

Information systems for community health: are we addressing the right strategy?

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Abstract

Computerised information systems for community health services have evolved with advances in information technology (IT) in Australia and overseas. However, there is evidence from other sectors for the need to distinguish between an information systems (IS) strategy and an IT strategy. This paper uses case studies of computerised information systems developed in New South Wales to identify issues that lead to success and failure. These issues show that many of the shortcomings can be attributed to a poor IS strategy. The paper discusses the shortcomings of an IT-driven strategy. It argues that an IS strategy needs to be congruent with the organisational strategy for community health and that the system design should satisfy the information needs of service personnel if the information is to be used.

Background to community health services in Australia

The Community Health Program was formally launched in Australia in 1973 as an innovative program, though the services it covered existed earlier in the form of baby health clinics, district nursing, school dental services, and so on. The policy for the program emphasised that the key component in the program is primary care and that it should provide high-quality, accessible, comprehensive, coordinated and efficient health and related welfare services, with an emphasis on prevention. This was expected to overcome the inefficient fragmentation of services (Hospitals and Health Services Commission 1973). A review of the Community Health Program

in 1976 found that the expected reorientation had not taken place; in fact, community health services had become an adjunct to the hospital services in most cases. The review also highlighted the need for greater emphasis on evaluation and record-keeping (Hospitals and Health Services Commission 1976). Over the next 10 years it was found that community health services organisation in the different States varied once the Commonwealth withdrew from financing and monitoring the program and States became responsible for providing these additional services during a period of resource constraints.

In New South Wales the organisation of community health services varied considerably from region to region as the 11 health regions had considerably autonomy. The content of services provided also varied due to the mixed administration and funding arrangements in each health region. In practice, though a mixture of generalists and specialist teams existed, the tendency was for more specialisation. This increased the need for coordination, which again varied from region to region. Thus, at the time of a review of the Community Health Program in 1986, the trend was towards a series of separate programs integrated with hospital services (Australian Community Health Association 1989).

With the establishment of area health services in New South Wales in 1986 there was further variation to the organisation and management of community health services. This incorporation of community health services to a larger bureaucracy created both threats and opportunities. One of the responsibilities of area health boards was to maintain an appropriate balance in providing resources for health promotion, health protection and health education and treatment services. However, in many instances community health services in New South Wales had to compete for resources with boards heavily dominated by hospital interests; in some cases, hospitals directly managed community health services. The lack of effective management information systems in community health has been attributed to the low priority given to their development, the difficulties in developing systems due to their complexity and even the resistance of staff (Eagar 1992).

Evolution of computerised information systems in community health

Computer technology was introduced to community health in the late 1960s in the United States. One of the earliest projects in public health was in Rockland County Health Department, New York. The project attempted to computerise the determination of patient care requirements to establish detailed patient classification and nurse staffing systems for public health agencies. It was abandoned due to the lack of resources and the poor technology available (Saba & McCormick 1986). Saba (1982) classified the systems of the 1970s as 'financial record and billing systems', 'statistical information systems' and 'patient care information systems'. The slow pace of development was attributed to unclear policies and strategies on health informatics.

Johnson, Gianetti and Williams (1976) identified three phases when examining trends in the development of automated systems of information in public health:

1. automation of statistical and financial systems
2. automation of patient care systems
3. 'needs-based' automation.

The first of these trends in automation was to computerise the extensive statistical and financial systems of the community agencies. These systems were of primary interest to administrators and served to:

- monitor service delivery patterns
- identify needs
- generate information required for funding bodies
- provide data for short and long-term planning (Lynch 1985).

State administrations undertook the early development of such systems. An example was the Missouri Standard System of Psychiatry where the management information system developed consisted of a part of clinical records, administrative and cost data of more than 100 000 clients. In this period such applications were run on large mainframe systems (Sletten 1974).

The second stage of development was the automation of patient care systems, including client contacts. Clinicians provided the driving force for these systems, their main purpose being to support clinical practice.

Inherent in these developments was the design of diagnostic classification systems and clinical recording systems. These developments typically took place in large community health agencies. In the early 1970s the Visiting Nurse Association of Omaha identified the need to develop a problem-oriented approach to clinical documentation. The New Jersey Department of Health developed a home health care system virtually across the state in the early 1970s. Nurses in agencies used pre-coded forms to collect information which was fed into the state's computer facilities for batch processing. The defects of the system were that the reports generated were slow and tedious and the agency directors received outdated information (Saba & Levine 1981).

