



The current issue and full text archive of this journal is available at  
<http://www.emerald-library.com>

# The information management and technology strategy of the UK National Health Service

Information  
management in  
the NHS

## Determining progress in the NHS acute hospital sector

241

David Wainwright

University of Durham Business School, Durham City, UK, and

Teresa Waring

Newcastle Business School, University of Northumbria,

Newcastle upon Tyne, UK

**Keywords** Information systems, Information technology strategy, National Health Service, Hospitals

**Abstract** The publication of the United Kingdom National Health Service (NHS) Information for Health Strategy heralded a new strategic focus for the provision of information systems (IS) support across the NHS. Key changes concerned the placement of much greater emphasis on clinical information needs by route of the Electronic Patient Record (EPR) and the Electronic Health Record (EHR). The last decade has seen unprecedented changes within the NHS due to government policies, political ideology, health-care reform and pace of technological progress. This paper argues that this rate and scale of change has outstripped the ability of health-care organisations to respond effectively in order to implement the key goals set by strategic policy makers. An historical review is combined with an analysis of recent empirical survey data to determine the evolution and progress of the NHS IM&T strategy over a period of ten years. The review and analysis is enabled by adopting techniques and theory derived from research within the field of Information Systems, whereby Information Systems maturity models are used as an heuristic to measure levels of sophistication of IT adoption and use. These models demonstrate that NHS hospitals are fairly immature in terms of the adoption and usage of information systems and technology; struggling to provide adequate foundations for systems integration (data, work and culture). Conclusions reflect on the current progress and ambition of the strategy and comment on its potential outcome given existing NHS knowledge of IT, skills, capability and infrastructure.

### Introduction

The publication of the United Kingdom National Health Service (NHS) Information for Health Strategy (Burns, 1998) heralded a new strategic focus for the provision of information systems (IS) support across the National Health Service (NHS). Emerging from its predecessor, the 1992 Information Management and Technology (IM&T) Strategy (NHS IMG, 1992), key changes concerned the placement of much greater emphasis on clinical information needs (customer focus) as opposed to a managerial and resource-based (monitoring and control) emphasis. The original business and managerial focus evolved from the creation of the NHS "quasi-market" to support the information needs of managers and planners, due to the new demands of the purchaser and provider reforms (outlined

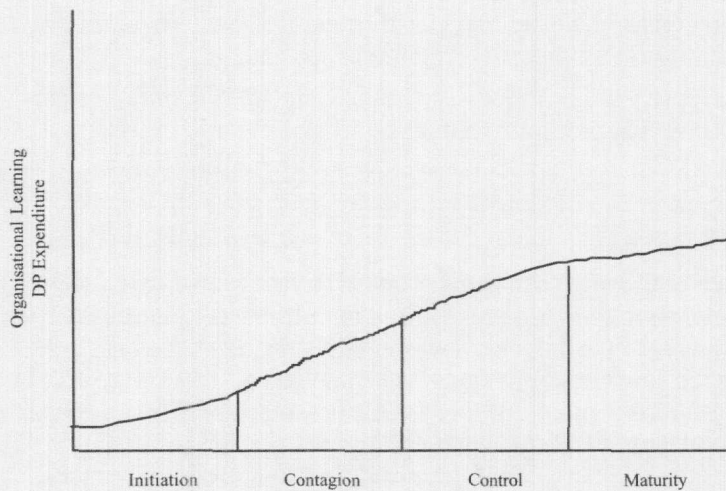
The International Journal of Public  
Sector Management,  
Vol. 13 No. 3, 2000, pp. 241-259.  
© MCB University Press, 0951-3558

in the white paper *Working for Patients* (HMSO, 1989). The new focus on clinical information systems is a response to attain a more balanced approach meeting the needs of patients, health-care professionals, managers and planners and the public; the prime focus now being the clinicians by route of the Electronic Patient Record (EPR) and the Electronic Health Record (EHR). The new emphasis focuses on integration of patient-based data for 24 hour access by multi-disciplinary stakeholders within the health-care system, stripping out the concept of professional boundaries and geographic location. In 1998 the new Labour government was prepared to allocate over £1 billion of its £5 billion NHS modernisation fund to finance many of the key technologies and programmes required to implement the *Information for Health Strategy* (Burns, 1998). The last decade prior to the millennium has been unprecedented in terms of scale of change within the NHS due to government policies, political ideology, health-care reform and pace of technological progress. We argue that the pace of change has outstripped the ability of health-care organisations to respond effectively in order to implement the key goals set by strategic policy makers within the NHS.

An historical review is combined with an analysis of recent empirical survey data to determine the evolution and progress of the NHS IM&T strategy over a period of ten years. The review and analysis is enabled through the use of IS maturity models as an heuristic. The first section investigates the use of maturity models within the context of IS and the NHS IM&T Strategy. The next section is a detailed review of the progress of the NHS IM&T strategy, from 1992 through to the major revision published in November 1998. This is undertaken in order to assess its early impact into the millennium. We then posit that the history of IT adoption across the NHS indicates that implementing the strategy is extremely problematic and complex. Finally, we reflect on the current progress and ambition of the strategy and comment on its potential outcome given existing IT capability and infrastructure.

### **Information systems maturity frameworks**

This section outlines a brief history of the application of maturity models (also known as stages of growth models) to IS and IT in organisations. There are many versions of models with many examples of usage together with various critiques of the approach. The Nolan stage model was one of the first attempts at using the approach within the context of IS. The Nolan maturity model (Gibson and Nolan, 1974; Nolan, 1979), known as the stages of growth theory, was derived from work carried out in the USA which identified that similar problems of growth were encountered by many companies involved in adopting computer-based systems. They discovered that budgets for IT expenditure followed an S shaped curve with three distinct change points enabling them to identify four key stages of growth in the life of IT systems. Initially four stages were identified comprising: initiation, contagion, control and maturity. Increased data processing (DP) expenditure was originally measured against these stages but this could also be interpreted as reflecting an increase in organisational learning – both showing an S curved profile (see Figure 1).

