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Research & Development Use of Computers in the N.H.S

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RESEARCH & DEVELOPMENT USE OF COMPUTERS IN THE NHS

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For the purpose of this document it is necessary for me to define what I mean by Research and Development Computing in the National Health Service.

Computing in the NHS is very much in its infancy especially as regards helping with patient care and to date has been tried at few user locations. Thus the further initial uses of computers employing either new methods, (real time, terminal based transaction processing, distributed intelligence, linked mini-computers, microprocessors) or older methods (batch processing, remote data capture) in new locations (hospitals, health centres, other departments) must initially come under the umbrella of Reasearch and/or Development. With the advances being made in computer technology, the rapidly decreasing hardware price versus performance and the emergence of more sophisticated software on both large and small machines the research element must be considered to cover this area at all levels as it affects the potential for practical implementation within the NHS.

1. THE ROLE OF COMPUTER RESEARCH & DEVELOPMENT IN THE NHS

There are two main categories of computer Research and Development. The first concerns new computer hardware and software and the second the use of existing hardware and software in new areas or applications. The latter must be considered as the prime role for any NHS Research and Development programme but complete divorce from the former is difficult because of the speed with which new developments take place and the time scales involved in developing widely acceptable new applications. It is in this latter area however where changes to the organisation of the NHS are likely to be necessary before the full benefits are realisable and for this reason they must initially be classed as part of a research programme. Once proven they can move into a development stage and be subject to agreed rules and procedures for an appropriate extension.

At present computing in the NHS is divided itself into two rather distinct categories. The first involves RHA computing concerned primarily with financial and HAA batch applications the second involves the DHSS experimental real time terminal based projects and the other smaller projects using computing aids in the areas of patient care and administration.

RHA computing is still largely based on well tried batch techniques which are gradually proving inadequate for the tasks undertaken. Exploiting alternative techniques, especially in the areas of data collection and validation, (for payroll and HAA), is thus one example of where RHA computing will need to perform some R&D activity to continue with an adequate service in its own sphere of operation.

Patient Care and Administrative computer aided systems largely performed on the non-RHA computers are still in their infancy but when accepted as valuable will be the natural area for any extensive future expansion of computing in the NHS. Both types of R&D computing will be necessary since new application areas are likely to be explored and they, along with the earlier application areas, may need new or different techniques applied to them.

Wherever possible the development of hardware and software should be left to the computer manufacturers. However the NHS has its own problems particularly where terminals are concerned and if it wishes to influence the design of equipment or ways in which it should be used via software then it cannot afford to wait until the manufacturer has completed his work outside the NHS environment. Cooperation between the NHS and the manufacturer is obviously one way in which R&D should be pursued. Since the NHS will in the future be a sufficiently major user of computer equipment it should be able to force a more helpful attitude from the suppliers.

There is useful R&D computer work to be undertaken in the NHS and one must further examine at what level in the NHS the work should take place and how it should be funded. Three possibilities are obvious. Work can be of National, Regional or Area/District interest. The more exploratory the nature of the work the better the case for National funding, the closer it becomes to having proven operational benefits the better the case for Area/District funding. In using newer methods to solve some of the old problems then a clear case can be made for Regional funding.

For some time to come developments in patient care computing are unlikely to be ready for Nation wide acceptance. Until this point is reached some National funding would seem most appropriate. Systems which have been running for some years and which have received wider support would seem to be candidates for more local funding with any future development coming from Regional or National R&D funds.

A small percentage element of National funding should be devoted to working with the manufacturers on the design and implementation of hardware and software suitable for wide implementation in the NHS.

Whatever form of funding is felt to be appropriate it should be recognised from the outset that, as with all R&D expenditure, some significant proportion of the total money spent at the development site will not be recoverable in cash terms from there alone. This applies both to successful and unsuccessful implementations. The latter will occur in any R&D programme and the former will lead to overall cash benefits only when the systems are implemented at more than the initial exploratory site.

