions

- No single system
- Success dependent on profit match
- Understanding dictates design
- Pertains to all work

It might surprise you when I give you the conclusions of those three groups of researchers that no single system design will meet every function in every organisation. Remember, that basically that is what we had for about six or seven years. Success depends upon the proper match of that work to the needs of the people. Having an understanding of that work through people internally getting involved, right down to your clerical and secretarial staff as well as functional heads, forcing the user to understand what you are trying to get him to do, rather than imposing it upon him, that worked for us much better. It dictates the design. It pertains to all the work and not just to document preparation.

So our researchers came out and said, "You have gone out to improve productivity when very few people understand it and certainly can't define it. You have gone out with the same modes." I am going to show you two polls, one a production profile that they brought back to us, and the other a custom profile. Remember that they gave us the ability to modify produc-

tion and custom. That got us out of the big syndrome of the large centre, with 10 or 15 keyboards. We built a counter in the early stages. We said, "None of you management people talk with anyone because we're headed for 15% more in productivity." It did not work, but that is what we did. There is nothing magic about a big centre on the seventh floor of a ten-floor building and saying to me, "Collins, if you want your work done you'll use that centre." Sometimes it is inconvenient. It is non-responsive and it is also a lot of other things that we found out about it.

Production Profile	**Custom Profile**
Principal work	Support work
Recurring	Non-recurring
Few alternatives to consider	Many alternatives to consider
Predictable	Unpredictable
Similar languages	Diverse languages
Familiar decisions	Diverse decisions
Support work	
Recurring	Non-recurring
Explicit instructions	Ambiguous instructions
Simple minimum re-work	Complex heavy rework
Output quality matches	Output quality matches
Principals instructions	Principals intent
Routine turnaround	Responsive turnaround

If the work is recurring and you have few alternants, and it is predictable, similar language and familiar decisions, you can really expect — and what we are finding in the States is that there is more customised work and the need for it, than there is work that lends itself to high productivity. But if you have that type of environment you can design to it.

Over on the other side, it is non-recurring, few alternants, unpredictable, diverse language and novel decisions. Naturally then your support staff have to have some of those characteristics if you are to survive. Recurring and explicit instructions. That is a hard one to get management to do. Simple minimum rework. But if they understand that you are headed for productivity, and they want it in two hours, four hours, eight hours or two days, or (if it is a long project) in a week, then they have to understand that they have to give more explicit instructions. It is costly. You cannot just say that because I have it stored (even on shared logic or any other way) that I will be able to get as many revisions as I want. I am confident that you cannot have six revisions on some of these documents and survive.

I have spent 20 years in a division which is not that different. I used to think that by the time 15 people had changed it, touched it, smelled it — I wish we had not even thought of getting it out, and sometimes we did not get it out. Have you ever had that experience? It bogs down. That is the real world. I am well into recognising it because you cannot design for higher productivity and then have some supervisor or manager measured on the lack of it if the work does not lend itself to it. Output quality matches that principal's or manager's intent, or that staff person's intent.

Turnaround may vary. If you can live with four hours in a production job, or eight hours, or a week on some projects. Many of our people are beginning to separate the routine work from the project work. I think that is a good separation. Then you can measure how many forms and how many letters. You can measure how many technical papers or rough drafts become finished manuscripts a month later. It makes a big difference in the way that we approach it. Response time on the custom side, maybe 15 minutes. Your procedures than have to match. They require rework in the custom. Input errors are corrected because you are paying management to do things other than the proof reading. If you want high productivity you have to depend on management or their systems out there in the administrative mode to give you some help on it. Set priorities in production have to be first in, first out. Set priorities, very flexible schedule on the other side of the house.

I want to move down to the interaction. I watched that word "minimum" down in interaction

and "vital" on the other side; because if I have a 10-page or a 20-page document that has any of my idiosyncrasies in it — in formatting or whatever — it is much better if I can talk with the supervisor or the person who is going to do it at the time that he gets ready to do it than if I despatch it to a cluster or a centre and hope that it comes back the way I want it. So I believe that those people have to be treated as if they are part of the organisation, and I do not undersell. So "minimum" maybe, but it could be more than minimum. It is vital over here where they are right in there, working with the management.

Maximum use of the equipment and moderate use of the equipment. That does not mean that you would not have any sophisticated equipment in the customised zone or profile, but if you put something sophisticated there and it is used only three hours a day you will know why, and no one will hang you because you have more power there than you need. Usually if you manage it right you will find more use of it when you put it in and build a programme even in a customised environment. The supervisor to improve that secretarial efficiency, and on the other side to improve the principal's effectiveness. I am sure that measurements will become more sophisticated in time.