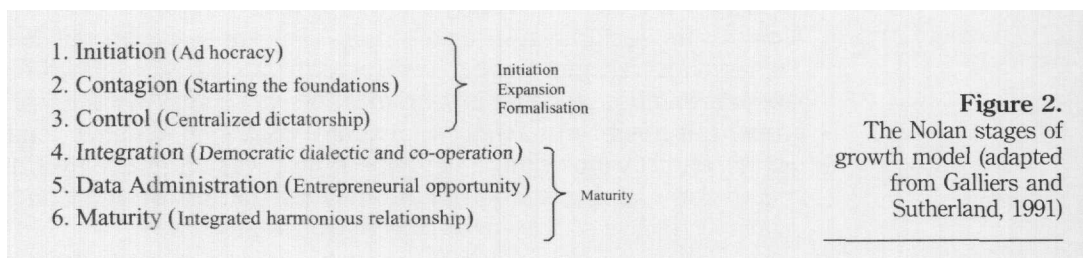


**Figure 1.**  
Four Stages of DP  
Growth (amended from  
Gibson and Nolan, 1974)

This model was revised by Nolan in 1979 to encompass: initiation, contagion, control, integration, data administration and maturity. Latterly, this was interpreted by Galliers and Sutherland (1991) in terms of a broader view of IT and information strategy (shown in brackets in Figure 2).

Galliers and Sutherland (1991) reviewed the evolution of Nolan's maturity model and highlighted how both critiques in terms of its application and the rate of technological progress have necessitated the production of more sophisticated growth models to explain more complex stages and dimensions associated with IT adoption. Galliers (1991) and Earl (1989) concur that the maturity model moves from a predominantly isolated IS function orientation, commencing in stage one, through an organizational focus, to a competitive, environmental focus in stage 6. Galliers and Sutherland (1991) recharacterise the six stages in terms of:

- (1) Adhocracy (lack of control and understanding of IT issues).
- (2) Starting the foundations (increasing unsatisfied demand for IT services and technology – lack of business involvement in IT).
- (3) Centralised dictatorship (conflict where IT department comes under scrutiny of senior management and growing end-user computing due to unsatisfactory service from the IT department).



**Figure 2.**  
The Nolan stages of  
growth model (adapted  
from Galliers and  
Sutherland, 1991)

- (4) Democratic dialectic and co-operation (lessons are learnt and more co-operative business and IT relationships emerge).
- (5) Entrepreneurial activity (adding value to IT and systems through effective use of information).
- (6) Integrated harmonious relationships (lessons are absorbed with emphasis on linkages between internal and external data and integration of IT into the mainstream of the organisation).

There have been many criticisms of these models as being too simplistic (they were developed in the era of centralised mainframe computing with traditional data processing departments). However Galliers and Sutherland (1991) respond to these criticisms of early "simplistic technological" models by acknowledging the organisations's goals, culture, skills and structure. They incorporated new issues concerning, database technology, networks and communications, micro-computer and end-user computing and also more complex mechanisms for managing the IT infrastructure. Their model retains the six stages of growth but adds extra dimensions to each stage for: strategy, structure, systems, staff, style, skills and super-ordinate goals.

The Galliers and Sutherland (1991) model is an attempt to synthesise a fairly comprehensive and generic model of IT maturity and growth which may be applied in a contingent manner to any suitable organisation. As such it represents a useful heuristic tool to inform both present and future IT capability. Galliers (1994) reflects on this model together with other IS frameworks for creative IT strategy formulation and easier strategy implementation. He proposes the use of the IS maturity model in its modified form to facilitate more effective formulation of IT strategy within the NHS.

Gillies (1998) takes the same concept but bases his simplified model on the capability maturity model developed for evaluating software quality by Carnegie Mellon University. Gillies (1998) concerns his research with analysing the current information management maturity within NHS primary care. This is based on his study of 1.1 million patients in the north west of England. Gillies (1998) draws from his other research experiences in office automation to produce a model based around five primary care maturity levels, the general practice information maturity model (GPIMM), with an additional level zero for non computerised practices (see Figure 3).

Gillies (1998) has used this model to demonstrate that although 95 per cent of general practices have computers, many of the practices are not making effective use of the technology. His survey analysis shows that the majority of practices in the north west region are at level 3 or below of the GPIMM model. This provides a significant barrier to clinical practice developments, as GPIMM level 4 is an absolute minimum for practices within the new NHS primary care groups (large consortiums of primary care general practices for more effective health purchasing, clinical provision and health planning) to function effectively. This has major implications for the feasibility of targets set for primary care groups within the 1998 Information strategy.

Level	Designation	Summary Description
0	Paper based	The practice has no computer system.
1	Computerised	The practice has a computer system. It is used only by the practice staff.
2	Computerised PHC team	The practice has a computer system. It is used by the practice staff and the PHC team, including the doctors.
3	Coded	The system makes limited use of Read Codes.
4	Bespoke	The system is tailored to the needs of the practice through agreed coding policies and the use of clinical protocols.
5	Paperless	The practice is completely paperless, except where paper records are a legal requirement.

**Figure 3.**  
Levels of general  
practice information  
maturity (Gillies, 1998)

### Applying maturity models to the emergent NHS IM&T strategy

The generic concept of the IS maturity model as revised by Galliers and Sutherland (1991) may therefore be applied to the NHS in the complex area of technology adoption for information systems across both the primary and secondary care sectors. As such it represents a useful tool to gauge progress. Also, perhaps to benchmark against other organisation types both externally (with the private sector) but perhaps more importantly internally (across comparable NHS organisations). GP practices, health authorities, hospitals and community services may be seen as distinct fairly homogeneous groups with many similar characteristics (all guided by a national strategy but muddled by local implementation). Perhaps the most powerful use would be as a learning mechanism to enhance strategic planning in terms of moving up a scale of progressive NHS integration in terms of technology, communications, shared data, relevant information and organisation structure where higher levels are progressively more complex to plan, implement and manage.