The NHS already has a number of suitable locations from which to launch an R&D programme for the future. In many cases R&D can only be successfully carried out by those who are not too close to the day to day operational requirements. The ability to sit back and review the overall scene is important if new developments are to bring maximum rewards. User defined needs must be critically examined and should not be the only criteria used in defining a future R&D programme. It must be recognised that we are currently dealing with largely naive computer users in the NHS and other input is necessary for the long term development of systems. Within the RHA computer centres and the experimental projects there already exists a wealth of unique knowledge of the NHS and computing which should be exploited in any future R&D programme.

Section 2 gives recommendations for a future programme of R&D whilst the remainder of the paper gives some supporting evidence.

2. RECOMMENDATIONS

a) R&D should be given proper recognition and status within the NHS.

b) Existing R&D projects should be encouraged to exploit their equipment, manpower and unique knowledge.

c) A programme of education should be undertaken (using R&D funds) to educate the potential users of computers in the NHS about the possibilities.

d) The existing personnel in the NHS with computer experience should be encouraged to develope their ideas on new equipment.

e) The future R&D programme should not be constrained simply by the lack of funds available for today.

f) Greater exchange should take place between those with operational experience and those with administrative and executive power.

g) In evaluating the R&D programme it must be accepted that monetary benefits will not be achieved at the primary site alone and in some areas not at all.

h) The NHS should collaborate closely with computer manufacturers to make the best use of existing equipment and influence the design of future equipment.

i) A second phase of R&D using the lessons learnt in the present phase should be undertaken but development on a wider scale should be approached with caution until this next phase was producing positive results.

j) There should be a clear intention from the outset to apply successful systems on a wider basis.

k) Greater importance should be given to computer assistance in the primary care area and methods of funding it should be reviewed.

l) Renewed support should be given to how information can be transferred from one location to another when patients move. (Linked via FPC registers).

m) Further linking of systems producing a much more integrated approach should be explored using modern techniques.

n) There should be a single executive computer committee charged with overall planning and the R&D programme and it should be constituted so as to involve some members with practical experience on a rotating basis.

o) Working parties or sub-committees supporting the executive committee should be composed mainly of those affected by the decisions and recommendations made.

p) Staff employed on Research and Development should have the same job security as others in the NHS.

3. CURRENT COMPUTING R&D PROGRAMME

a) History

The majority of the Research work within the NHS is felt to reside within the DHSS experimental programme and the smaller regional, area or district supported projects. Whilst this is true for the patient orientated systems which have been evolving for only some eight years there has been a much longer development period for the RHA commercial systems. By comparison with outside commercial organisations development over the past twenty years has been rather slow and unimaginative. It is only in the past few years however that some attempt has been made to write more widely acceptable standard batch systems for the regions to use. Some regional authorities are already preparing for or undergoing their third change of main frame computer equipment and are experiencing the problems of keeping up with the fast changing computer technology, at the same time as a continually varying DHSS policy for computing.

In the more closely defined areas of commercial application, where the NHS is less different from other outside organisations, no proper account has been taken to date of the development effort so far and progress has been slow. In the patient care areas where the definitions are less clear work is still in its infancy but the results are being evaluated more stringently and replication/transferability is expected to be achieved in a much shorter time scale (~5 years). Whilst the evaluation is very proper the expectation that, in this more difficult field, the returns should be seen more rapidly is not. Research and Development is seen to relate more closely to the patient care systems and only because the costs have been more clearly defined and evaluation uniquely accepted as part of the programme does the anomaly arise.

The 'experimental' programme was first set up in the belief that computers could and would be of assistance in the areas associated with patient care. There was no obvious choice of hardware or software so a variety of manufacturers and methods were to be investigated. Enthusiastic support from the NHS which was largely (and still is) unaware of computer potential was also a necessary ingredient. This enthusiasm was found in various locations and formed the basis of the proposals for a number of large scale projects. The size and scope of the projects were at that time thought to be correct although with hindsight a different approach might have been adopted.