Treat department A and department B as if they were alike, and man them about the same, even to the same amount of administrative work and document preparation work in each of those functions.

When we started pulling away document preparation or the typing, we left secretaries out here with typewriters in many instances, and created a pecking order which your human factors or personnel people could never understand: that you had to be smarter to be out there with management than if you were over here in the centre. The supervisors had to take the beginners over here. It was very much akin to the old secretarial pool. Many people at this time said to me, "Collins, you people have created a glorified secretarial pool. The only difference is that you've added potted plants and carpeting.". Sometimes that was true, because if we left typewriters out there my work is too confidential in departments A, B and C to send into the document preparation centre; it has to be done at my elbow, which is a bit ridiculous.

If you had a customised environment in A, and a modified custom in B, and a production environment in C, then you staffed differently for each of them. If you need your document preparation and administrative tasks handled near, to be handled in a cluster rather than in a centre; if you need some keyboarding ability in the modified custom, put it there. If you do not need any in the production environment send it to your word processing production centre. You can also from the custom peel off anything over 10 pages, by managing and supervising to it.

Then you have got to offload. We have got to train those people to pull away from management everything that they can do better than most people can do, in order to get them out of the comfort zone, to get them doing what the organisation hired them to do.

I think that it will evolve again. The way that it will converge is acceptance on both sides of the house. We could very easily fragment. I have been listening to your other speakers, and your challenge is not to let it become fragmented but to bring it together in a combined effort. Three years ago the DP staffs would not talk with us, but we did 89 briefings in Dallas last year to Fortune's 500 companies, and 30% to 40% of those people were from the data processing camp. I welcome it, because when we sit down and talk together we have a lot in common. That is what this presentation will try to show in a few minutes.

Understand data processing/word processing similarities. The similarity is that we are all handling some type of information. Discuss the driving forces, and realise the potential of an integrated information system. Certainly you must develop an awareness of the concern that

everyone has for getting that information done economically and, where possible, in a production mode, a higher productivity rate. How and where to start is very significant. The system approach has to be the one to go for.

The elements of a word processing system in my book. These are not all of them, but to whet the appetite they are very similar. Input. Processing throughput. Output storage. Distribution. Documentation. Communications, and anything else you want to add.

The input is a little different, but it has to be compatible with the processing. Let us take a look at word processing. Longhand/shorthand/machine dictation. In 1960, when we went into that business, the market was about 25% sold, and the non-use factor was 75%. My latest calculation of a few industries shows that percentage still holds. But the longhand — you want keyboards where people can type 100 words a minute, can store and fast communicate at so many bits. And then you have longhand going in, where they decipher a keyboard at six words a minute in many instances. I am sure that does not happen in any British company. I am sure that all of you write very plainly.

Chairman of the Board, the president, and the executive vice-president. They have to begin to think about this in a different mode from you people, who realise much of it already.

You remember that I said that in 1964 we started with the tape, and that is the rundown. Shared logic is in the word processing camp today. Some of the minicomputers are. Data processing programmes. I heard a man from a data processing unit that has the office systems and data processing of a major hospital speak at a conference, about a month ago. He said, "You people in your word processing office systems be sure and talk with the data processing manager. If he's as nice as I am, he'll be glad to talk with you." That expresses my feeling that we have no choice but to get together.

The challenge is there. The technology is there for it to evolve. It will take longer than a four-day weekend to get there.

It is amazing if you sit down and take a look at it. I think that the word processing side of the house needs to understand this just the same as data processing and top management.

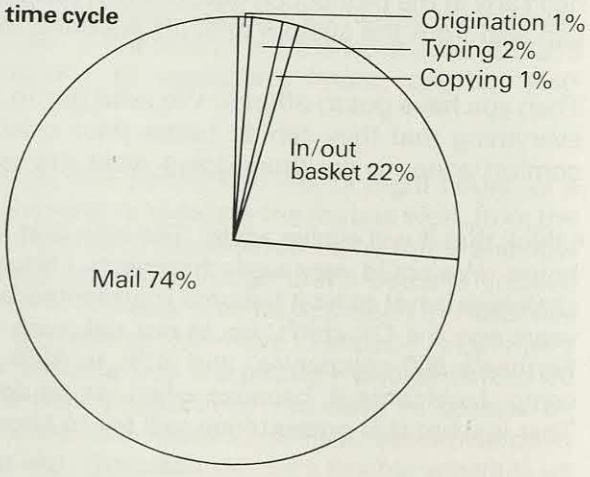
Take a look at the data processing. It is very similar.