To illustrate this concept, the Galliers and Sutherland (1991) revised maturity model is applied at a macro-strategic level against the NHS information strategy to gauge its utility in informing the current levels of ambition compared to actual feasibility and progress. Figure 4 represents what we believe to be the developments in IM&T, both in the primary and secondary care sectors, mapped on to the IS maturity model. This reflects previous analysis by the authors (Waring and Wainwright, 1995; Thomas *et al.*, 1995).

#### *Initiation*

In terms of the maturity models, *Initiation* is the phase where information technology is introduced into the organisation, and in relation to the NHS this began in the early 1980s.

*The Financial Information Project (FIP)*

The origins of the IM&T strategy can be found in the FIP. This particular project was undertaken throughout the early 1980s. Central concern was the development of systems capable of recording the use of resources in the form of manpower, consumables and equipment in the care of individual patients. The FIP project, undertaken prior to the Körner and Griffiths (Griffiths, 1983) initiatives but without the scale of their resources, ultimately failed in developing a comprehensive patient costing system and it proposed that the development of departmental systems should be a priority – the order of which should be established by each unit. Each of these departmental systems should be linked through a patient identifier.

*The Griffiths report*

The Griffiths report, undertaken concurrently with the Körner report but reporting before it, centred upon the creation of a general management function within the acute sector in England. The provision of improved information to management was seen as essential to the success of the initiative, as was the involvement of clinicians in a “management budgeting” system. Management budgeting was to:

... involve clinicians and relate workload and service objectives to financial and manpower allocations, so as to sharpen the questioning of overheads (Griffiths, 1983).

Once again it was regional health authorities developing the large accounting systems in order to supply central government with performance indicators. Hospitals submitted returns but gained very little useful feedback.

*Contagion*

Contagion implies that there is rapid proliferation of systems, technology and supporting infrastructure. This is driven by technological progress, opportunity, political decisions and increased consumer demand. In the NHS, contagion is demonstrated by the following initiatives.

Stages of Growth	Acute Hospital Sector
Initiation	Financial Information Project; Griffith's Report; Management Budgeting
Contagion	Körner; Resource Management Initiative; Hospital Information Support Systems (HISS) Pilots
Control	NAO (1996) HISS Report; Introduction of POISE, PRINCE, NHS Wide Clearing System
Integration	GP Hospital Links; NHSnet; Hospital Order Communications Systems.
Data Administration	Hospital Electronic Patient Record (EPR) Level 4+
Maturity	Not achieved to date (this would be a fully integrated EHR/EPR system across primary and secondary sectors of the NHS)

**Figure 4.**  
The IS maturity model mapped to NHS IM&T initiatives

*The Körner Report (1982-1984)*

The next major initiative was the Körner Steering Group on Health Service Information. The central argument contained within the report was that staff should be provided with information on the cost of procedures within their area of responsibility in order to support decision making. This type of costing system would also serve the management activities of planning, budget setting, monitoring, control and performance evaluation. However, the main thrust of the recommendations became obscured with their implementation. IT was introduced on an *ad hoc* basis to aid in the supply of data, much to the dissatisfaction of staff. Rather than becoming central to either evaluation or decision making, specialty costing became an annual exercise in which average specialty costs were calculated or estimated from whatever sources of information were available (Forte, 1986). Research performed in 1991 (Waring and Maguire, 1992) indicated that NHS staff at ward level were completely dissatisfied with the amount of Körner data they were expected to supply to the regional health authority and the lack of information (relating to the data itself) they received in return.

*The Resource Management Initiative (RMI)*

In 1986, the NHS Management Executive (NHSME) undertook a review of the progress district health authorities had made in establishing management budgeting in England and concluded that, generally, no worthwhile contribution had been made to the planning and costing of patient care (DHSS, 1986). Existing information systems were not able to comprehensively relate cost data to clinical activities in the way envisaged and crucially, the co-operation of clinicians was very limited. In response to this failure, the NHSME decided to change the name of the initiative to "resource management" (RM) and establish a set of six new pilot sites.

... we are determined to establish once and for all, as objectively as possible, the practicality or otherwise of developing cost-effective information services, for clinicians in our acute units (DHSS, 1986).

Central to the RM process was the creation of a database which would serve clinicians in the planning and audit of their work and budget holders in the costing and control of activity. Suddenly hospitals were being encouraged to develop their own organisation-wide computerised information systems. The experimental nature of the work being carried out at the pilot sites led to differences in approach (Packwood *et al.*, 1991). All of the designs attempted to capture data on basic, aggregate patient activity from a patient administration system (PAS) and also the associated resource usage in theatres, diagnostic departments and pharmacy, together with data on nursing workload. This initially involved attempts to individually link existing departmental systems to the RM database.

Even before the review of the RMI had been published, the NHS pushed ahead with its next initiative – the 1992 IM&T strategy. This was despite

views at the time that many NHS systems had not demonstrated substantial enough benefits to justify the investment (NAO, 1990). These concerns were specifically pertinent to the RMI initiative whereby many of these systems had a narrow technical focus aimed at improving financial control, demanding greater efforts from clinical staff in terms of data collection whilst providing no meaningful information back to them in return (Aldridge, 1995).

Despite these mixed views, it was assumed that the RMI had been a success and the way forward for the service involved extensive use of IT and development of complex integrated information systems. The strategic vision for large acute hospitals in the UK as outlined by the NHSME, was for them to develop fully integrated, patient-based information systems by the year 2000. To do this they perceived the need to introduce hospital information support systems (HISS). HISS was defined as:

an IT environment which meets the real-time operational and information needs of health professionals who deliver care to patients, whilst also providing accurate and timely information for management purposes (Benson and Neame, 1994).