The problems of introducing new ideas and techniques within the NHS were underestimated and the complex nature of the work undertaken in the NHS required extensive design and planning before systems acceptable to the users could be implemented. Once the users began to see the advantages of the computerised systems then the demands grew but the limited resources devoted to new Research and Development work could not always satisfy those demands.

The novel nature of the experiments which were largely tackling unexplored fields attracted the attention of most organisations within the DHSS and NHS concerned with expenditure and policy. Since the programme was clearly defined as Research and Development it was felt to be 'fair game' by all to delay, reappraise or redirect the overall programme. Other developments not so obviously identified or spread over many more smaller projects did not come in for the same degree of scrutiny.

Now that the 'experimental' programme has come to the situation where its future is in considerable doubt economic pressures alone are largely being used to decide its longer term future. The concepts of integration of patient records, ready availability of information at the right place at the right time (which still appear to be correct in concept and have been shown to work in practice where they have been introduced) are being sacrificed to short term financial constraint. The easy way out is to assume on very little evidence, that large integrated systems are unacceptable and the only way ahead is with small dedicated machines. It is ironic that the experimental programme itself in some respects has gone a complete circle since its inception in 1968/69. Initial proposals were made by some projects for small scale experimentation on limited systems but these were rejected in favour of pursuing the large scale projects.

b) Development

Rightly or wrongly projects have been set up in an 'experimental' mode to pursue research activities not carried out elsewhere in the NHS. Whilst described as 'experimental' the objective of the most successful has always been to provide operational systems replacing and enhancing those already in existence and in this sense at least locally they have moved out of an experimental phase. These projects are consuming a trivial amount of NHS resource when compared to the total expenditure. They are however providing a knowledge and expertise to the NHS which is unlikely to be achieved elsewhere. Equipment is available and can be exploited further in the short term by the staff employed at the projects. The long term is marred only by the cost of replacing the large central computer without disrupting the service to local users.

Two obvious paths are open apart from that of closing the projects completely. The first rests largely on changing the method of financing large scale R&D expenditure in the NHS. It would require modification of the present rules and procedures so that sums of ~£2M can be realised in one financial year but paid off over several. In this way the large computer solution can be pursued and the benefits of more integration achieved.

The second would be to pursue the more successful aspects of the projects using smaller computer complexes. Initially the capital expenditure in terms of equipment would be smaller but a new phase of R&D would be necessary to transfer the sub-systems to these smaller computers. The longer term benefits of integration would then have to be achieved by the linking of these subsystems - or at least their respective data-bases - via computer to computer links. If phase 1 patient orientated R&D is considered to be the present experimental programme then this new stage would be phase 2 and transferability would not take place until at least phase 3. Some of phase 2 and possibly phase 3 would need to be carried in parallel with the current phase 1.

If a new phase 2 were to be considered then some reappraisal not only of operational systems but those under development and perhaps those not yet being developed would be necessary before proceeding. To avoid unnecessary duplication of effort central control of phase 2 would be necessary and from the experience of phase 1 better inter-project communication should be an objective from the outset.

c) Lessons to be learnt

It is easy with hindsight to go back over the history of the 'experimental' computer programme in the NHS and point out the mistakes. Some obvious examples are:-

i) Projects conceived individually in the main with too little emphasis on a National plan.

ii) Too much duplication.

iii) Too much secrecy because of competition for inadequate financial resources.

iv) Too many delays.

v) Objectives changed part way through programme.

vi) Programme not sufficiently flexible to react quickly to changing circumstances.

vii) Too many projects for the money available.

viii) Techniques not as advanced as necessary for use in the NHS thus too much emphasis necessary on hardware and software research.

ix) Hardware purchasing policy somewhat ambiguous.

All the above contributed to a longer and more expensive programme than was originally conceived but nevertheless an expertise has been created which should stand the NHS in good stead for any future programme.

In early sections it has been suggested that R&D can be of value at all levels within the NHS structure. In the more exploratory areas some degree of National funding and control will be necessary, but at the lower levels sight must not be lost of the essential cooperation and exchange of ideas between the sites chosen.

