Research Paper ■

Information Technology in Complex Health Services: Organizational Impediments to Successful Technology Transfer and Diffusion

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Abstract **Objective:** To identify impediments to the successful transfer and implementation of packaged information systems through large, divisionalized health services.

Design: A case analysis of the failure of an implementation of a critical application in the Public Health System of the State of New South Wales, Australia, was carried out. This application had been proven in the United States environment.

Measurements: Interviews involving over 60 staff at all levels of the service were undertaken by a team of three. The interviews were recorded and analyzed for key themes, and the results were shared and compared to enable a continuing critical assessment.

Results: Two components of the transfer of the system were considered: the transfer from a different environment, and the diffusion throughout a large, divisionalized organization. The analyses were based on the Scott–Morton organizational fit framework. In relation to the first, it was found that there was a lack of fit in the business environments and strategies, organizational structures and strategy-structure pairing as well as the management process-roles pairing. The diffusion process experienced problems because of the lack of fit in the strategy–structure, strategy–structure–management processes, and strategy–structure–role relationships.

Conclusion: The large-scale developments of integrated health services present great challenges to the efficient and reliable implementation of information technology, especially in large, divisionalized organizations. There is a need to take a more sophisticated approach to understanding the complexities of organizational factors than has traditionally been the case.

■ **J Am Med Inform Assoc.** 1997;4:112–124.

Throughout the world, health service organizations are searching for ways to constrain the costs of providing an ever-increasing range of services. One approach is the development of large-scale, integrated organizations that offer the benefits of coordinated care and more effective monitoring and enhancement of clinical practices; processes in which information technology (IT) is expected to play a vital role. However, information systems themselves are costly, and risks can be high. There is considerable evidence that the implementation of large-scale information systems is extremely difficult to achieve, with failure rates of 30% or greater reported.[1–3] It is therefore essential that the technology be implemented reliably and economically.

Many health organizations are turning to package solutions because technology transfer appears to be a lower risk alternative to homegrown technology in-

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Received for publication: 9/24/96; accepted for publication: 11/14/96.

novation. Packaged solutions are particularly attractive to large organizations with a divisionalized structure made up of many similar sub-units.[4] There are potentials for cost saving on bulk purchase and standardization of data and procedures.

However, little attention has been paid to the considerable risk arising from the organizational context. Effective technology transfer often requires adaptation of work practices, invention, reorientation, and organizational change far beyond what is initially apparent. This is particularly true for knowledge-intensive activity such as medical practice, especially when the organization is large. Usually, in such organizations, the various units have a substantial degree of autonomy, and work habits and professional practice are deeply ingrained and expensive to replace. Large organizations are often divisionalized, combining central control with decentralized autonomy. This creates a tension between central interests in uniformity and local sensitivity to operational priorities. This tension particularly affects information technology. In organizations that typically have strong central control, such as banking, IT is usually uniform and centralized. In health services organizations, where strong peripheral initiative is allowed or even encouraged, there is much less central control and some diversity of practice. Attempts to achieve common systems that are sensitive to operational needs present basic problems. In the British National Health Service, decentralized IT structure was adopted in line with a decentralized provider framework, but problems with fragmented information systems have recently prompted a change to more centralized standards.[5]

The task of transferring information technology in large, complex divisionalized organizations reliant on highly professional workers such as doctors presents a particularly difficult challenge. Much more is needed to be known, particularly in terms of the organizational factors. This paper explores two aspects of such transfer:

1. Transfer of a proven technology from different operating environments
2. Diffusion of technology throughout a divisionalized health system. (Diffusion, as used here, refers to the internal transfer of technology through an organization.)

These two issues have been researched through a case analysis of a project to implement a packaged clinical information system from the United States into the state public health system in New South Wales, Australia. The first stage was to implement, simultaneously, three core systems: financial, pathology and patient administration (PAS)/clinicals. Although all met with considerable difficulty, the first was fairly extensively implemented, the second had substantial success, while the system that was central to the strategy—the PAS clinical system—was completely withdrawn after being tried in several pilot sites. The approximate costs of the clinical system in equivalent United States dollars was $11 million in hardware, $6.4 million in licenses, and $9 million in implementation and interfaces. With the hardware retained, and some benefit gained from the implementation, the overall loss is estimated at $12 million.

This case study does not intend to be an exhaustive review of either the technology evaluation or management literature nor an analysis of the medical informatics aspects of the systems being implemented. It attempts a detailed analysis of one significant failure in technology transfer using a specific conceptual framework as a way of gaining greater understanding of the complexity of the process. The focus, therefore is not on the technology itself nor on those components of the project that were implemented with partial success, but on identifying the significant elements that led to failure of the most important component of the core system that was being implemented.

This study focuses on the experiences with the PAS/clinicals system, analyzing many of the difficulties the project encountered. The analysis highlights the importance of the fit of the organizational configuration in managing the transfer and diffusion of technology, specifically organizational strategy, structure, management processes, roles and skills. It contributes to an understanding of IT transfer and diffusion in health by introducing the idea that for successful transfer the organizational contexts of successful implementations and the new target should be compatible. It demonstrates that without a tight organizational fit, the diffusion of IT will be problematic and expensive and will require close management attention.