The vision for HISS originated in the USA and was intended to provide an infrastructure which would allow separate IT applications to communicate and share information by working together. As can be seen from Figure 5, HISS is very complex and according to Benson and Neame (1994) the implementation of such a system is not just about installing networks and computers, but is concerned with changing information flows throughout the hospital. This fact has sometimes been ignored with consequent serious implications for everyone working there (Gowling, 1994).

In 1988/1989, while the RMI was still yet to report on its outcomes, the Information Management Group (IMG) of the NHSME established the "HISS central team" based in Winchester. Their brief at that time was to establish

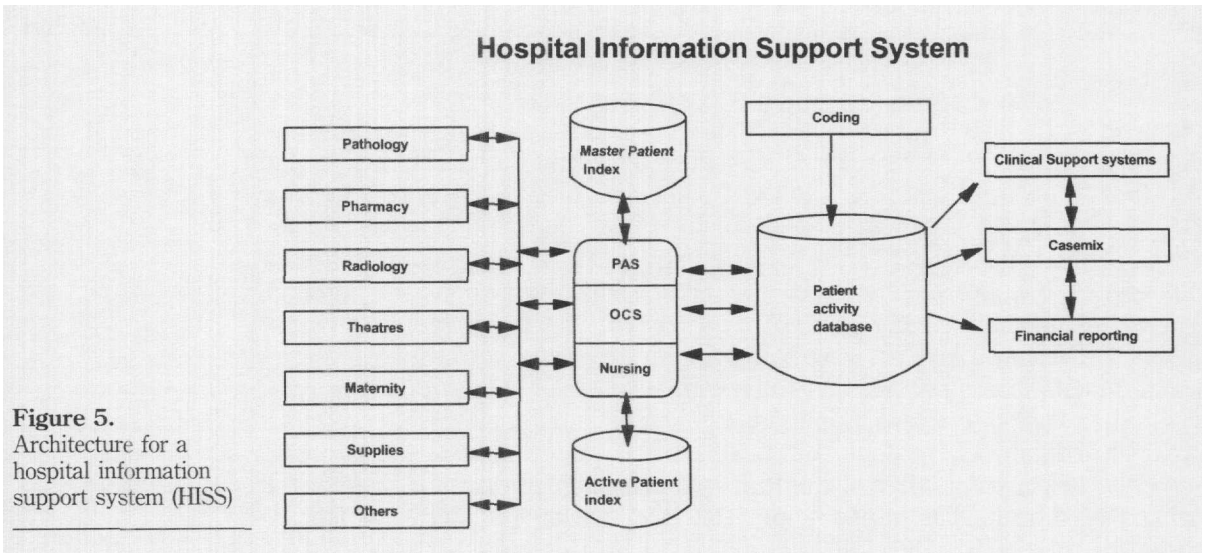


Figure 5. Architecture for a hospital information support system (HISS)



HISS pilot sites in England and Wales and then to determine the feasibility of this approach to delivering the required operational and management information for the new markets. Three initial sites were established: Greenwich, Nottingham and Darlington, with others joining the study at later dates. Each of the three pilot sites was allowed to define its own individual specifications and requirements and then invite suppliers to tender for the contracts. What actually happened at the micro-level within the hospitals only emerged much later, with the publication of post-implementation reviews of the pilot studies (NAO, 1996).

### *Control*

The *Control* phase of the maturity model is entered when spending on IT has escalated and returns on investment are negligible. There may have also been some disasters along the way. Organisations take back the control of IT spending by cutting budgets, introducing stricter procedures for purchasing and developing systems, and even placing the IT department under the direct control of the finance director.

There has been much written on the disastrous approach to developing IT systems within the NHS and the public sector generally (Coopers and Lybrand, 1994; NAO, 1996; Thomas *et al.*, 1994, 1995). This led to a change in culture for public accountability and control of large-scale IT procurements and implementation. The Department of Health and the Treasury, through the Information Management Group (IMG), imposed strict guidelines regarding the writing of business (economic, financial and IT) cases and the use of POISE (procurement of information systems effectively). Implementations were required to adhere to the project management principles of PRINCE (projects in controlled environments). This therefore halted the rapid proliferation of high-cost, large-scale systems by making the process of acquisition extremely difficult in terms of financial justifications and business cases. At the same time the private finance initiative (PFI) was imposed by the government on all procurements over £1 million. Early 1990s HISS systems were averaging over £5 million (e.g. the Darlington and Nottingham pilot sites).

### *Integration*

The term *Integration* in the context of the maturity model is a stage which implies that the organisation is beginning to address its difficulties and become more comfortable with IT and systems in general. Information systems are organisation-wide, they are seamless, duplication of data is minimal and departments share common databases. However, we do not believe that the NHS has reached this level of maturity and that it is still in the Control phase, with some evidence of interfaced systems but very little evidence of integration. We outline our case below.

The 1998 IM&T strategy (Burns, 1998, *Information for Health*) is based upon the premise that the acute hospital sector is at the integration phase of the maturity model. This would imply that the majority of departmental IT

systems -- as can be seen in the HISS model (Figure 5) -- would have significant communication links in terms of common data and shared tasks, procedures and work processes. This view of integration is very much a technical view and omits complex human and cultural issues which need to be addressed for effective ways of organisational working (for a detailed account of IS integration and its complexity see Waring and Wainwright (2000)). The 1998 strategy is also dependent to a large degree on the assumption that the objectives of the 1992 strategy are being achieved.