Little attempt was made initially to gauge reaction to ideas outside the immediate locality. This has led naturally to the situation where local users are enthusiastic about the computer systems implemented but those outside this immediate sphere of influence have little knowledge of what is being achieved or, and perhaps more importantly, what is possible. When asked if they would like a computer system their natural reaction, to something they do not fully comprehend, is no. An important stage before any future developments are undertaken is to make the NHS generally more aware of what is possible thus sparking off a more imaginative approach. Whilst not strictly Research and Development, perhaps more general education and computer systems appreciation work, this could lie within its overall funding.

In addition to writing about and showing the projects to various interested parties other methods should be considered to 'educate' the NHS in general to the uses to which computers can be put in the NHS. Investment in film making, the provision of terminals and modems that could be linked to existing systems from any part of the country would help spread the knowledge of systems and as a result obtain a more informed response to the question "would you like a computer system?" We must not be afraid to ask the question even if the reply might be yes and we cannot afford it at present.

The overall programme of future development should be looked at in the context of the new ideas in the NHS. Following various government papers, the Court Report, Regional Strategic Plans, and other documents emphasis would appear to be placed more dominantly in the community sector lying outside the acute hospital sphere. The existing programme does not nearly reflect this trend and thus cannot hope to help solve many of the problems presented in the future. The DHSS currently has no rules for the funding of computers used to assist primary care and any extension to facilities within the community will require this situation to be remedied.

4. FUTURE ACTIVITIES

a) Replication/Extension

Most of the major projects have systems implemented which are recognised by the users as beneficial in a variety of ways. These projects have already uncovered an increased demand for services at their own sites not included in their original proposals. Some have already extended the scope of their influence beyond the units initially defined in the systems study report. Those projects which are still some way from full completion of their programme are still underutilising their total computer capacity but are not yet in a position to replicate or extend.

Because of the recent dominant role that financial stringency has been playing generally in the NHS and specifically in the R&D field, pressure is being brought to bear to show early replication or extension capabilities. With a few exceptions the R&D patient care systems are only ready for that type of expansion at the original sites and on the original computer equipment. Before wider use of the systems is contemplated the experience gained from the past five years exploratory work should be used to improve the basic systems and make replication far more beneficial. In no other sphere of research does the first prototype model become the production model.

If the present financial commitment to direct patient care systems cannot be extended to new sites and environments the continued funding of the present projects needs to be reconsidered. The properly apportioned operational costs of the services provided should be met locally but the larger sums involved in developing the existing systems and undertaking new research should remain as Regionally or Nationally funded.

b) Transferability/Standardisation

The points raised about replication and extension can also be applied to transferability and standardisation. However there are some additional questions:

i) What should be transferred and how?

ii) What should be standardised and what does standardisation mean?

iii) To what should standardisation and transferability apply?

A number of systems both at RHA and 'experimental' projects have proven to be valuable in their own environment. Little transfer of these systems has yet taken place between parts of the NHS organisation administered by different teams. With each unit convinced that it must perform its duties in its own unique way transfer will be made more difficult. Additionally the NHS itself does not know what exists and how it could be used and sufficient resource has never been provided to tackle the transfer in a sensible fashion. Most computer departments have the resources supplied to design and implement the initial system but none to aid with its transferability. Documentation is usually available at a level to enable the creator to use and amend the systems but not at the level required by outside organisations to implement or maintain them.

Without some further concentrated activity of a development and educational nature the answer to 'What should be transferred and how' cannot be given.

An initial attempt at standardisation of National systems has been started by the DHSS in collaboration with the RHA computer departments. This has largely been undertaken in conjunction with a standardised hardware purchasing policy which is already suspect in that not all RHA's have the standard hardware (and one at least may never get it). Little practical results of the standardisation policy are yet to be seen in respect of the 'well tried' regional systems and almost none in the newer patient care systems.