Conceptual Framework

There are two major conceptual approaches to the study of technology transfer relevant to the situation to be described and explained here: innovation/diffusion theory and configurational theories of IT-organizational fit. Innovation/diffusion theory was developed to explain the acceptance or otherwise of product innovations by consumers.[6] Its central focus is on the utility of the innovation to the individual consumer. While its findings are often transferable to organizational innovations such as new health technologies, in common with the attention to user acceptance in medical informatics its analysis remains

firmly rooted at the level of the individual user and hence only tells part of the story of technology transfer and diffusion.

Theories of IT-organizational fit have been developed to provide a better understanding of the full range of organizational factors affecting the strategic application of IT.[7] They see IT as one key component of the wider organization. The case described here sought to achieve strategic gains through a major IT strategy initiative. While innovation/diffusion theory is relevant to certain aspects of the case, this paper focuses on the IT project in its wider organizational context. Consequently, we use IT-organizational fit as our analytical framework.

The concept of fit has a well-established place in the IT literature.[8] Researchers in IS/IT have extensively explored the bivariate fit of IT to its organizational context.[9,10] In this bivariate form, constituents of context include technology, task, strategy, structure, management processes, individual roles and skills, environment, culture, and size.[7,11–13] Unfortunately, this approach to fit has often been interpreted to mean that systems should be developed and implemented for one aspect of the existing state of the organization rather than that IT and the whole organization should be managed in a mutually complementary fashion. In models of IT based organizational transformation, it has become common to adopt a configurational approach to fit.[14,15] A popular model which includes both internal and external elements of fit is the MIT'90s (Fig. 1). Externally, the organization's strategy must be appropriate to its market or industry environment. Internally, IT must fit a configuration of organizational components including business strategy, organizational structure, management processes, and roles and skills. A tight internal and external fit is necessary for sustained high performance. The logic by which internal fit achieves high performance is the logic of the configuration. In a tight fit the coherence of the configuration is clear to all organizational members so that they can readily see what needs to be done with less attention being required to manage and control day to day operations and organizational change.[16] In practice, IT configurational fit has been operationalized through two particular approaches to managing. The first is *IT strategic planning*.[17] The thrust of this has been to use planning processes to ensure that IT plans match strategic plans for the business and hence that what IT does is consistent with business priorities and initiatives.

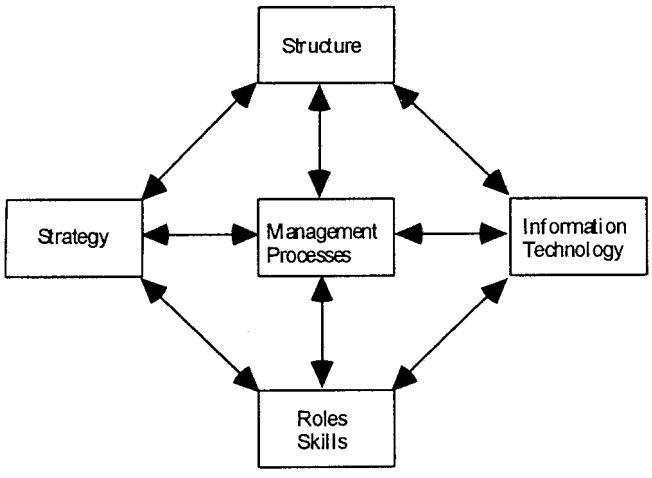

Figure 1 IT-organizational fit framework (MITO90s; adapted from Scott Morton 1991).

The second approach has been based on organizing to achieve *strategic alignment*.[15] Alignment is a more powerful approach than strategic planning in that it tries to tie IT performance more closely to business needs throughout the corporation. Instead of relying on planning processes which are only loosely coupled to performance, strategic alignment involves configuring the organization so that IT is strategically, structurally and managerially aligned to the business strategy, structure, and management processes. The principle of strategic alignment is that IT should be managed in a way that mirrors management of the business.

Strategic alignment may be best understood in the context of the *federal structure*.[18] Figure 2 depicts this structure for a multidivisional organization. In the federal design, there is a structural fit between IT and the business because IT is located at all levels of the organization close to the business units it serves. In addition to structural fit, strategic alignment also requires that IT be managed according to processes that ensure consistency in direction and incentive between business and IT priorities at all levels and between all levels. In principle, in an aligned organization IT will add strategic value for the business.

The configurational approach to IT-organizational fit is helpful to explaining technology transfer and diffusion in two different ways. In the case of technology transfer, it permits us to compare the organizational fit of the technology in existing implementation sites with the anticipated configuration at the target site. The configurations can be compared for compatibility, as Johnston and Yetton[19] have demonstrated in the case of the merger of two organizations. In the case of diffusion within a multidivisional organization, the organizational configuration can be analyzed in relation to the technology. The degree of fit or lack of fit of the technology with the organization can explain the ease or difficulty of managing the diffusion process.

Research Methodology

The central purpose of this paper is to demonstrate the applicability of the configurational theory of IT fit for explaining problems in the transfer and diffusion of IT systems in health. A case analysis is therefore highly appropriate, since a case can serve the purpose of exemplifying theory application. It has the further advantage of demonstrating *why* the theory is useful by making causal relationships transparent.

The field research was conducted between February and June 1996 by the three authors. Data collection involved interviews and document review. Public service organizations typically maintain high levels of documentation, which they file systematically. In this case, the sponsor provided the researchers with an office in which the relevant files were housed. This allowed the researchers to make several return visits after initial document review and during the interview process so as to triangulate data and emerging interpretations.