Here is one that Exxon did in 1975. A document spends 74% of its time in the mail, 21% in the in/out basket. The two time spans revealed by this survey have to be shortened. The origination is 1%; keyboarding is 3%; copying is 1%.

Notice there is not a complete takeover on either side, it is the merging of the commonalities and similarities that need to be expanded.

I think of word processing as your information base. Certainly you have procedures, and the security of that information has to be considered.

Document time cycle



Take a look at the data processing and the database management. I had a call from a large

company last week, and the head of data processing said, "All of a sudden I realise that you are chairman of the standards committee. Are you doing anything on what we could do to standardise to get to the communication network that we want to have in our multiple locations by 1985 to 1990? We know where we are in data processing, but we have 12 different suppliers bringing in word processing from stand-alone units to shared logic and just about everything else.". That is a good question and I am not sure that I should answer it, but I asked, "Who is doing the procurement of all of your equipment if you want a future match?". That is important. That does not mean that I would give it totally to the director or the manager of administrative services, but I would have representations from whatever your office staff is. If you have all of it, fine. Then you need a group of users and people who are going to be using the equipment, to help you put it together as to what they need. They overlap, nothing is pure. You people are handling a lot of information, but you have a database there that has certainly grown sizable, and a lot of it needs to be used to support the general, day-to-day information that we are all using and needing.

Four stages. You got the six stages today. Maybe I will have to update mine. I am not sure that I will. This is a different rendition of the same report that Mr Robinson gave you earlier. I have lived through the four stages in word processing. I have got all the bruises to show for it, because I was manager of word processing and customer education, which was the installation of the first word processing machines in the States nationally, with about 350 in the field helping me.

We automated manual operations and we tried to place an MTST, Mod 2 at $175 a month, a Mod 4 at $225 a month. I am not in marketing, but when you get those prices drilled into you the way that I did from my management, I do not forget them; because remember we had been spending 45 minutes to two hours on a typewriter installation. Dictation equipment, if we could get people to sit still long enough, maybe an hour or two hours. It was not long, because I had written a course for dictation users — based on organisation, preparation and delivery — that took a minimum of 10 hours, with a back-up training on that within six weeks of another two hours. So we got into all kinds of things. Randomly placing them, application processing and cost savings. Stand-alone device. Then the power typing expansion here, larger typing centres for production. Promises, promises, like the Broadway play. Forced in to users, closer supervision.

Stage 3, addressing that administrative support. That is when we began to go into our research and take a look at it, in late 1973. User oriented with the custom and production in design, rather designing everything in the same way. Records processing, distribution, introduction to EED, higher function equipment. We certainly were not the only manufacturer who was leading to that. I have a lot of sympathy with the user there — 80 different keyboard manufacturers. I understand that you people in the UK have some 70-odd. If you add everybody else up, as we did recently in the standards meeting with users and manufacturers, we counted 105 different manufacturers that are offering something in just the office systems mode. I am not including data processing, just the office systems mode.

The fourth stage is where we are now. Notice that I do not plan a takeover. I think that you have to be sure in today's world that you are not misunderstood, in case your embassy might be closed. But you have got to watch here. This interaction is what I would like to see. Expanded communications capability. Distributed information. Expansion of electronic document distribution for code and non-coded. Multi-function devices. Component parts as hardware/software in the systems design.

I do not plan to carry this into the fifth stage, because I do not know what it will be yet. But I think this is reachable. The driving forces. Business requirements, technology and communications. Communications still at the core of all of it.

SESSION L

CONFERENCE CONCLUSION

David Butler,
Butler Cox & Partners Limited

It falls to me on this occasion to close the conference. I will not attempt a detailed summary of each of the sessions presented, but rather attempt to put what we have heard in the last two days into some kind of context and draw out some of the major lessons which might have emerged during the course of the two days. I want to touch on a number of specific points which I think are of significance and concern, and then try to draw out a single major lesson which I think is of importance.