The 1992 strategy was described in over 40 separate small documents and was built on five key aims (NHS IMG, 1992):

- (1) Information will be person based.
- (2) Systems may be integrated.
- (3) Information will be derived from operational systems.
- (4) Information will be secure and confidential.
- (5) Information will be shared across the NHS.

The actual implementation of this strategy (like its predecessors) has not been seen as very successful. Frank Dobson, in the foreword to the 1998 strategy for health, states:

Up to now the use of IT in the NHS has not been a success story. Far from it. Lots of money has been wasted ... There has been too much emphasis on financial data to support an internal market at the expense of IT systems which could directly benefit patients. As a result, clinicians working in the NHS came to see data collection not as a help but as a hindrance to their work (Burns, 1998, p. 5).

This comment has been based on many reports which evaluated major IT initiatives within the NHS over the last decade.

Key IT policymakers such as Rogers (1996), involved in the formulation of the 1992 IM&T strategy, defend its progress citing achievements in six key components:

- (1) clarity about national standards (EDI etc.);
- (2) unique identifiers for health-care purposes (NHS number);
- (3) sharing arrangements for the administrative details of the population (administrative registers);
- (4) a basic language for health (Read codes and Healthcare Resource Groups);
- (5) NHS wide telecommunications system (NHSnet); and
- (6) a framework for security and confidentiality (secure encryption and access).

Other authors raise concerns over this rhetoric relating to the ambition of the technological infrastructure and the organisational change needed to accommodate such massive modernisation. These include: slow uptake of the

use of NHSnet as a preferred communications system, problems with the implementation of the NHS number, slow adoption of Read codes and the problems of secure electronic transfer of patient information (Keen, 1998; Stuart-Buttle *et al.*, 1996; King and Molteno, 1996; Bywater, 1996).

Bywater (1996) comments on the problems of implementing the 1992 IM&T Strategy, arguing that progress has been poor due to: the low functionality of patient administration systems (PAS), the low numbers of order communications systems (OCS), seen as the hub of an integrated patient-based system, non integrated financial systems, and the virtually non-existent IM&T support for clinicians at the point of delivery of care.

This is coupled with a lack of clear management objectives from the top of the NHS Executive, with over 25 major infrastructure projects under way with no clear prioritisation in terms of objectives, goals and benefits. Bywater (1996) states that:

against this backdrop it is difficult to see how the ambitious infrastructure projects defined in the NHS IM&T strategy could have realistically been expected to deliver direct end-user benefits within the anticipated timescales . . . the result is a series of iterations towards a theoretically perfect solution which may never do an adequate job for the operational user . . . the strategy has been characterised by preoccupation with technological issues, standards and procurement procedures . . . perhaps the most critical strategic obstacle to the progress in the NHS is the cultural gulf which exists between management and clinicians (Bywater, 1996, p. 30).

He then argues that the IM&T strategy is visionary but perhaps too distant for most of the rest of the NHS whose sights are set firmly on the short term. A distinction should be made between "perfection" and "good enough" with a willingness to accept something short of the leading edge which actually works in practice.

Other problems identified to date concern issues of:

- standardisation of record structures within and between primary and secondary care;
- the actual definition and agreement by patients, clinicians, public health specialists and planners over the nature, content and security of EPRs and EHRs;
- the mandatory use of Version 3 Read codes;
- problems over restricted access to NHSnet;
- a clinical informatics skill shortage;
- the complexity of the IT procurement process;
- the tension between local implementation and regional policy, co-ordination and control; lack of senior management involvement;
- lack of performance management; and
- lack of academic involvement.

An analysis of recent major IT surveys within English NHS hospital Trusts (Thorpe, 1993; Thomas *et al.*, 1994; Tarpey, 1997; Crouch, 1999; Olalekan, 1999) show that anticipated levels of IT integration fall far below those originally anticipated both in the 1992 IM&T and 1998 Information for Health strategies. The figures compiled and averaged in Figure 6 indicate the major departmental and clinical IT systems present, together with the percentages that are perceived by hospital IT managers to be integrated with other departmental or clinical systems within the hospitals. Of course these are subjective perceptions where opinions of the meaning of integration and the relative degree of inter-connectivity may not be totally consistent. It does provide an indication however of perceived IT systems integration over a period spanning five years.

The surveys demonstrate that in 1993, 75 per cent of hospital Trusts had some form of electronic network and there was an almost 100 per cent coverage in terms of the basic patient administration systems. Much lower levels of success were apparent in the areas of both management information and clinical support systems, with the lack of integration hindering access to information. The 1994 survey identified that only 13 per cent of hospitals possessed to varying degrees order communications systems which were seen as the integrated hub of a HISS system. Also, only 8 per cent of hospitals at that time were procuring HISS. Again the main problems were seen in the areas of interfacing (as opposed to the more sophisticated concept of integrating) discrete proprietary systems. Key findings from the 1997 survey found that hospitals were focusing on external interfacing of systems to GPs, with over 50 per cent having some access to NHSnet. Only 25 per cent claimed to have an interface engine for integrating existing systems together; 28 per cent were in the process of procurement of a HISS. In 1998, 93 per cent of Trusts had access to NHSnet and most considered themselves to be at EPR level 1, with 53 per

NHS Acute Provider Hospital Information Support Systems Integrated Modules	(Thorpe, 1993) Hospital Survey (n=248, 80% response)	(Thomas et al, 1994) HISS Survey (n=164, 60% response)	(Tarpey, 1997) NHS IMG Hospital Survey (n=all acute Trusts in England, 80% response)	(Crouch, 1999) NHS IMG Hospital Survey (n=221, 75% response)	(Olalekan, 1999) Hospital Survey (Survey of 63 acute Trusts)
Patient Administration System	56%	83%			84%
General Pathology Services	47%	36%	51%	59%	36%
Other Patient Systems	42%		40%		
Business Systems	40%				
Casemix Systems		50%			37%
Order Communications Systems		13%	29%	33%	30%
Hospital and GP electronic links			74%	74%	45%
Access to NHSnet			>50%	93%	
Organisational Website			19%	28%	
Interface Engine Applications			25%		
Pharmacy Systems		36%	35%	22%	
Theatre Systems		26%	18%	61%	
Nursing Systems		40%	43%	63%	

**Figure 6.**  
Analysing IT  
integration progress  
over five years

cent at level 2, 10 per cent at level 3 and 3 per cent at level 4. An independent academic survey (Olalekan, 1998) showed that the IM&T strategy implementation progress was perhaps slower than expected when compared to the major investments in strategic planning, government and private finance initiative finance, and human resource over the four year period. Overall, the findings showed, when all of the HISS components were taken into consideration, there was a net sum increase of only 2.8 per cent in terms of integrated systems over a four-year period from 1994 through until 1998.