Interviews were conducted with staff from all the relevant organizational locations within the New South Wales (NSW) health system, including the central Department of Health and five pilot sites. It also included staff from the vendor and staff who had since moved to new employment. In total, 64 people were interviewed. Interviews were tape-recorded and transcribed when possible. Detailed field notes were also taken. Whenever possible interviews were conducted by two researchers with a single interviewee; this was found to improve the comprehensiveness of the data collection, and to provide a validity check on interpretations. There were a few group interviews, and some by telephone. Face-to-face interviews lasted between 45 minutes and 3 hours.

The researchers maintained a consistent discipline of sharing the data collected from document review and interviews, holding two hour meetings fortnightly during the data collection process and in between communicating new developments by e-mail. This enabled a continuing critical assessment of progress and permitted the researchers to conduct follow-up where necessary. Data and interpretations have been checked with NSW Health through an interim report, a final report of 50 pages, and through two staff presentations.

Case Description

Background

New South Wales is the most populous state in Australia, with over 7 million people in an area larger than Texas. Sydney, the state capital, has over 3 million people. Health services are dominated by the state-administered public health service, providing integrated hospital and community services to the population. It is a large operation, with a budget of approximately $5 billion (US) and around 100,000 employees. The cities boast a number of large, highly specialized hospitals, and there are a range of units down to quite small rural institutions. Medical staff are mostly contracted, although there are a substantial number of salaried staff specialists in the major hospitals. Services are normally provided free to the population. A smaller private health system also exists alongside the public system, supported by an insurance industry. General practitioners are principally supported by federal funding.

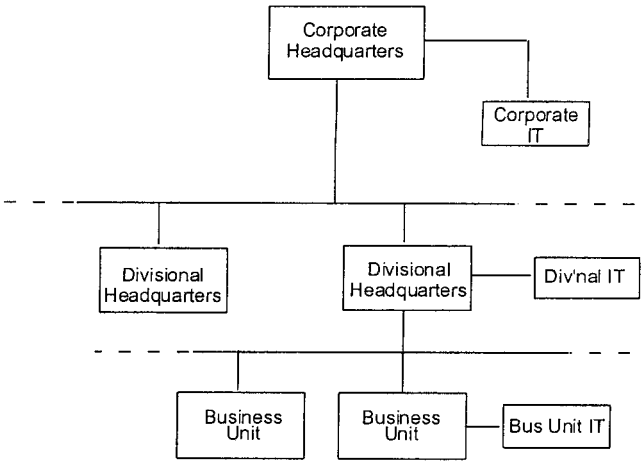

Figure 2 The structure of the federal model for managing IT.

The health system has a geographically divisionalized structure. Its chief executive is the Director-General who reports directly to the NSW Minister for Health. A central Department of Health reports to the Director-General. It has responsibility for corporate issues, including state wide funding and policy. Provision of hospital-based care is the province of the Area Health Services (AHSs) and rural Districts (for simplicity we refer to them all as Areas in this study). Area chief executives and their boards report to the Director-General but have a significant level of independence in respect to the organization and provision of health care services in their geographic area. Areas typically include one large teaching hospital and several smaller community care units. The hospitals have the form of a professional bureaucracy in that clinical staff, especially medical staff, act with a considerable level of autonomy.

Management of IT within the NSW health system conforms to the federal structure (Fig. 3). The department

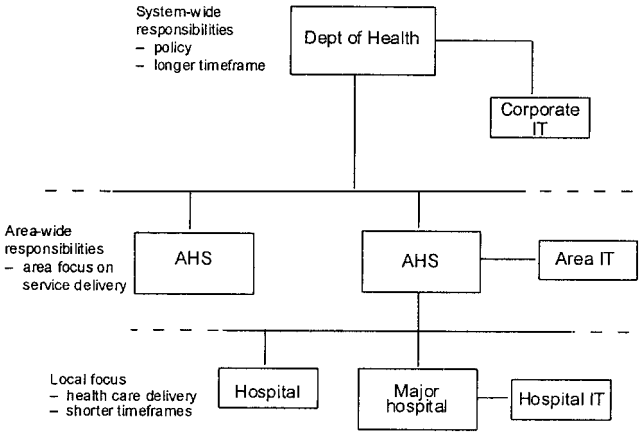

Figure 3 Federal structure applied to IT at NSW Health.

has a central information management group, which establishes technical and information standards and manages the state IT strategy. In the past it has funded a considerable amount of hardware and has written a number of core applications which have been implemented in most Areas. Areas also have IT staff who maintain local operations, support software, develop smaller applications and provide policy support for their own administrations. Some of the hospitals also had their own centres of expertise.

With this structure, the NSW health system has been able to take advantage of economies of scale in providing core systems. At the start of the period covered by this case study (1989–1995), many basic administrative and clinical IT services had been developed over the previous decade, and many institutions relied heavily on them. However, there was considerable dissatisfaction with the capabilities of the existing systems. They were not very flexible and were not able to provide the management information required or the sophistication of the clinical services that were being demanded. A number of the larger Areas had already built supplementary applications to meet their own special needs.

The New IT Strategy

In 1989 a new strategy was embarked upon; its objective was better resource management. There was pressure to contain costs, and because the funding came from the public purse, the political imperative was to retain existing services and develop new ones where possible. A new minister of health felt that better information was needed to enable the proper management of the health system. It was also believed that the technology would streamline operations and help clinicians provide better services. At the same time, there was an increasing awareness that the federal government might impose new reporting requirements, using case-mix. This reinforced the need for a new IT strategy.

