Managing the gap: Balancing advances in technology with advances in management practice

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Abstract

Expenditure on information systems is widely anticipated to lead to improved management of health care resources. Despite large investments in hardware and software, these expectations are difficult to realise. Part of the difficulty lies in the manner in which information systems are applied to, rather than integrated within, organisations. This paper considers some of the personal and organisational issues that need to be addressed to 'manage the gap' in balancing advances in information technology with advances in management practice. The issues identified are consistent with the concept of a learning organisation dealing with environmental change.

Introduction

It is easy to become mesmerised by the potential of technology, particularly information technology, but it is less easy to translate that potential into realised managerial or organisational performance gains. Impressive improvements in hardware performance and the presentation of data are lauded by the supporters of information technology. Less likely to be presented is any comprehensive, objective or independent evaluation of the full costs of introduction and maintenance, or the actual benefits realised within health organisations. Some of the costs may be hidden or discounted by the perception of change being positive and progressive, but in an environment of finite health care resources, are health service managers maximising the return from investments in technology? Has the use of information systems and technology resolved the problems health service managers face? How have information systems and technology affected management practice?

Contemporary approaches to information systems differentiate between technical (management science, computer science, operations research) and behavioural elements (psychology, political science, sociology) (Laudon & Laudon 1995, p 19). In seeking to consider advances in technology, we should also seek to consider advances in the manner in which information systems have affected managerial and organisational effectiveness. The basic interface of technology and organisation should be considered within the context of organisational culture, 'a fundamental set of assumptions, values, and ways of doing things, that have been accepted by most of its members' (Laudon & Laudon 1995, p 10). Organisational culture can also be regarded as a critical factor affecting change and the achievement of effective and efficient information systems. Health informatics, as a higher level of technical and behavioural complexity, complicates further some of the fundamental issues raised in this paper. Even at the most basic level of consideration of information systems, there needs to be less emphasis on the collection and storage of data and more on the use of information in supporting decisions.

Examples of some of the gaps that need to be addressed to help achieve information system performance potentials include those between:

- management and clinicians, managerial and clinical decision support systems, and about their respective roles

- hospitals, districts and areas and the Department of Health, about management and leadership, management practice and health policy

- roles of public and private sectors

- academic institutions and the health industry – State and federal Departments of Health and Human Services and Health, in supporting the personal and organisational developments required

- the time and money to achieve system benefit realisation

- the real problems and those that are perceived.

These gaps are important to acknowledge, but rather than be pessimistic about their number and extent, we should address the issues they represent. This paper seeks to provoke consideration of some of the gaps between technological and managerial advances within the context of the New South Wales health care system. The paper presents two examples of clinical decision support systems, supported by some of the interim findings of a comprehensive evaluation of an integrated hospital information system in Clwyd, Wales (Health Services Management Unit & CSL Healthcare Management 1993).

Clinical decision-making in intensive care situations

There is compelling evidence to the advantages that technology offers in specific situations. Mudaliar (1995) has identified over 200 data inputs from monitors and charts surrounding a single patient in an intensive care situation that need to be interpreted to form a judgement on the appropriate clinical action required. The EMTEK system that was introduced simplified and improved clinical decisions by identifying deviation from acceptable value ranges. Mudaliar is convinced of the improvement in clinical judgement this system facilitates.

Considered from a different perspective, the improved management of individual cases needs to translate into more effective management decisions affecting resource utilisation at an organisational level to justify the system establishment and maintenance costs. The EMTEK system adds a capital and maintenance cost to the already high costs of the treatment of patients within an intensive care environment. If the EMTEK system enables patients to be treated more effectively and efficiently within the intensive care unit, is the technology enabling the clinician to better manage the patient, better manage the unit's resources, or both?

The choice in the allocation of resources epitomises the dilemma in resource allocation in health: to what extent should the benefit to the individual be placed ahead of, or balanced by, the overall benefit to the population? Are the clinical and managerial decision-making roles convergent or conflicting? Is the information technology an enhancement or a constraint, or does that depend on how the overall costs or outcomes change? And from whose perspective? Has the clinical decision support system solved a clinical difficulty or created a managerial or organisational dilemma? Has it shifted from being a clinical issue to a management issue? What are the boundaries, or overlaps, between a clinical issue and a management issue? Some of these issues deserve to be more widely considered before we increase investment in, or increase our expectation of returns from, information systems.