Doherty *et al.* (1999) undertook an exploratory survey of HISS in 12 acute hospitals in the UK, interviewing IM&T managers to ascertain progress in terms of HISS module implementation and roll out. This qualitative study found that two hospitals had achieved 25 per cent of their overall HISS plan, two had achieved around 80 per cent and overall that the average progress for the 12 Trusts was a little under 60 per cent. They also find that the reported levels of integration were not as high as might be expected, with comments such as, "under way but not complete" "access to information rather than transference of data" and "many links are one way, so there is still much to accomplish".

To summarise, the degree of integration achieved by 1999 falls much shorter than anticipated after over a decade of strategic IT initiatives. This lower than anticipated technological and organisational maturity places a heavy burden on the new and even more ambitious goals of the 1998 Information for Health Strategy.

### **Integration, data administration, maturity and the 1998 information for health strategy**

Current emphasis by IT policy makers within the NHS is now focused on the data administration and maturity phases (seamless sharing of data and multi-media information at any place, at any time in the desired format) of the maturity model. This is based on the assumption that targets concerning both technical and organisational integration have been achieved.

The 1998 strategy retains the five key aims of its predecessor but with one important change – it states that systems *will* be integrated. On the surface this may seem subtle but in reality it represents a major difference in emphasis in terms of complexity, both in terms of information technology, its use, and the organisational structures and processes within the NHS. The strategy is focused on the fundamental premise that good clinical data collection and information provision will drive management and performance information at the higher levels, whereas the existing emphasis is reversed. The new strategic IS objectives are based around the vision that information will be available online at any place, at any time, in multi-media form if relevant, by those who need it – serving health care professionals, patients, the public and NHS managers and planners.

Specific targets are centred upon developing and implementing a first generation of person-based health records. These records will enable GP practices to link to NHSnet for appointment booking, referrals, discharge information, radiology and laboratory requests and results. It will require the

development of systems to “push” data from hospitals down to GP practices; agreeing suitable standards for security and confidentiality; and developing increasingly sophisticated integrated hospital systems with links between patient administration systems, departments, and order communications systems and prescribing phased over the next seven years.

Hospitals will develop the electronic patient record (EPR) according to six increasingly sophisticated levels of integration, as shown in Figure 7.

The most significant target in terms of the EPR is the achievement for all acute hospitals, by the year 2002, of a level 3 EPR “clinical activity support”. This will comprise the integration of order communications, results reporting, multi-professional care pathways, and a master patient index administration system that is integrated with departmental systems.

In the second phase of implementation, substantial progress will be seen in delivering the Electronic Patient Record and Electronic Health Record . . . 35 per cent of all acute hospitals to have implemented a level 3 EPR (requires each acute hospital to have an integrated master patient index, patient administration and departmental systems, plus electronic clinical orders, results reporting, prescribing and multi-professional care pathways) (Burns, 1998, p. 109).

In primary care the strategy states that all computerised GP practices must be connected to NHSnet and able to receive at least one type of test report from hospitals by the end of 1999, then to be able to book appointments on-line by the year 2002.

Then by the year 2003-5 for:

all acute hospitals with level 3 (or higher) electronic patient record systems and the full implementation at primary care level of first generation person based electronic health records with electronic transfer of patient records between GPs and 24 hour emergency care access to patient records (Burns, 1998, p. 110).

<b>Level 6</b>	<b>Advanced multi-media and telematics</b> Level 5 plus telemedicine, other multi-media applications (e.g. picture archiving and communications systems)
<b>Level 5</b>	<b>Specialty specific support</b> Level 3 plus special clinical modules, document imaging
<b>Level 4</b>	<b>Clinical knowledge and decision support</b> Level 3 plus electronic access to knowledge bases, embedded guidelines, rules, electronic alerts, expert systems support
<b>Level 3</b>	<b>Clinical activity support</b> Level 2 plus electronic clinical orders, results reporting, prescribing, multi-professional care pathways
<b>Level 2</b>	<b>Integrated clinical diagnosis and treatment support</b> Level 1 plus integrated master patient index, departmental systems
<b>Level 1</b>	<b>Clinical administrative data</b> patient administration and independent departmental systems

Figure 7.  
The electronic patient record – levels of integration (Burns, 1998)

## Discussion and conclusions

The maturity model approach has allowed us to explore historical progress to date in terms of the NHS IM&T strategies and then to consider whether the NHS is in a position to move into a phase for which they may not be prepared. The current information strategy (Burns, 1998) has been predicated on integrated systems being in place to underpin the new initiatives of the EPR and the EHR. Ambitious targets have been set for the delivery of these new systems. However, we believe that we have demonstrated that the NHS has not reached a level of maturity in information systems, management and technology which can support these new initiatives.