A group of IT strategists based in one of the hospitals had for some time been arguing for the purchase of a "state-of-the-art" system. When a major consulting company conducted an IT strategy formulation exercise, it recommended the purchase of a new suite of systems, starting with financial, pathology, and clinical applications. A "best of breed" policy was adopted to select the best system available in each of these areas, with an integration strategy to link these systems. This strategy was argued in terms of economy, in relation to both the costs of development and the economies of scale in a state-wide implementation. The advice was adopted, and a sum of over $110 million (US) was allocated, with further internal funds added at a later stage. The intention was to support both more effective clinical care and better management information. The "best of breed" policy made effective integration a crucial element in gaining the benefits. The program was overseen by an Information Services Steering Committee consisting of policymakers, CEOs of involved Areas and IT specialists.

Accountability was to be the hallmark of the selection. A request for tenders was issued internationally, and a search team toured to find what was available. Applicants were screened to form a short list. With the final short listed offerings, a set of scenarios was established, and the systems were trialed with set-piece scripts. Vendors were given only a limited time to demonstrate the capabilities of their systems. Great care was taken to ensure that each system was trialed under the same conditions and judged by the same criteria. The short time-frame for the project excluded any substantial consultation, but the selection team of central policymakers and site IT specialists included doctors and managers.

The selection program was considered rigorous, and the systems finally chosen were generally agreed to be the best available systems that met the criteria. The PAS/clinical system in particular had been implemented in approximately 100 sites in the United States and in several in Europe. Its principal functions were patient administration, records management (but not electronic medical record), order communication (order entry and results reporting), and clinic scheduling. It also had a general report generation facility.

Over the next year, contracts were drawn up and signed. During that time, the Area administrations had been invited to bid for the opportunity for participating in pilot site trials of the system. Funding was to be shared between the central department and

the sites: one third from the central department, and two thirds from the Area, half of which was to be a loan. The incentive for participating as a pilot site was that other Areas would have to pay a considerably greater portion of the funding. However, despite this support from the Department, the Areas were reluctant to make the commitment required. They were under continuing financial constraint, and management had little basis to assess the cost-benefit of the system. The Department had to increase its contribution to 80% before the Areas would agree to participate in pilot studies.

Implementing the PAS/Clinicals System

The PAS/clinicals system was to be tested in three different types of site: a major metropolitan hospital, a major rural hospital, and a group of hospitals. The last was to demonstrate that the system could integrate a number of institutions within an Area. As the program proceeded there were concerns about the integration strategy. None of the three pilot sites was also a pilot for both the pathology and financial systems. To demonstrate the viability of this integration they engaged two further pilot sites in which the integration strategy could be tested. These sites were two major metropolitan referral hospitals. There were now five pilot sites.

The vendor worked directly with the pilot sites to implement the system and had the responsibility of achieving successful implementation given a certain support infrastructure from the sites. The implementation commenced with a ''localization'' process to adapt the system to Australian, and specifically NSW, conditions. Both the vendor and the Department wanted to minimize these changes to enable a rapid implementation, and they intended that the sites would adapt their operations as much as possible to fit in with the system. The vendor, in addition, wanted to retain the integrity of their common international system. However, the sites took a very different approach. They had not been party to the development of the strategy and had had little involvement in the selection of the system. Further, they had little besides sales presentations on which to base their expectations. Their priority was to ensure that the system would serve them effectively. When they saw the system, they found a considerable difference between what the system provided and what they considered they needed. The sites argued for more changes than the central IT staff and the vendor wanted. The result was a continuing conflict between the centre and Areas, the resolution of which required compromises on both sides. The sites were also disturbed by the cost of many of the changes. Making the bulk of these changes delayed the project by a year. Because of the compromises that had to be made in the changes requested, there were still substantial deficiencies that had to be worked around.

The concepts of benefits varied considerably. The original strategy was based on a very general benefits definition. The sites were expected to justify their pilot proposal with a more detailed specification of benefits. This was done by each site independently, as their proposals were competitive. These benefits were defined both in general terms and by many specific details. However, under the pressure of implementation, little attention was paid to these original benefit definitions.

Implementation was undertaken in a number of stages. The first was the patient administration system (PAS) which handled the registration, admission, and transfer of patients, as well as medical records and sundry other tasks. Other stages were the order communication system (OC) handling clinical order entry (OE) and results reporting (RR), and the clinic scheduling (CS) systems. The PAS system was the basic module on which the others depended, but it was not expected to provide functionality that was not already substantially provided by the existing system, apart from functionality in areas such as outpatients. It was the order communication and the clinical scheduling systems that were expected to provide the main benefits through improved management information and clinical support.

The implementation of the PAS generally went off successfully, with the rural hospital going first, and one of the hospital group, a medium-sized metropolitan hospital, going several months later. There were teams of people allocated to the programs, and it was undertaken with considerable attention to training and the preparation of manuals. Some members of the teams were very stretched, but there was a high level of dedication that pulled them through. The people involved were mainly full-time staff of the hospital, and they felt themselves committed to making it work. There were some significant benefits with the improvement of admissions processes and greater involvement by the nurses in managing patient movements. There were, however, significant problems. Training requirements were substantial, and there was difficulty in getting time off for nurses to undertake training. Not all nurses were able to adapt to the use of the computer, which created an extra load for the other staff. There was a continuing need to train new staff and update staff for system changes. The report generator was not suitable for managers to use, and they had to wait on programmers to write the reports

that they wanted. There were also problems reported in the consistency of the data concerning bed allocations and active patient lists. Nevertheless, the PAS system was installed in four of the five hospitals and was considered to be operating successfully.