Extending specialist involvement in case management through telemedicine

Manson & de Silva (1995) described the benefits of telemedicine in appropriately supporting clinical decision-making and management of paediatric cases at sites geographically remote from the Royal Alexandra Hospital for Children. The cost of establishing and maintaining the technology to support the telemedicine system is continuing to decrease and the impact on reducing patient

transportation and associated costs results in an attractive 'payback' period. The payback is to the health system in its larger form but, while the benefits can be measured and demonstrated, it is not necessarily being returned to the cost centre incurring the expense. The implications of changes to funding mechanisms along casemix reimbursement lines to provide incentives for such initiatives have yet to be ascertained. The support of the separate managements to the service also needs to be tested within a funding, as well as a patient outcome, context.

Both examples reflect not only an emphasis on teamwork and commitment to an improved quality of service to the patient, but also to referring clinicians, departments or services. The localised subculture (fundamental assumptions, shared values and ways of working – Laudon & Laudon 1995, p 10), the familiarity with technology and the recognition of possible benefits have affected the success of those developments to date. But what about the broader context of information technology? Can successful approaches to the installation of systems within departments be transferred and applied to organisations? What learning principles do we need to apply to larger scale attempts?

Implementing information systems within organisations

Decisions on the implementation of applications need to be made closer to the point of data entry to reinforce system ownership because of the numerous changes in work practice required. Additional effort required to achieve accurate and timely input needs to be balanced by a demonstrable return, particularly at the 'local' level. Contemporary systems have shifted from uninformed data entry to more informed data entry. This development is highlighted by the trend for clinicians to directly input data, rather than clerks inputting secondary data, to emergency, ward and departmental systems. This trend has implications for the type of hardware and software specified but is expected to improve the quality of data input. Direct clinician input should reduce the probability of potential coding or interpretation errors by reducing the duplication of writing and translation activities. This approach does not remove the requirement for an appropriate level of audit or evaluation of costs and benefits. At least four potential gaps are inherent in the above statements: level of decision-making, local returns, clinician input and involvement, and hardware and software specification.

If information technology is to assist in improving clinical and managerial decision-making, it must be recognised as only a part of the approach required to achieve the desired outcomes. The systems identified by Mudaliar (1995) and Manson and de Silva (1995) may or may not fit into larger managerial or clinical

information systems. Elements might form part of feeder systems, but not necessarily. Is a return or benefit to a department more or less important than a return to the organisation? Which systems should be paramount or developed first – the department's or the organisation's? What is the minimum data collection set that is required to be common? Again, a number of gaps exist between our present use of information systems and their larger potential returns to the health system.

New South Wales, and indeed Australia, lacks any significant number of capable practitioners with an effective understanding of the three discrete bodies of knowledge required to ensure effective performance in the area of health information systems (comprising health services management, clinical sciences and information technology). There are only two academic institutions currently addressing this deficiency (Central Queensland and Charles Sturt) and it will be some time before there are sufficient graduates to make any impact on health information systems. Cartwright et al. (1994) discuss the nature of one approach to the development of this emerging practitioner. Health service executives have not moved sufficiently to address the managerial issues involved because of the narrow technical and centralist approaches that have been adopted in developing and applying information systems. Our ability to apply information systems to the real problems rather than for reporting purposes is compromised by the relatively narrow abilities of information system managers.

Understanding information systems

In the absence of a widespread knowledge of information technology and systems, there has been a tendency in health care services to abdicate responsibility to the 'experts'. There has been an underestimation of the need to *tailor systems to specific organisations and to recognise the personal and organisational development required to achieve significant organisational returns.* Some effort to understand the development of specific applications is important to appreciate their inherent strengths and weaknesses. The problems they were intended to address in their development may or may not be the same problems faced in all organisations.