Leading medical commentators of the new Information for Health strategy urge caution with respect to its scale, scope, rhetoric and ambition. Carnall (1998) ironically states that "booking an NHS outpatient appointment in the future should be as easy as booking a package holiday in the sun if the new information strategy . . . is successful". The same commentary states that the report is receiving a cautious welcome due to the new clinical emphasis but some concern exists over the ambitious timeframe. Wyatt and Keen (1998) comment in the same vein, outlining the attractive clinical and managerial benefits to be gained from the £1 billion new investment but expressing cautionary tales. These consist of unforeseen efforts in data collection, information overload, ambitious timescales, pressures resulting from the unheralded information access for NHS stakeholders, and the need for strong clinical leadership to guard against technology being seen for its own sake.

The 1998 Information for Health strategy has many ambitious targets and goals that are based upon a central premise that NHS organisations, both individually and collectively, have reached the fourth "integration" stage towards the six progressive stages of IS maturity. It can be seen that this is a false assumption and that progress has been very problematic, with both an historical analysis and survey data showing much slower progress than anticipated over the last decade.

Much greater consolidation, resourcing, practical effort and academic research must take place in terms of what the NHS interprets as minimal, satisfactory and over-engineered levels and the relative degrees of both technical and organisational integration. Integration is a complex concept (Waring and Wainwright, 2000) and must be examined carefully to assess appropriateness relative to context. In most cases to date, all that has been achieved is really "technical interfacing" of discrete systems using interface engineering technologies on an internal organisational level. At the external levels, NHSnet and the NHS wide (EDIFACT) Clearing System have enabled inter-organisational transmission of data but this is still mainly focused on Department of Health statistical performance indicators and purchaser-provider contracting transactions very much focused on efficient resource usage and local and government control. The "mythology of disaster" (Burns, 1998) surrounding NHS IT initiatives has certainly tipped the balance in favour of an IS stage control regime. This militates against the innovation and local

autonomy required to pursue integrated systems that serve the short and medium term information and knowledge requirements of senior and middle managers, administrative users, clinicians and the public. This top-down rational and deliberate planning approach to IT strategy is very much focused on providing systems for central control, as opposed to providing support for local decision making at middle management levels for operationalisation and implementation of the strategy (Currie, 1999).

The fourth IS maturity level of "integration" must be achieved, first, at local pilot levels to enable organisational and individual learning to take place before the more ambitious leap to the next level of "data administration" can take place. The targets set for the six levels of integration (maturity) of the EPR at the secondary hospital levels and the EHR in the general practice primary care levels, are based around the notion of achieving a maturity level equivalent to that of "data administration" in IS stages of growth terms. Even the private manufacturing and service sectors are struggling to achieve this state, exemplified by the many accounts of enterprise resource planning systems (ERP) which have not been successfully implemented (Waring and Wainwright, 2000; Davenport, 1998). An examination of the private sector ERP literature provides many parallels with both HISS and the concept of the EPR. Specifically, HISS may be seen as the hospital equivalent of an ERP system in a commercial organisation (large scale, wide business and functional coverage, integrated, shared data, highly complex) where the vision was for a single technology solution that met multiple organisational information requirements. Latterly in the 1998 Information for Health strategy the term HISS is not mentioned but inferred by a focus on the data and information (the EPR) as opposed to the technology itself.

HISS was probably a concept too far. The IMG at that time did not openly admit that they were over-ambitious in setting a target of the Year 2000 for all acute hospitals to implement a HISS. However, NHS IM&T literature began to be toned down and urged hospitals not to abandon the HISS concept but to adopt an "incremental" rather than a "big bang" approach to implementation (NHS IMG, 1992). It has to be remembered that the NHS as a whole has very little experience of implementing large-scale information systems and that these types of projects have steep learning curves, even for the skilled practitioner.

The concept of the EPR also raises interesting questions. Is the EPR (as evidenced by the survey data, Figure 6) no more than a sophisticated patient administration system? Is the degree of integration implied by the strategy to reach successive levels of EPR maturity actually necessary and required by the stakeholders involved? These questions must be asked against the current progress of the 1998 strategy which has been determined in a "top down" fashion driven by government policy reforms and structural changes within the NHS. The strategy is driven by a desire to make the restructured NHS work cohesively (aims of efficient usage of resources) as opposed to meeting the direct needs of individual stakeholders and local organisations.



Finally we believe that the NHS must allow time for consolidation within its user community. Attention must be focused on organisational learning with regard to managing the introduction of new information technology to consolidate progress at the "integration" stage of the IS maturity level. An IS maturity framework revised to reflect technological and organisational progress (Galliers and Sutherland, 1991) may be used as a diagnostic tool to distil this learning, measure progress against objectives, benchmark between organisations and departments and to identify good practice. Integration as a concept has been demonstrated to be very complex and too obtuse a term. The term "interfacing" where integration goals are not potentially equivalent in terms of organisation, tasks and technology may be a useful addition to the current seven stages of IS maturity. This would provide a more realistic assessment of progress to date against the stages of initiation, contagion, control, interfacing, integration, data administration and maturity. Current assessment would put the NHS Information strategy at the "interfacing" stage, striving in some areas towards differing degrees of "integration" with perhaps unrealistic goals at this stage of "data administration" the achievement for all hospitals to have level 3+ EPR by the years 2003-2005.