The order communication system turned out to be a very much greater challenge. There were two major reasons for this:

1. Order entry required a substantial involvement of medical staff.
2. The principal gain for clinicians lay in the reporting of pathology results. This required an effective integration with the pathology system.

In the existing procedures, medical staff had to sign all orders on paper forms. The forms were then conveyed to the relevant department for action. The forms had the patient name on a sticker, and the clinician's task was merely to name the test, note any clinically relevant details, and sign it. This could be easily done at the patient's bedside during rounds. There were, however, problems in delays and in the legibility of the orders.

The new system involved the clinician entering the test directly into the computer using an electronic signature. The clinician, then, had to go to a terminal and enter the test by using the OC system. The system was considered rather user unfriendly by the clinicians. They had to pass through four levels of log-in, some with rather obscure passwords. The screen navigation system was complex, with nonintuitive commands and a variety of confusing shortcuts. There were up to 11 screens and up to 43 key strokes required to order 1 test. Despite promises, the link with pathology had not been achieved in most hospitals, so the bulk of results were not getting through to the sources immediately. There was no connection between order entry and results reporting, so the clinician could not assess the past results while ordering tests. Further, the character-based screens seemed antiquated in comparison with Windows-based systems which some clinicians were familiar with.

A task that previously took about 20 seconds was now taking several minutes and was causing considerable frustration. It took a lot of time for people who used it frequently, and it was difficult to master for those who used it infrequently. There did not appear to be any significant gain for medical staff, and any gain that could be argued was mainly in enabling management to monitor clinical activity. Given the continuing financial constraints, medical staff members were not sympathetic to the expenditure of funds on these systems nor of the burden of learning and operation it placed on them.

To make matters worse, some hospitals already had reasonably effective results reporting systems, so clinicians were actually losing functionality.

There were three types of medical staff involved:

1. Staff specialists. These were the only doctors who were actually employees of the hospital.
2. Visiting Medical Officers (VMOs) were specialists who were contracted by the hospital to treat patients. Many ordered tests only on an occasional basis when assistance was not available.
3. Resident Medical Officers (RMOs) were trainee doctors who rotated amongst the hospitals. These staff carried out most of the ordering and were generally too hard pressed to involve themselves in planning.

Most medical staff were very busy and had limited time to undertake training. Some had high expectations of information technology, and those who were computer literate were familiar with the conveniences of a Windows-based interface. It was not too surprising, therefore, that there were strong complaints by medical staff, leading to collective protest in several cases.

Other modules were having difficulty. In particular the clinic scheduling system had been declared inadequate for major hospitals, and an alternative was being sought. There were operational problems as well. Technical staff found the system very cumbersome. It required 24-hour, 7-days-a-week support and it had to be taken down about 1 hour each day. They found it difficult to get adequate documentation on the system, or to get reasonable explanations for the problems that they were experiencing. They also found that data storage was complex, confusing, and redundant. Overall, they found themselves very dependent on the technical support from the suppliers in the United States.

Despite all these problems, there were significant successes. Some departments, such as radiology and allied health had much improved order delivery, and they much appreciated the legibility and the timeliness of the orders. Orders could be placed at any computer in the hospital and small clinics were also able to use the clinic scheduling system effectively. Some innovative centres were able to use the management reporting system to extract useful analysis. By adapt-

ing the allocation of some of the fields, useful information on clinical services was also available.

Of the four sites that implemented PAS, the first of these, the rural hospital, implemented the OC for a period of 15 months and the second, a smaller urban hospital, implemented it for 6 weeks. The clinic scheduling system was implemented only in the rural hospital. There were other partial implementations as well. However it was only the rural hospital which had implemented all the principal systems and realized most of those benefits that were achieved. This site was considered by many to be a success.

As the program proceeded, the level of dissension gradually increased. In particular, medical staff were becoming more resistant to having to use the system. Managers saw continuing maintenance and support costs and little evidence of cost savings or the resolution of the problems. Finally, with a change in state government, it was decided to withdraw the system. Although the rural hospital would have liked to continue, a single implementation was not commercially viable. Fortunately, the previous system was still available and had been upgraded to provide most of the critical functionality, so the hospitals were able to adopt this system with relative ease.

The losses were substantial and took several forms. There was the financial cost, the delay in the strategy with opportunity costs, and the considerable distrust generated in central IT initiatives. There were significant assets retained, however, in communication infrastructure, hardware installed, and computer familiarity among the staff. There was also much learned about the complexities of large-scale implementation, particularly in terms of organizational issues, and about the organizations themselves.

Analysis

In this analysis we concentrate on the organizational issues which emerge from the attempt by NSW Health to transfer a proven clinical OC system from the United States to Australia and on the organizational reasons why diffusion of the technology through a number of sites in NSW proved difficult to manage. Technology transfer is analyzed by using the elements of the organizational-IT configurational framework described earlier to assess the compatibility of the organizational configuration in NSW with a typical organizational configuration in the US health sector where the system has been used successfully. Diffusion of the technology is analyzed in terms of the problems of internal fit of the NSW Health organizational configuration.