Laudon & Laudon (1995, p 8), using the simple analogy of housing, emphasise the distinction between information technology and information systems.

> *Houses are built with hammers, nails and wood, but these do not make a house. The architecture, design, setting, landscaping, and all the crucial decisions that lead to the creation of these features are part of the house and are crucial for finding a solution to the problem of putting a roof over one's*

*head. Computers and programs are the hammer, nails and [timber] of [a Computer-Based Information System], but alone they cannot produce the information a particular organisation needs....To understand information systems, one must understand the problems they are designed to solve, their architectural and design elements, and the organisational processes that lead to these solutions. **Today's managers must combine computer literacy with information system literacy** (emphasis added).*

Information systems in health care are required to be complex, reflecting the complexity of the processes of health care delivery itself, but the analogy holds. Health information systems must consider design and use considerations paramount to the hardware and software specifications. The respective roles of the central organisation and the area health services need to be clearly understood and the information required to manage or address problem situations at the various levels differentiated. If there is a lack of understanding of the problems that need to be addressed within an organisation or department, a system that facilitates reporting for central purposes is unlikely to meet the requirements of a departmental or organisational user. An application of computer technology to an information system should be an organisational and managerial response to a challenge posed by the internal or external environment. It should be a strategic managerial response (as discussed by Mintzberg 1994) rather than a strategic planning response.

The capital investment in information technology needs to be congruent with the time required to achieve personal and organisational development. The perceived technical and financial attractiveness of upfront economies in the installation of information system packages developed internationally for specific purposes in different health system environments is to the detriment of real returns. The New South Wales Health Department has recently withdrawn from its use of First Data Corporation (formerly Gerber Alley) core clinical systems in a number of pilot sites despite a substantial investment in the systems.

Have we achieved an appropriate return on the investment of the hundreds of millions of dollars already spent on information technology and systems? The dollar amounts of investment in information technology are large, although as a proportion of expenditure not as large in health care as in other Australian industries or, indeed, within health care internationally. Johnstone (1995) has recently used Nolan's model of stages of growth in technology within organisations to comment on technology-driven change within Australian health care. One of Johnstone's conclusions was that a comparison between levels of current expenditure and stages of growth between Australia

and America was largely one of an immature level of development versus a maintenance stage of maturity, and hence fraught with problems. The level of Australian investment needs to be adjusted to achieve the performance objectives within the time lines suggested.

Integrating information and learning

The focus in New South Wales has been largely in the technical domain, with an emphasis on computer science over and above operations research and management science. At the federal level, operations research has largely driven the development of the AN-DRG grouper and the refinement of casemix funding strategies. Smith (1995) discusses a number of approaches to the strategic planning of health information management systems which tend to reinforce this technical reliance rather than incorporation of behavioural elements. The products of this rationalist approach to problem-solving still need to be embedded within organisations to achieve the intended results. At a State level, we need to shift more towards a consideration of the behavioural issues involved, recognising that information is continually being created within social constructs.

Davies & Ledington (1991) assert that learning and information are mutually dependent, and that managing information is a process we do all the time in the ordering and renegotiating of our realities. Information management is not just a series of technical steps which will move to an easily identifiable solution, but understanding the situation will lead to a choice of appropriate and acceptable management processes. Information management is about managing a learning process and approaches to information management must allow for designs to unfold which can then be the basis for further information management. We need to understand people when dealing with information management to better understand the role of information technology in the management of information (Davies & Ledington 1991).

A learning organisation

There have been a number of information systems developed for use within New South Wales Health, but there does not appear publicly to have been a systematic, objective or independent evaluation of those efforts. The Welsh Office demonstrated some conviction in the commissioning of its approach to the Clwyd Resource Management Project. The Welsh Office commissioned the University of Manchester's Health Services Management Unit in conjunction

with CSL Healthcare Management to undertake the evaluation. The choice of both formative evaluation (defined by Thomas (1992, p 74) as comparing 'program goals with program performance resulting in either modification of the program and perhaps the program goals' with a developmental approach) and summative evaluation (an assessment of the achievement of the original or overall objectives of the project, without any suggestions as to how performance might be improved) was taken to assure the ultimate success of the project.