The patient care systems investigated by the experimental projects are themselves covering a variety of techniques on a variety of computer equipment. It is thus not surprising that in such a short timescale the NHS has no clear view as to how it should standardise or transfer the systems developed. This should not be seen as a failure of the programme but just as a necessary phase in a long term plan. If the NHS is convinced that it must standardise in future on common hardware then this fact should be borne in mind when the next phase of development is tackled.

Again the NHS must be informed in more detail as to what is possible and practical before it can be expected to answer the question 'what should be standardised'.

Despite reorganisation of the NHS there still remains within it a large degree of flexibility which enables individual units to operate in their own way under a general policy but with widely differing effectiveness. Unless some significant changes to this situation are going to be made this flexibility must be reflected in any computer system to be transferred or standardised. Complete computer systems which are to be transferred in their entirety must therefore have this flexibility built into them from the outset or they must be so attractive that potential users will change their practices in order to acquire them.

If working systems are to be transferred and standardised, then some considerable further effort must be devoted to the full documentation and the on-going maintenance of both documentation and software. If this level of effort is not available then transfer of ideas and concepts should be considered with the local organisation adapting these for their own configuration in line with their own local plans.

More effort should be devoted to the problems of transferring the information provided by systems without necessarily transferring the system itself. Many of the existing systems would operate satisfactorily if the data pertaining to patients in one location and on one computer system could be transferred easily when the patient moves.

Before answering the third question 'to what should standardisation and transferability apply' we must solve the problems of flexibility and data transfer.

c) New Applications

Over the development periods for both conventional RHA computing and the 'experimental' programme problems within the NHS have changed.

Greater financial constraints have produced the need for improved financial control systems and the realisation that planning, manpower and resource utilisation are so intimately connected as to be part of the same integrated system. These problems are being tackled in a development programme utilising more modern techniques and based on the experience of the past.

Patient care systems are emerging from a programme conceived in the late sixties but have not yet established themselves as an accepted part of the NHS. Many ideas in the original programme have been tested and some have been shown to be more successful than others. Some early ideas have been dropped and others modified in the light of practical experience. Others have not yet been tried and the full potential of exploiting the early, necessary but least beneficial systems, has not yet been fully realised. (eg Hospital registration systems not yet linked to clinical information). Fully integrated patient care systems whilst accepted by all as desirable have yet to be proven cost effective. Since the NHS is primarily set up to serve the needs of the patients (rather than the employees) it must be in the area of patient care systems that most benefit is to be achieved in the long term. In section 3c reference was made to the changing patterns of patient care that have been recommended for the NHS and full account must be taken of this in any future programme.

The patient care computer programme concentrated much of its activities in the area of hospital administration. Only very limited research and development has taken place in the clinical areas inside and outside the hospital and new application research and development in this area would seem necessary before a long term plan for wider implementation of systems can be embarked upon. Given the new emphasis on community care and the best possible use of scarce resources considerable benefits would appear to be more certain in this area.

New applications should be chosen both for short and long term benefits. They should be developed on the most appropriate equipment available, using existing resources wherever possible, but not constrained completely by the present inflexible attitudes to computing. Resources must be shared to get the maximum benefit using the minimum of scarce resources.

d) New Approaches

Several different computer techniques are already under development in the NHS. (eg Interactive systems, large multi-purpose computers, small dedicated computers, marked sense readers, optical character readers etc.) More research of this nature is likely in the future especially with the growth of more sophisticated (but easy to use) terminal equipment. Terminal based systems are liked by the present users and would seem to commend themselves to others having the virtue of data entered, sent back and checked by the originator in his own location. Improved methods of communicating directly with the computer will need to be explored if the NHS is to influence manufacturers in subsequent design.

One attitude to research and development within the NHS is that it should only be undertaken when the 'need' has been defined by the potential users. Whilst a small proportion of research can be done in this way most research is carried out by individuals or teams who are able to look at overall problems and without the day to day commitments. This does not mean that the full cooperation of the users is not necessary or desirable but only that seeing possible solutions in their widest context is vital. Existing project teams, have largely been built up from staff initially outside the service so they can more easily have an objective view and are likely therefore to produce systems of greater depth and effect. Supplemented by a few key personnel from within the NHS they would easily form the spearhead for a further research and development programme.