The third stage of development was known as 'needs-based' and reflected the need for integrating both clinical and administrative information into a single comprehensive system. An important trend that emerged was the involvement of users in the design of these systems, hitherto the exclusive domain of computer professionals.

Important advancements in information technology that facilitated this last trend in the early 1980s were the introduction of the microcomputer, the gradual reduction of the 'backlog' of programming with the arrival of software that could be used by professionals without a programming expertise, the dramatic drop in prices and increased computer power of these machines. This made it possible for even small community health centres to purchase and operate their own computerised systems. This also promoted the uncoordinated development of automated information systems as the investments were within the capacity of even small organisations. This is well illustrated in the development of community health information systems in New South Wales.

Frameworks and methods of investigation

Earl (1989) developed a framework to understand an IT strategy. He makes a useful distinction between an IS strategy which is the 'end' and an IT strategy which is the 'means' of information systems development.

The IS strategy answers the question 'what' and is concerned primarily with aligning IS developments with organisational (business) needs and seeks strategic advantage from IT. It should be closely aligned to corporate strategy.

The IT strategy is concerned primarily with technology policies. It includes architecture, methods, standards and security. The IT strategy is

also concerned with data—its definitions, flows, utilisation, value, availability and security.

Earl (1989) also linked these two strategies with a third level—‘information management (IM) strategy’. He said that an IM strategy aims at ‘putting the management into IT’. It is concerned with the role and structure of IT activities in the organisation, its management and control of IT and evaluation. Earl identified an IM strategy to be concerned with such questions as: Which way? Who does it? Where?

While the above framework identifies the strategy and plans for information systems development, Lorenzi and Riley (1995) have identified the following reasons for the failure of many health informatics projects.

1. **Technical shortcomings.** The rate of change in IT and the inability for IS organisations to upgrade their approach, and the absence of an IT strategy. One of the handicaps relates to the massive base of outdated software (referred to as legacy systems) that cannot be abandoned overnight. The other issue relates to technical competence of vendors and consultants who make grossly exaggerated promises (‘vaporware’).
2. **Project management shortcomings.** The authors identify that technical competence is necessary but not sufficient for implementation success. Over the years, shortcomings in scope, time and budget have left IS projects with a reputation for taking twice the time, costing twice as much and delivering half that is promised.
3. **Organisational shortcomings.** The successful introduction of major new systems requires good organisational skills, especially in complex situations such as hospitals and community health agencies.

To overcome many of the above shortcomings, the project teams need both project organisation and people skills. The implementation success is measured by the ability to meet the often conflicting needs of various stakeholders in the system.

This paper will use the framework of Lorenzi and Riley (1995) to analyse case studies for factors that led to failure and success in designing and implementing community health information systems. It will then use Earl’s (1989) model to ascertain the role of strategy and its relevance.

The case study methodology provides an opportunity to understand complex organisational phenomenon (Benbasat, Goldstein & Mead 1987). It is more receptive than surveys for obtaining information not specifically

sought and has been used to complement survey research. While in some respects case studies are specific to a situation, they provide valuable contextual information that allows the testing of generic models and frameworks for understanding the problems and issues. Eisenhardt (1989) has argued that at least four cases are needed for theory-building efforts, while more than 10 cases make it difficult to manage the volume and complexity of the information.

A 1992 statewide study of computerisation in community health in New South Wales (Jayasuriya 1993) investigated systems in five selected health areas: Western Sydney, South Western Sydney, Central Sydney, Eastern Sydney and Southern Sydney (out of 14 areas/regions). The purposive selection was to select fully developed systems for multidisciplinary teams. Five computerised systems (COMCAS, Clininfo, CRISP, Clittrak and Contact) were reviewed through in-depth interviews with developers/computer personnel, users and management staff. Demonstrations of the systems in use were attended, documentation and literature on the systems was collected. A user satisfaction survey was administered to a sample of health centres in the selected areas. Fifty-nine users responded. In addition, information from a concurrent study evaluating a computerised community health information system in the Illawarra (named DRACIS) was also added. In the Illawarra, 87 respondents completed the user satisfaction survey.