Transferring an Established System From Another Country

Despite extensive implementation elsewhere in the world, and despite being selected for its functionality, the system proved not to transfer successfully to the Australian environment. However, those parts of the system that were implemented actually functioned. The difficulties were essentially due to issues that were organizational, rather than technical. These issues arose from the different business and operational environments of the USA and NSW health industries. We compare business environments and strategies, structures, management processes, and roles. The technology we considered to be the one invariant.

Business Environments and Strategies

The United States health sector in which the system was proven is predominantly private. Conditions of competition in the United States health market are strongly influenced by the health insurers, who require that costs be charged against individual patients. There is therefore a business imperative for having systems that permit incurred costs of each patient to be traced. In NSW, there has not previously been a business imperative to track costs in the same way. Most costs have been covered by bulk subventions from the public purse. More recently, there had been increasing expectations that more detailed cost data would be readily available. However, the overriding imperative for NSW was cost control rather than cost allocation.

Organizational Structures

There also is a major structural difference between the US and NSW environments. For a health system with a common IT policy, the NSW system is very large by world standards. The Areas are structured in very different ways because of their different geography and demography. Some Areas have a large general hospital of up to 800 beds with a wide range of sophisticated specialities. Large specialty outpatient clinics are involved. Specialist doctors tend to place particular demands on information systems and new standards of customer service place complex demands on the scheduling of outpatients, requiring the coordination of the patient with the various professionals involved together with support services such as interpreters. By contrast, the hospitals in which the system had been proven in the United States were typically smaller, private hospitals which were not so specialized.

Strategy-Structure Pairing

The strategy-structure pairing in NSW imposed further demands on the system which were not present

Table 1 ■

Contrast Between Organizational Configurations for Successful OC in US and Unsuccessful Transfer to NSW

	US	NSW
Business environment	Private sector, insurers pay	Public sector, public purse pays
Strategic focus	Competitive pricing based on costs	Cost control
Structure	Smaller, loosely linked chains of smaller hospital units	Multi-divisional with large hospital units and Areas with related units
Management processes	Cost allocation to individual patients' physicians as customers	Block funding, contract system for VMOs, rotation of RMOs
Roles	Differentiated clerical and clinical	Undifferentiated clerical and clinical

in United States sites. The strategic cost control focus in the context of such a large multi-divisional structure meant that the government and health managers wanted state-wide and Area-wide benefits from the system. The state-wide benefits were to come from better resource allocation as a result of better information about expenditures, but this could only come from integration between the PAS/clinicals system, the pathology systems, other clinically related systems and the finance system. The Area wide benefits were to come from integration of data across the several institutions in a single Area. The combination of these systems was without precedent in successful applications of this system in the United States. Hence, the different organizational conditions in NSW led to a focus on benefits to be gained from *integration.*

Management Processes-Roles Pairing

In the United States, a crucial condition for successful use of the OC system was a differentiation of roles; clerks were employed to carry out data entry. Physicians are important customers in that they bring patients to the hospital, and are thus insulated from such demands. Thus, the ability and preparedness of the medical staff to navigate multiple data entry screens has been irrelevant. In NSW, there are no such differentiated roles, and medical staff were required to enter the orders. However, clerical work is marginal to doctors' main role in health care. With pressure on them to maximize the use of their professional skills, usability of the system became a highly salient issue in a way which it was not for clerical staff for whom data entry was their organizational raison d'être. System use for medical staff thus became an additional burden rather than a transparent replacement for order entry by pen and paper. Management processes, specifically human resource management, had been established to staff the hospital system with a large proportion of VMOs who simply did not use the system with sufficient frequency to become fluent users. As a result of another human resource management policy, the RMOs, whose constant work on the wards gave them regular need to use the system, were rotated out of pilot sites before they could become fluent users.

Summary

Table 1 summarizes the differences between the organizational configurations in NSW and the United States. Difference, however, does not imply incompatibility. The incompatibility lay in the organizational impossibility of NSW Health either gaining clinical acceptance of the system despite its shortcomings or, alternatively, of adopting the American way of operating the OC system. The NSW human resource management processes prevented easy acceptance by clinicians. The NSW strategic focus on cost control meant that it was not organizationally or politically feasible to introduce a clerical role similar to that in the American hospitals to deal with order entry because of the high costs involved.

Thus, despite successful implementations of the system in other countries, this particular system proved more difficult to transfer to NSW than was anticipated. Our analysis shows that the reasons lie in the very different kind of organizational configuration in NSW. The system was not required to carry out different functions so much as to serve different organizational purposes within a broader organizational strategic context which precluded emulating successful organizational conditions overseas.

Technology Diffusion in a Large, Divisionally Structured Health Organization

The factors that prevented the technology from transferring successfully provide one explanation of the failure of the technology to be successfully diffused throughout NSW, although these factors were not fully recognized for 5 years. During that time there was some diffusion of the technology but it proved a problematic process and by no means were all the problems derived from the difficulty of technology transfer. There is something to be learned from this experience about the management of the diffusion process. Analysis in terms of the organizational configuration of NSW Health demonstrates how problems of organizational fit cause problems in managing diffusion.

In principle, the system could have been expected to

serve NSW Health's strategy successfully because it was the outcome of an IT strategic planning exercise and because IT management was structurally aligned to the organization in a federal design. The following analysis shows that this was not enough; the whole organizational configuration was not in a tight fit, and consequently the whole diffusion process became difficult to manage.