The systems developed to date in the NHS have concentrated very significantly on large main frame computers. The small machines have been used mainly in service department areas and little or no attempt has been made (or found practical to date) to coordinate the activities. The linking that has been attempted, with some success, is that of the small machine linked directly to the large main frame. If this situation is to change and more linking and integration is to take place some considerable direction of effort will be necessary at Regional/National level.

A number of systems have been developed using batch techniques and these are expected to become National Standards. Part of the Research and Development programme should be to review these established techniques to ascertain whether newer approaches to them might not be more appropriate and cost effective for long term development.

5. APPROACH TO HEALTH CARE COMPUTING IN NHS

a) Large Central Main Frames

Certain applications lend themselves naturally to the concept of the large central machine. Regional based systems already running satisfactorily on this basis are perhaps the obvious example. Their impact on the users would be greater if easier entry and access to the information held were possible and this should be supplied in the future by the introduction of terminal systems and the wider use of microfiche or microfilm.

Apart from one or two smaller scale experiments and one major experiment the patient care projects have been attempted on the concept of the large central main frame. From the outset they planned terminal based communications systems and in most cases some form of integrated patient record. The latter has usually led to a relatively large data base which can easily get unmanageable if the size of the population grows beyond that originally conceived (District or Area). Growth beyond the population size originally conceived on the single machine would therefore seem unlikely and unprofitable to pursue. A case for larger and possibly more economic units can be made if this automatically brings with it extra resilience.

Both types of system based on the large central computer suffer from having only one central module (CPU, core, discs etc) with the terminal based interactive systems suffering more than the conventional batch systems. Two possible solutions are:-

i) Duplicate central equipment, as is done in most real time terminal based systems outside the NHS, using the spare capacity for other non time-critical applications.

ii) Decentralise from the one large machine and have several smaller machines at the same location each with appropriate users and access to the database.

Economic viability of the large machine concept can only be practical if most of the capacity of the machine is usable. Evaluation of the present patient care systems (and the RHA systems if it were done) is made more difficult because this is not generally the case. Some considerable allowance for spare capacity must be made in estimating real costs. Using the full capacity of a newly installed large machine within a short time scale will only be possible if many systems can be transferred and implemented without difficulties.

The spare capacity on a large machine can of course be used for development and this is a course to be recommended for those computers which already exist and which are not yet fully committed.

Decentralising the large computer's facilities has some advantages but can provide problems. If the decentralisation means installing smaller units in different locations operating and maintenance will be more difficult. Breaking the large unit down into small sub-sections is however quite possible whilst maintaining the advantages of centralisation regarding operating, maintenance and development. Each unit could be organised to handle an appropriate sized database via terminals with the linking for regional or national purposes being done in batch mode. The breaking down of the large system into its smaller sub-sections would need to be done with care so that the advantages of integration of systems were not lost.

With this approach the initial capital costs would be smaller, the central complex would be more easily used to its full capacity and separate machines could be made available for new developments. Providing control was under one management body transferability and integration should both be soluble problems.

b) Dedicated Mini Computers

In the previous section decentralisation of the large main frames has been postulated as a feasible way ahead for NHS computing. This may be achieved by using mini computers although the essential difference between mini and large mainframes lies in the areas of data storage and peripherals. Once a mini requires significant magnetic storage media and air conditioning facilities it suffers many of the problems associated in the past with large main frames.

Dedicated minis are already in use in many pathology laboratories, radiotherapy departments, ECG and EEG departments. They have been installed largely to satisfy a local need and little attempt has been made to produce generally acceptable packages. Very often they have been installed to help cope with a larger throughput or output without any question as to the significance or value of the results. More is not necessarily better! At present little is known about the spare capacity on these minis which might be used for other applications. The fact that many systems exist with duplication of effort and little coordination should be a stern warning for the future potential haphazard growth of computing in the NHS via dedicated mini computers.