First, listening to many of the papers during the two days, I was struck with a recollection of a passage from a book that I have been reading recently. It is called *Good as Gold* and is by the world's greatest living novelist, Joseph Heller. It comes from a chapter of the book headed "All change is for the worse". It reads as follows:

> "Gold never doubted that racial discrimination was atrocious, unjust, and despicably cruel and degrading, but he knew in his heart that he much preferred it the old way when he was safe. Things were much better for him when they had been much worse. It was a fact, one that did not touch on the virtue of the situation, but a fact none the less, that many people like himself who had worked and argued for the annihilation of racial prejudice would be those who would be least inconvenienced when they succeeded. Gold himself lived in a building with a doorman and negroes were not numerous in places he went to for the summer. If they had been, he would have gone somewhere else. When he came to realise this, he realised also that he was not just a liar but a hypocrite; a liar he always knew he had been."

All change is for the worse.

We have spent two days talking about the changing role of management services, but the question was not asked whether management services has a future. Perhaps with hindsight it might have been better if we had considered that question right at the beginning of the conference, or is perhaps management services as we now know it going to disappear entirely?

A phrase that came up time and time again during the conference was the expectation of the users and how it is managed. Perhaps there was a major lesson in the conference for us there. It is a phrase that is quite popular now in the United States — "expectation management". That is, the leading of people not to expect more than you really know that you can deliver. I am sure that there is a lesson there for management services function.

Let me give you an example. We talk about the backlog of applications in many installations right now, and we say that we have 50 man years' backlog, or that the projects which are currently awaiting implementation amount to 60 man years' of effort. The implicit message to the user there is that these projects are, sooner or later, going to be implemented. I wonder how often this is not true, that we know in our heart that many of those projects will never be

implemented. It is a bad piece of expectation management to give people the impression that they will be.

We also heard a lot during the course of the conference about attempts to involve the users much more in the process of system design, and to try to find ways of showing systems to the user before they were delivered for operational use. The research that we have been doing recently suggests that there is a big future for what one might call prototype systems, systems that can be knocked up very quickly for the user to look at, to test drive as it were; and then find out whether that is what he wants; react; find it is not what he wants; try again; and keep going until you get something that resembles what he wants, and implement that. In fact one of our clients has set up quite deliberately, in an attempt to move in this direction, what they call a "quick and dirty department"; a department that cuts all the corners, that delivers systems which are not documented and which cannot be maintained, to serve a specific function for a very limited period of time. When I recommended to another of our clients that they might consider doing the same thing they said, "All our systems are like that! What we might consider is setting up a 'slow and clean department!'"

I was also struck by another point, which is the role and outlook of the management services director himself. By a fundamental confusion that I think in many cases lies at the heart of some of our soul searching on these questions, do you know the harshest criticism that it is possible to bring against a management services director, or indeed any of his senior staff? That he is "technically fascinated". That is the harshest thing that you can say, and it was repeated time and time again from this rostrum: do not get absorbed in the technology. I think that is wrong. I think that people working in management services ought to be deeply into the technology; but they ought to be in it at a strategic level, not at a detailed level.

A few years ago, when I started to go regularly to the USA, I was always impressed by how many managers there were there who knew a lot about the technology but at the same time were very good business managers. I think that we are growing the same breed of managers here in Europe now. I think that as long as our interest in technical matters is at the strategic level, it is good, worthy and necessary not to be concerned with details of implementation, but to understand the strategy of the technology is very important.

I should like to introduce my final, detailed point by telling you a little story about one of our colleagues who is not here today. He is our only outside partner in Butler Cox and Partners — Hamish Donaldson — who is also the management services director of Hill Samuel. Hamish invented a game which he had people play on a training course which he had organised. The game consisted of taking pieces of a jigsaw, putting them in plastic bags, handing them out to syndicates on the training course, and asking them to complete the jigsaw. There was one thing that he knew that they did not: all of the syndicates except one had their pieces of jigsaw in random sequence, just put in the bags, and one bag given to each member of the syndicate. One syndicate had their bags given to them in the following way: the jigsaw was completed; one part of it was taken away, broken up into pieces, put into a bag and given to one individual; and another part the same. So one syndicate had their part of the problem handed to them in a highly structured way. They finished first, because each of them puts his pieces on the table, realises that it makes a part of the picture, and then their only problem is fitting the pieces together. So Hamish says, "Now, gentlemen, you understand the importance of having the problem presented to you in a structured fashion."

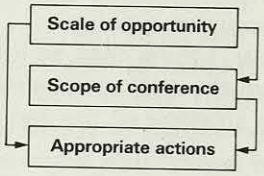
But on the last occasion that Hamish used this technique, it did not work. The people who had the favoured bags took just as long to complete the process as anybody else. When Hamish said to them, "Why did you do it?" they said, "Well, we decided we wanted to see the problem as a whole, so we mixed up all our pieces." A systematic approach to the problem had destroyed their unfair advantage.