A summary of some of the learning points from the third report on the Clwyd project that relate to the issues and gaps identified earlier in this paper about the need to integrate information systems shows that there needed to be:

- a *broad vision* about how the technology and organisation were expected to interact

- a sufficient number and range *(early critical mass)* of clinical professionals involved at an early, definitional stage of a project to ensure a full understanding of the implications of the decisions being made

- provision of *specific organisational development* skills

- a formal, structured and corporate business *planning process* to establish objectives

- a nurturing of, and an ongoing effort to sustain, an initial mass of *key supporters at all levels* of the organisation

- an acknowledgement of the need to change ways of working (in the hospital and with other local staff such as general practitioners), reinforced with obvious, early and *planned-for benefits*

- specific identification in the project's management of who was *responsible and accountable* for identifying and realising the *benefits* as envisioned

- a *specific vision* developed for each site of how its *integrated information systems* could work, including planned efforts to sustain this understanding by helping staff appreciate the wider issues, the practical consequences and benefits of the project (Health Services Management Unit & CSL Healthcare Management 1993, p 16).

Clwyd used an *incremental* approach to developing a Hospital Information System and the feasibility of linking a Patient Administration System and Order Entry/Results Communication (OERC) systems to existing departmental systems. Experience highlighted the need to involve suppliers of existing systems to gain their commitment to the project, preferably through on-site technical expertise (Health Services Management Unit & CSL Healthcare Management 1993, p 18). The project also demonstrated that some

junior doctors might not have perceived the increased efficiency of OERC as of critical value to their jobs, and this was linked to both hardware and systems issues *(clinical acceptance)* (Health Services Management Unit & CSL Healthcare Management 1993, p 19).

In assessing the benefits to date, the financial appraisal identified the *main benefits* to be operational and managerial returns from the Patient Administration System. This system was estimated to produce a four- to five-year payback, but *neither* the *OERC nor casemix* had produced a sufficient financial benefit during the evaluation period to *justify routine investments* (Health Services Management Unit & CSL Healthcare Management 1993, p 24).

Conclusion

To return to some of the questions posed earlier. Are we maximising the return from our investments in technology? The answer is most likely no. Does information technology resolve the problems or problem situations we wish to address? The answer again is probably no because it was introduced for reasons other than the managerial issues we would like to address now. How has information technology affected management practice? Given the lack of personal and organisational development to accompany the progress in technology developments, the impact has not been pronounced. Information technology and systems are only tools. Their effectiveness depends very much on the way in which those tools are used.

How then can we improve our situation? Do the lessons from Clwyd apply to an Australian context? The findings from Clwyd seem to be remarkably sensible and possibly obvious but, in a well-resourced and scrutinised project that was both formative and summative in nature, difficulties continued to occur in implementing the integrated information systems, reflecting the impact of the socio-cultural-political dimensions involved. These behavioural dimensions are significant to the realisation of any benefit, let alone success, of technological developments. The process of preparing an organisation's information strategy before procuring either hardware or software; the recognition of organisational and personal development that needed to precede and at worst parallel the implementation of systems; the need to identify and assess the realisation of benefits to justify not only the recurrent system costs but also the capital; the early involvement of clinicians; and the tailoring of software acquisitions to the organisation's systems are some of the learning points we could benefit from. Referring back to the Australian examples of Mudaliar (1995) and Manson and de Silva (1995), some of the indicators which lead to the success of small-scale

systems correlate with the suggested approaches to organisational systems identified at Clwyd.

Successfully implementing advances in information technology requires much more than investment in hardware and software. The cost–benefits of the potential clinical and managerial gains need to be offset by changes in work practice and demands placed upon clinicians and others required to enter data. There is already a huge cost associated with the collection and storage of data that will never be anything else. Management needs to be able to interpret and act on information, and what key information needs to be collected to achieve performance gains in service delivery or management should be determined before information technology is introduced. Organisational design and behavioural requirements for successful information management implementation need to be planned and factored into any development. The implementation of technological advances should flow from managerial advances rather than the reverse.

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