The large 'experimental' projects working with substantial main frame computers have all been subject to evaluation on an application by application basis. Because of this philosophy many people outside the immediate projects environment are looking for 'best buys' and ways in which they could put these 'best buys' on to alternative dedicated machines. The present NHS organisation will not be able to prevent this development so any future R&D programme should recognise and evaluate it fully. From both a systems and an economic viewpoint the use of dedicated mini computers arising from the present experimental programme should be treated with extreme caution.

If certain aspects of the programme are to be pursued on alternative equipment then a reappraisal of the objectives of the system should be made before proceeding. Those parts of the design which are essential should be separated from those which are just desirable and those not achievable at all because of limitations to, say, hardware or software. Present users and existing systems and programming staff are in the best position to provide this breakdown for new or potential users.

Having reestablished the objectives and priorities then some R&D investment will be necessary to implement them on the new range of equipment chosen. Depending on the scale of the activity this should be funded Nationally, Regionally or by Area. Whatever the appropriate level chosen coordination of this activity with others of a similar nature will be essential. The work would in addition need to be linked to any new research going on in NHS as outlined in sections 4c and 4d.

If not carefully coordinated the use of mini computers in the NHS could have a much larger effect on the wastage of resources than concentration on larger main frame solutions. The latter force some form of management structure and control but the former can be built up to consume similar resources without the same control.

c) Linked Systems

The concept of the fully integrated system based on a large main frame at one end of the spectrum and the (many) dedicated mini computers doing simpler individual tasks at the other end of the spectrum can be drawn together if linkable systems are designed. Linkable systems, based individually on mini computers, can give the same benefits as the fully integrated main frame solutions only if this objective is designed in from the start and some common management structure and control is adopted.

Computer systems can be linked in two ways:-

i) Via their data which can be transferred on magnetic media.

ii) Physically linked by direct connection.

The former needs careful specification of the data and routines to dump the information on one machine in a form that can be read by the second. Different internal structures for both hardware and software on various computers could be overcome on this way provided the data interface was clearly defined.

The direct linking of computers can either be permanent or via dial up telephone lines. In addition to defining the data base clearly extra effort must be devoted to writing communications software and producing the appropriate hardware interfaces. Unless the NHS were to standardise on one manufacturer for its small computers this is a task which is probably best left to the manufacturers although the NHS should influence the developments.

The direct linking of computers can bring an added advantage of resilience. Users of one system may well be able to use a second machine temporarily, albeit in a degraded mode, should their own computer fail. This is an area in which the NHS has little experience and because of the complex nature of its operations and the data required it will not be able to rely entirely on experience elsewhere. The NHS will certainly need to carry out its own programme of R&D in connection with the linking of computers and the standby procedures for terminal based systems.

6. MANAGEMENT STRUCTURES

a) Committees and Sponsoring

In all the committee structures proposed to date the role of Research and Development in computing has been underestimated and in general has been added to a structure not really designed to handle it. If the current and future programme is however going to lead to a substantial increase in patient care computing full recognition of this fact must be taken now when considering its role viz a viz other expenditure and control. This would mean removing Research and Development computing from an added afterthought to one where it, or perhaps more especially the Development part, plays a more dominant role.

A computer policy committee, an R&D committee and a standardisation committee have been suggested for the DHSS reorganised computer structure. If these committees are to function properly and have the backing of the NHS generally they must be constituted from those with experience in the relevant fields. To be fully effective they must have executive power and not just play an advisory role or the problems of the present will remain with us in the future. The committees might well duplicate each other's role so causing great frustration and confusion. One committee concerned with both research and development may well be all that is necessary. The new ideas, proposals etc., would be considered by the research side of the committee whilst implementation, transferability, standardisation etc., would be the responsibility of the development side. One body responsible for considering the ideas, seeing them put into practice on a pilot basis and then widely implemented would more likely satisfy all concerned. Obviously there would need to be close liaison and cooperation both with innovators and implementers of systems. To ensure that an active committee was maintained secondment of practicing computer staff and users would be necessary on, say, a three year rotating basis. Whilst outside consultants could be invited this should be done with extreme caution and most attention should be given to those with practical and relevant experience within the NHS. Many problems have existed in the past due to the separation of the DHSS and NHS. The committee structure is an attempt to overcome these inherent management problems.