Again and again the term "integrated systems" was used, as though our desire for integration meant having everything part of a large, monolithic system, with all the pieces of the jigsaw thrown into one pool. I just wonder whether in fact genuine integration is not more attainable through the use of small systems in a coherent network than by having everything in one large, monolithic system. What I am trying to say is: is a plate of spaghetti integrated, or is it just a muddle? If we really thought about what we mean by integration we might find that integration is easier to achieve with a network of small computers than with one large one.

Let me progress now to my overall view of the conference. I want to say something now which initially may sound like rudeness to our speakers and disloyalty to my colleagues. I want to say that, personally, I found the conference disappointing. If you compare this conference with the one that we held a few months ago at the Rye Town Hilton, in New York, I found it a disappointing one. I was a little bit at a loss to think why I was disappointed. It certainly was not because of the quality of the individual speakers. I felt that all the sessions were good, except perhaps one or two, which is in my view par for the course. Some were really outstanding.

It coalesced in my mind that after the Rye Town Hilton conference I had the feeling that synergy had taken place; that the whole of that conference was much more than the sum of the parts. I have a feeling that at this conference negative synergy has taken place; that the whole has been somewhat less than the sum of the parts. If I am right, I should like to explore with you why that might be so.

It seems to me that we ought to concern ourselves with three things as far as the current situation of the management services department is concerned. First, the scale of the opportunity open to the management services department. Second, the scope of this conference, the subjects that it has embraced. Thirdly, appropriate actions stemming from an understanding of the opportunity and an examination of the subjects of the conference. If we get all those things right, we are in a position to benefit greatly.



There is a linkage between the scale of the opportunity and the scope of the conference. Did the scope of the conference match up to the scale of the opportunity? I would say not quite, but fairly nearly.

What appropriate actions would stem from the scope of the conference? Forgive me if I say not all that many. It is not clear to me what you people should go back to your offices and do differently than you would have done before. If you look at the big link between the scale of opportunity and the appropriate action, then I see almost a complete vacuum. The scale of the opportunity, in my view, is absolutely staggering. We have a situation where we all agree that the price of the technology is tumbling; the price of the people is increasing. We are now finding it relatively easy to implement systems compared with the past. Our bosses are aware of what is possible and are asking for more and more, and we are sitting around here, discussing in the main how awfully difficult everything has been in the past.

If we carry on — and I am talking not just about the people in this room but everybody concerned with information systems — with this obsession with the past and how difficult everything has been, at a point in our history when everything is changing in our favour, then

I promise you that we will be swept away by the tide of history. A new generation of managers is coming into businesses now with, as somebody said to me, terminals under their arms, saying "Where do I plug these in?" Unless we can find a way to bring service to managers like that, I fear that history will sweep us away.

What is the appropriate action that we should consider when we leave this conference? Let me nominate to you some of the sacred cows that I think we ought to be prepared to lead, blinking, out of the barn, into the sunlight, and see whether or not they deserve slaughtering.

We all agree that we do not want a revolution in information systems. As usual, when we all agree on something, it is highly suspect. We all say, "We can't change our systems quickly because we've spent too much money on creating them and we can't throw them away." I worked out what it would mean to an individual if he had spent as much of his money on systems as most of your companies have. An individual earning £15,000 a year would have spent about £6 a week on systems for the past few years. If, for those £6 a week, he had produced a lot of systems that he decided that he did not particularly like and would like to build new ones, then I suspect that, earning £15,000 a year and spending £6 a week, he would not have much hesitation in writing off that investment as fast as he conveniently could. Yet we persist with the belief and the conviction that we have spent far too much on systems in the past quickly to write them off.

May I ask you to cast your minds back to the early 1960s when we were thinking about our first teleprocessing systems. The first sales order entry; the first parts ordering systems. I can remember submitting a proposal to a client that was about 100 pages thick, saying, "If you want to implement this sales order processing system, you will be advancing the cause of human knowledge." They were going to advance the cause of human knowledge by carrying out a sales order teleprocessing application. This was before the days of CICS and all the rest. It required a great deal of courage to do that in those days, but we do it every month now and think nothing of it. I just wonder whether in fact the principal obstacle to creating new systems now to replace the ones that we have is not just the confidence to do it.