Strategy-Structure Fit

The 1989 IT strategy was derived from a vision that arose from one of the hospitals, but it was formulated centrally and principally served the corporate business strategy in its pursuit of more cost-effective resource allocation. The organizational structure, though, was decentralized: i.e., it was a multi-divisional structure, the logic of which was that the divisions had a high degree of autonomy. The Areas were focused on health care delivery, whereas the corporate center was concerned with state wide policy issues. In this case, the centrally selected clinical system proved not to meet the day to day needs of the Areas. Consequently, they battled to have changes made to the system to meet their needs while the central IT group was more concerned with gaining state wide implementation and hence resisted changes that would delay the project. Thus in this case, because the technology which was selected to realize the central strategy did not satisfactorily meet Areas' needs, there was continuing conflict between the centre and the Areas. Thus the structural alignment of IT did not prevent management difficulties. Although IT was attempting to serve organizational management at each level, there was a conflict between the levels. The strategy was centrally driven but Area and hospital business was locally driven.

Strategy-Structure-Management Processes Fit

The tensions between the central strategy and the decentralized structure required some new management processes. In particular, funding processes were required to persuade the Areas and hospital sites to adopt the system. The sites thus had mixed incentives. They were initially asked to make a business decision which required putting up two thirds of the funds necessary for implementation in their site. They saw many of the clear benefits being for the center, and many of the benefits for them as being rather vague. Some thought that there were cheaper ways of getting by, so they were reluctant to commit themselves. The center then had to commit 80% to convince the Areas to move. With this change in incentive, the strategy for the Areas changed. There was no longer the same need to recover costs through realizing benefits. There were, in fact, many benefits such as new equipment, communication infrastructure and computer awareness which were independent of the success of the system. With these secondary benefits arising from the project, it was not actually essential to achieve a successful implementation for the Areas to win from the deal. Thus the funding process, which was a central component of the central strategy, was inappropriate to the decentralized structure.

There was also a conflict between the responsibility of the center and its power to influence the success of the program. The decentralized structure meant that central IT was removed from the implementation activity, and thus had no direct authority to control site implementation projects.

Strategy-Structure-Role Fit

The lack of fit between strategy and structure caused role ambiguity and uncertainty. Despite the involvement of site representatives in the selection and on the steering committee, policy formulation and system selection was seen by the sites to have been conducted centrally. However, the decision to adopt the system as a pilot was a site decision. The strategy being central, the sites assumed that the selection process had evaluated the feasibility of the system for the sites. By contrast, the structure being decentralized, the central IT unit assumed that the sites, in applying for the pilot project, were satisfied of the value of the system. Because of the poor fit between strategy and structure, individuals were unable to correctly infer where responsibilities lay. Lacking a clear definition of such roles, inappropriate inferences were drawn leading to sub-optimal adoption decisions.

Concurrent Systems

The significance of this fit can be highlighted by comparison with the systems (finance and pathology) which were concurrently being implemented. While these did have many problems, the systems were retained. The key difference was that each was dominated by a strong actor (directors of finance and pathology, respectively) who had a vital interest in the success of the system and had significant experience with the technology. For the director of finance, the adoption of the system was driven by the requirement to move to accural accounting. Thus, for these systems, the centralized strategy was much more consistent with the centralized structure of these departments, and the much clearer benefits enabled a stronger focus for the implementation.

Summary

The importance of having a tight fit among organizational components is that there is a logic to the way the organization operates. This logic makes it easier

for all members to anticipate what they have to do and what others will do for them. At NSW Health, this poor fit resulted in conflicting priorities without the availability of any immediate mechanism for resolution. It resulted in the development of special incentive systems which turned out to be counterproductive. It also resulted in role ambiguities with sub-optimal outcomes. This meant that considerable amounts of time and effort had to be expended on managing these kinds of issue either before or after they became a problem. Yet these were not problems of diffusion but organizational problems requiring organizational solutions.

Discussion

Both vendors of health IT systems and their customers can learn useful lessons about technology transfer from our analysis of the NSW Health case. Our analysis has shown the importance of the different organizational conditions from one country to another in determining the feasibility of the technology transfer process. In this case the transfer was from the United States to Australia. However, the principle is equally applicable to technology transfer from Australia or another country to the United States. Moreover, the transfer does not have to be across countries but might be across any boundaries that affect organizational arrangements, such as state jurisdictions. Our analysis clearly highlights the different strategic emphases in public and private health sectors. Configurational theory implies that if the strategies differ then the internal configurations of organizational elements are likely to differ accordingly.

As we noted earlier, difference in organizational arrangements is not the problem—rather, incompatibility is. Determining compatibility requires hypothetical analysis to determine the answer to ''what if'' questions. In short, configurations may be compatible if ways can be found of overcoming differences. Thus in our case if it had been possible to employ clerks to perform order entry for the doctors a major sticking point for adoption by the doctors would have been solved.

As more and more health organizations choose to buy rather than build IT systems, it is important that the lessons of NSW Health's experience be learned. System acquisition is not a solely technical and economic choice. Successful technology transfer requires a pre-acquisition assessment of the compatibility of the target organizational context with that of existing successful implementations. This is in contrast to the tacit assumption made when adopting a ''best of breed'' policy that there is unequivocally such a system. Our analysis suggests that this is a dangerous assumption to make. The system with the best technical characteristics and the greatest functionality might still be organizationally inappropriate compared to a lesser system which is more compatible with the target configuration.