#### References

- Aldridge, S. (1995), "Implementing an information strategy at local level", in Sheaff, R. and Peel, V. (Eds), *Managing Health Service Information Systems*, Open University Press, Buckingham, pp. 104-19.
- Benson, T. and Neame, R. (1994), *Healthcare Computing*, Longman, Harlow.
- Burns, F. (1998), *Information for Health*, Leeds NHS Executive, A1103.
- Bywater, M. (1996), "Big-bang impetus for IM&T strategy", *The British Journal of Healthcare Computing & Information Management*, Vol. 13 No. 1, pp. 29-31.
- Carnall, D. (1998), "NHS information strategy launched", *The British Medical Journal*, 3 October, Vol. 317 No. 901.
- Coopers & Lybrand (1994), "HISS Central Team and Darlington Memorial NHS Trust HISS implementation review, final report", unpublished internal report.
- Crouch, P. (1999), *A Survey of Acute Hospital Patient Centred and Clinical Information Systems 1998*, NHS Executive IMG E5614.
- Currie, G. (1999), "The influence of middle managers in the business planning process: a case study in the UK NHS", *British Journal of Management*, Vol. 10, pp. 141-55.
- Davenport, T.H. (1998), "Putting the enterprise into the enterprise system", *Harvard Business Review*, July-August, pp. 121-31.
- DHSS (1986), *A National Strategic Framework for Information Management in the Hospital and Community Health Services*, DHSS, London.
- Doherty, N.F., King, M. and Marples, C.G. (1999), "The impact of the Hospital Information Support Systems Initiative on the operation and performance of acute hospitals", in Brooks, L. and Kimble, C. (Eds), *Proceedings of the 4th UKAIS Conference, University of York, 7-9 April*, McGraw-Hill International Editions, London, pp. 645-55.
- Earl, M.J. (1989), *Management Strategies for Information Technology*, Prentice-Hall, Hemel Hempstead.

- Forste, P. (1986), "Management Budgeting in the NHS", in Brooks, R. (Ed.), *Public Health Services Manpower Review*.
- Galliers, R.D. (1991), "Strategic information systems planning: myths, reality and guidelines for successful implementation", *European Journal of Information Systems*, Vol. 1 No. 1, pp. 55-64.
- Galliers, R. (1994), "Information and IT strategy" in Keen, J. (Ed.), *Information Management in Health Services*. Open University Press, Buckingham, pp. 147-70.
- Galliers, R.D. and Sutherland, A.R. (1991), "Information systems management and strategy formulation: the stages of growth model revisited", *Journal of Information Systems*, Vol 1, pp. 89-114.
- Gibson, C.F. and Nolan, R.L. (1974), "Managing the four stages of EDP growth", *Harvard Business Review*, Vol. 52 No. 1, January-February, pp. 76-88.
- Gillies, A. (1998), "GPIMM: an information maturity model for general practice", in Teasdale, S. (Ed.), *Primary Health Care Specialist Group of the British Computer Society – Proceedings of the Annual Conference*, Cambridge, UK, September, pp. 107-11.
- Gowling, W. (1994), "Operational systems", in Keen, J. (Ed.), *Information Management in Health Services*. Open University Press, Buckingham, pp. 31-49.
- Griffiths, R. (1983), *NHS Management Enquiry (The Griffiths Report)*, DHSS, London.
- HMSO (Secretaries of State for Health, Wales, Northern Ireland and Scotland) (1989), *Working for Patients*, Cmnd 555, HMSO, London.
- Keen, J. (1998), "Rethinking NHS networking", *The British Medical Journal*, Vol. 316 Nos 1291-3, 25 April.
- King, T. and Molteno, B. (1996), "Confidentiality and security using the NHSnet", *The British Journal of Healthcare Computing & Information Management*, Vol. 13 No. 1, pp. 26-8.
- NAO (1990), *Managing Computer Projects in the NHS*, HMSO, London.
- NAO (1996), *Department of Health: the Hospital Information Support Systems Initiative*, Stationery Office, London.
- NHS IMG (1992), *Information Management and Technology Strategy: Overview*, NHSME, London.
- Nolan, R.L. (1979), "Managing the crises in data processing", *Harvard Business Review*, Vol. 57 No 2, March-April, pp. 115-26.
- Olalekan, K.B. (1999), "HISS implementation", unpublished MSc thesis, University of Northumbria at Newcastle upon Tyne, UK.
- Packwood, T., Keen, J. and Buxton, M. (1991), *Hospitals in Transition, the Resource Management Experiment*, Open University Press, Buckingham.
- Rogers, R. (1996), "An NHS infrastructure – the long trek", *The British Journal of Healthcare Computing & Information Management*, Vol. 13 No. 1, pp. 18-21.
- Stuart-Buttle, C., Sutton, Y. and Walters, P. (1996), "The facts about Read codes", *The British Journal of Healthcare Computing & Information Management*, Vol. 13 No. 1, pp. 22-5.
- Tarpey, S. (1997), *A Survey of Acute Hospital Patient Centred and Clinical Information Systems – July 1997*, NHS Executive IMG, D4056.
- Thomas, R., Robinson, J., Waring, T., Wainwright, D. and Maguire, S. (1995), "Information management and technology in England's large acute NHS hospitals: national strategy versus local reality", *Journal of Management in Medicine*, Vol. 9 No. 1, pp. 40-9.

- 
- Thomas, R., Wainwright, D., Robinson, J., Waring, T. and Maguire, S. (1994), "Has HISS run out of steam . . .", *Health Service Journal*, Vol. 104 No. 5413, pp. 24-6.
- Thorpe, S. (1993), *Hospital Systems Report 1993 – a Report on the Implementation of Hospital Information Systems in England*, NHS Executive IMG, DE D40009.
- Waring, T. and Wainwright, D. (1995), "Action research: what lessons for HISS?", in Gillies, A. (Ed.), *Proceedings of the 1995 European Conference on Health Informatics, 24-25 October, University of Central Lancashire, DisneyLand Paris*, pp. 75-87.
- Waring, T. and Wainwright, D. (2000), "Interpreting integration with respect to information systems in organisations image, theory and reality", *Journal of Information Technology*, Vol. 15, pp. 131-48.
- Waring, T.S. and Maguire, S. (1992), *Managing Information: Book 4 Sources of Information*, HSSM (Advanced Mesol), Open University Press, Buckingham.
- Wyatt, J. and Keen, J. (1998), "The NHS's new information strategy", *The British Medical Journal*, Vol. 317 No. 900, 3 October.