Let me offer, for what they are worth, my own conclusions; my variant on Gresham's Law that the bad drives out the good is that perhaps we are in danger that the bad experiences of the past are driving out the good possibilities for the future. Maybe we are in a situation where we are all so obsessed with the difficulties of the past that we do not recognise the fundamental change, both in our current situation and in the possibilities for the future. If that is true, unless we can decontaminate ourselves fast a generation of managers will come along that did not have that traumatic experience in the past and who are too ignorant to fail.

Conclusions

Butler's variant on Gresham's law

The dangers of daring too little

The indispensable albatross

A platform for the future

Secondly, it seems to me that we are in a situation where we are facing the dangers of daring too little. We always talk about the dangers of a revolutionary approach, of throwing all the pieces up in the air and seeing where they come down. It seems to me that, given that manufacturers are trying to sell direct to end users, and that end users are having their appetites whetted, the dangers of being too conservative, of being too ready to say

"That didn't work last time we tried it and we're not prepared to try it again" are being underestimated.

Thirdly, the indispensable (or *is* it indispensable?) albatross that we wear around our neck in the shape of last year's systems, or the last generation of systems. We had the most vivid illustration of that at this conference in the last speaker, Mil Collins. I believe — and I said this to Mil the other day and I saw an expression of horror pass across his face — that if it were not for the data processing division of IBM, the office processing division of IBM could offer us the kind of networks that we need very soon. They cannot because they have this commitment to things like SNA, which they cannot just jettison. However, that is their problem. I wonder, when the pleasant fellow said to the Ancient Mariner, "Let me take that albatross off your neck so that you can live a normal life again", whether the Ancient Mariner said, "Ah, but what are you going to put in its place?" I doubt if he did. The evidence coming to us from our clients is that it is possible to replace existing systems very fast, very efficiently, and at a fraction of the prior cost.

If it is, and if those three conclusions are anything like valid, then I suggest that by adopting a rather more aggressive approach to the problems which we have discussed in the past couple of days, we might create a platform for the future which is more solid and more promising than that which we currently enjoy.

Let me leave you with an example which illustrates perhaps what I am talking about.

A few years ago I sent one of our consultants off to the United States to see what was happening in the field of distributed processing. He toured around all the normal installations in the USA, in all the major centres; and, to be honest, it was all fairly humdrum, everybody doing the same kind of thing, the usual confusion of tenses: "We have implemented such and such a system next year."

Then one day, he found himself visiting a medium size wholesaling company, out in the middle of North Carolina. Somebody had told him that something interesting was going on in this place. He went in and he saw the most amazing system that he could possibly have imagined. I will not describe it to you because it is a little bit old hat now, but at that time it was a revolutionary system of minicomputers, all talking to each other, load sharing, message switching — you name it, they were doing it, and all under pretty good control. I invited the manager of that installation to come across to Europe, in 1968, and he gave a presentation which was absolutely spellbinding to a European audience. The first question that he was asked afterwards was, "How did you come to implement such an advanced system?" He flicked back through his slides and pointed to where he was, geographically, in the United States, which was a long way from any real centre of expertise. He said, "We were so dumb and so ignorant that nobody told us it was impossible." I wonder whether we do not need some more dumb, ignorant people doing things that the rest of us all assume to have been impossible.

In the sense that I said that I found this conference a little disappointing, it is that sense that I feel we are all somewhat over-cautious, over-conservative, over-protective of what we have, not prepared to run the risks to realise the real potential of information systems in an era of high inflation, scarce resources, pressure on revenues and margins, which I think is there to be realised. However, let me say it before you say it: I am just an adviser and you actually have to do it. But for what it is worth, that is my assessment of the somewhat muted response at this conference.

I should like to thank all our speakers for their contribution to this conference. I should like to thank the hotel management and staff. Once they got their act together and really began to operate, I think they did us reasonably well. I hope that we shall see as many of you as possible at our next management conference for which, as I said earlier, we are obliged to ask you to make the tiring and arduous journey to Venice. I should like to thank you, on behalf of all the speakers, for your attention, your questions and comments. Ladies and gentlemen, thank you very much.

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The Butler Cox Foundation

Butler Cox & Partners Limited
Morley House, 26-30 Holborn Viaduct, London EC1A 2BP
Tel 01-583 9381, Telex 8813717-GARFLD

SISDOCONSULT
20123 Milano – Via Caradosso 7 – Italy
Tel 86.53.55/87.62.27

Akzo Systems B.V.
Velperweg 76, Arnhem, The Netherlands
Tel 85-662629

Butler Cox & Partners Limited
216 Cooper Center, Pennsauken, New Jersey 08109, USA
Tel (609) 665 3210

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