Pre-acquisition assessment is not a task for technical specialists to undertake alone. It requires the assistance of specialists in organizational analysis, particularly in the health industry. Moreover, such specialists will need an understanding of both contexts because often crucial data can be overlooked. For example, NSW Health thought that IT was aligned with the organization because it adopted a federal structure, but this overlooked the fact that the strategy was essentially a central strategy. Configurational frameworks such as the MIT'90s model provide a starting point for conducting such as analysis.

The NSW Health case offers some general lessons concerning diffusion of health IT systems, and some more specific ones for diffusion in a complex, multidivisional organizational structure. Our analysis has not sought to explain the final abandonment of the clinical system project but rather to explain some of the management difficulties which arose while the project continued. The principal lesson of this analysis is that lack of fit in the configuration of the health organization within which the system is to be diffused makes diffusion difficult to manage. In an organization in poor fit, there will not only be inconsistencies in the organizational arrangements, there will also be no underlying logic to ensure that improvized solutions are organizationally appropriate. Consequently, attempts at solutions generate unanticipated outcomes such as delays while solutions are sought, and higher costs as expensive alternative solutions are tried.

Issues relating to the overall organization are not within the scope of IT managers to resolve. The lesson here is for senior general managers at the vice-president level and above who need to appreciate that new IT systems will be difficult to diffuse successfully if the organization lacks a tight fit. In particular, this case has shown that the principal operationalizations of the idea of fit do not work when the broader organizational arrangements and IT strategy are not consistent. Thus, NSW Health engaged in a formal IT strategic planning exercise supported by considerable consultancy expertise, but the creation of a plan was not sufficient to make the strategy implementation manageable. Further, NSW Health's IT was structurally aligned in a federal design, but, because the strategy was central, structural alignment did not facilitate management of diffusion. Implementation of popular nostrums such as strategic planning and alignment

are no guarantee of success in an organization with problems of fit. What is required to cope in such circumstances is intensive management based in experience, knowledge, and expertise together with slack resources to allow for alternative solutions.

Problems associated with managing IT and hence successful diffusion are exacerbated in large, multi-divisional health care organizations for two reasons. First, there are currently no successful designs for managing IT in multi-divisional structures.[20] The federal structure creates too many tensions and, as this case has shown, IT must also be aligned to strategy, management processes, and roles and skills. Second, the hospitals which are the business units in such a structure are professional bureaucracies, which means that they have a split internal structure of administration and clinical care which reflects the different objectives of efficiency and effective health care, respectively.[21] Therefore, IT cannot be aligned with both at once. This means that such organizations are inherently difficult to manage and that IT diffusion will always take place within an organizational configuration in less than tight fit. Nonetheless, the image of IT as an enabler of change in such organizations means that managers will be drawn to strategic initiatives that seek to diffuse common systems throughout the divisions and hospital units so as to gain benefits of standardization and management reporting. The analysis here suggests that such strategies will necessarily encounter difficulties and that in the absence of intensive management they will risk experiencing the same fate as NSW Health. The comparison between the three concurrent systems shows that the nature of that management will depend very much on the nature of the application, the organization and experience of the users and the way that the benefits are conceptualized and realized.

Conclusion

The NSW Health experience demonstrates once again that not only are organizational issues relevant to successful deployment of IT but also that the fit of the whole organization can affect transfer and diffusion of the technology. As IT transfer increasingly takes over from in-house development, it will be important for system selection and acquisition processes to include formal analysis of source and target contexts for the system. Configurational frameworks such as MIT'90s offer a basis for such analyses, but they will still need to be undertaken by analysts who not only can study the work design surrounding an existing implementation but also can understand the larger managerial issues of strategy, structure and processes. This suggests that it will pay vendors to study and understand how the differences among sites implementing their systems affect success and customer satisfaction so that they are better positioned to advise potential customers about appropriate organizational changes to make. The vendors who will add the greatest value will be those who understand the organizational context of their systems.

Likewise, the NSW Health case has shown us that the management of diffusion is affected by organizational-IT fit, the application of popular solutions notwithstanding. Because there are inherent inconsistencies in complex, multi-divisional health organizations and because IT is difficult to manage in such contexts, it is to be expected that diffusion will be problematic to manage. The key implications are that success in such contexts will require intense management effort and will have unexpected costs. In the absence of the resources to deal with these, serious dysfunctional outcomes are likely.

It is clear from this case study that the depth and complexities of the issues that surround the transfer of large-scale technology from another environment, and its diffusion throughout a large federally structured health service, are far greater than generally have been considered. Thus, these two important means of minimizing the cost of implementing information technology to health services are fraught with problems, many of which may be intrinsic to that environment. While there may be means of reducing the impact of some of the factors involved, others may not be amenable to treatment. In either event, it is critical that IT strategies incorporate a much more sophisticated appreciation of the complexities of organizational processes than traditionally has been the case. Transfer of strategies and methodologies across industries, and even across applications carry high risks unless such complexities are taken into account.

The authors are grateful to New South Wales Health, which approved and funded this study, and to its staff, who gave very willing and open cooperation. We thank in particular Sherryn Clinton, who supported us in the project, and Bernie Gromek and David Gates, who contributed to and approved the paper. We are also grateful for the cooperation of the staff of the vendor and several others who had moved on to other organizations.

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