Existing projects within the NHS and the RHA computer section should be instructed regularly to submit evidence (verbal and written) as to how the research and development aspects of their computing were proceeding. Sub-committees (with membership drawn from existing NHS personnel) concerned with special aspects of the full committee's work (ie standardisation, transferability, use of mini computers) should be created to assist the main committee with the vast amount of work involved.

The committee will need to operate alongside the DHSS, RHA and AHA structures. At all levels those providing advice and guidance should be drawn from the ranks of active users and designers of computer systems in the NHS since these are the people to be most affected by the decisions and recommendations made. In addition to secondment to the committee it may well be necessary to have some secondment to the departments in DHSS with an interest in computing. The latter should be staffed by people with a career interest in computing. This would help ensure that their interest would be in the promotion of computing rather than that computing should help their promotion.

New ideas for inclusion in the R&D programme would be expected from those working operationally in the NHS who would normally use their own local channels for promoting ideas. Whilst some form of sponsorship would be expected for these ideas they should not be abandoned simply because of some local problems (eg attitude of individuals, funds available etc). It is essential however that a mechanism is provided whereby those outside the immediate operational

/level can suggest

level can suggest and get support for new ideas. In this way significant advances might be possible but only via considerable reorganisation within the service. Some overview, without total regard to the status quo, is a method to be recommended for R&D which may bring more benefits to an organisation like the NHS.

b) Funding

In earlier sections it has been suggested that various levels of research and development should be appropriately administered by AHA, RHA or DHSS. The new research elements of the programme should continue to be funded at a national level by the DHSS. The dissemination of this information to the NHS at large should also be centrally funded.

In the area of primary care applications a new method of funding must be established. At present few methods exist for funding centrally or otherwise the activities administered via the Family Practitioner Committee. Whilst the FPC have administrative responsibility and funds to pay salaries and for specific items of service from GP's it is the Areas and Regions who are responsible for coordinating the clinical care with that carried out in hospitals. The latter however have no substantial funds with which to execute their responsibilities. In particular there is at present no direct way of funding computer aided research in the primary care sector without using funds allocated for some other purpose. There is no way in which successful research can be implemented in a widescale development programme in the primary care field.

Once the applications have met with approval locally and a development phase can be undertaken the funding should be a joint effort between the DHSS, RHA and/or AHA. Special allocation would be necessary to cover documentation, maintenance and additional staff costs. If the system involves the capital purchase of significant quantities of computer hardware then some assistance with this capital purchase will be necessary.

The DHSS should withhold a significant sum of money prior to allocation to RHA's. This money could then be used to purchase new or replacement equipment which would be leased to the appropriate administrative body. Leasing equipment in this fashion and charging users at a rate which would see a return on capital in say four years would enable the NHS to replace equipment every seven years and use the remaining funds to purchase new. The current trauma experienced by all the major budget holders in the NHS whenever large capital items have to be purchased would thus be eliminated to the benefit of all. Whilst a system of this nature would seem necessary for large computer installations, in any future expansion programme, if the same policy were adopted for the smaller capital items then this could form a basis on which central information concerning the availability of computer equipment in the NHS could be maintained. It would also make feasible the setting up of short fixed term projects.

Some flexibility on the total use of the equipment would have to be exercised at the local working level. Using any spare capacity on the machine and developing some ideas with initially local interest only would need to be at the discretion of the local administrative body. Funding this type of operation (using the same principle if desired) should be entirely at the discretion of the local bodies but in the knowledge that any escalation of use not notified centrally would not receive replacement funding and would lead back to the present situation where information is not readily available as to who is doing what.