The results reported in this paper pertain to the non-quantitative aspects of the study. Comments made by developers and users were analysed and issues in the development and implementation of the systems identified.

Issues arising in the development of community health information systems: evidence from NSW

The results are presented under the framework used by Lorenzi and Riley (1995) to describe reasons for success and failure of health information systems. The framework is utilised to understand not only the failures but also the factors for success. Each case study is compared and contrasted with evidence from the literature to tease out characteristics common to other information systems and characteristics unique to community health information systems development.

Technical issues

Identifying hardware and design methodology

Cost is the main argument for a microcomputer strategy. In the case of Illawarra and Western Sydney, this could have been a major factor in pursuing a microcomputer-based information strategy. In contrast, South Western Sydney implemented a centralised (mainframe) system (COMCAS) with terminals at health centres. It was justified on the argument that the marginal cost of additional terminals was much less than stand-alone computers. This had enabled South Western to be the area/region with the highest computer/staff ratio. Most costing systems of computer proposals for microcomputers include only the cost of hardware and do not include costs of training, software tailoring, maintenance and user support. However, if these are included, it has been estimated that a \$3000 microcomputer would cost about four to five times that amount.

The other major issue in using a microcomputer-based strategy relates more to the typical environment for the application development. Usually the development is based on a 'grey analyst', that is, someone who has little or no information systems training but develops the system for others (Lockett 1988). There are many pitfalls if trained professionals do not oversee this development. They include poor maintenance procedures, backup, security and the extreme lack of documentation. This was illustrated in the case studies which showed that the documentation and maintenance features were of higher quality where the development was in collaboration with technical staff.

On the other hand, the major gains of a microcomputer strategy are its effectiveness and efficiency in terms of the short lag time for systems development. It is very hard to quantify or measure gains in quality and usability that can be found in applications developed by users who have insight into the 'issues in real life'. The higher use of information in Western Sydney and Central Sydney does in a way reflect this issue. The DRACIS system in Illawarra is also evidence that user-developed systems can provide usable information systems very early in their development cycle as most of the early versions developed addressed current and local issues of information needs.

Developing standards

Agreed organisational standards for end-user computing and the link between these and organisations' overall information systems architecture are important dimensions of any end-user strategy. The development of computerised information systems for community health in New South Wales has not had consistent standards in hardware or software. Initial departmental support for 'Open Access' resulted in some areas/regions following this direction. Subsequently, the support shifted to the use of 'Paradox' on which at least two systems (Clininfo and CRISP) were built.

The gains in statewide agreed standards are not only in the cost savings of bulk purchasing; they are also in the savings in support costs (evident in the use of one support position for all areas/regions for CRISP) and additional training costs, especially if there is mobility of staff among units and areas.

Integration of information systems

The real (strategic) pay-off in end-user computing strategies is seen in the integration of corporate (organisational) data with that of the end-user systems. An important advantage that would follow from setting standards for community health service information systems would be the ability to link each area/region and the central level. This is essential for better integrated management information systems. Integration of patient records between areas/regions is necessary to improve clinical care through linked records and provision of continuity of care. Only the CRISP system was designed for this, but this has not been implemented at the sites studied.

On the other hand, the integration of hospital patient data with that of community health (within an area/region) would be a more important link that could have large pay-offs for certain specialisations—mental health services, rehabilitation, early discharge programs. At the time of the survey, the only links that had been looked at in the systems in New South Wales were those between the medical record number and cases in community health services. In Western Sydney, efforts have been taken to port the Patient Master Index data across to the community systems. Many of the other systems are now recognising the need: new versions of DRACIS and CRISP are addressing this issue.

Data classification and coding

Health services in general and community health in particular are complex due to the varied nature of the problems presenting to services. Medical diagnosis coding has been used to systematise the enumeration of these problems. Other classifications developed in medical and allied health professions allow health workers to recognise and manage presenting problems. The complexity of community health is due to the multipurpose nature of activities and services provided. Therefore, there is a need to bring together different nomenclatures and classifications.

Many of the presenting problem classification systems developed in New South Wales (specifically those investigated in the study) have originated from requests to professional groups to identify the categories they need. The variation in the lists from only 15 broad categories (Clininfo) to over 200 (in COMCAS) illustrates the differences in development. The classification used in CRISP is based on DSMIIIR which is suitable for mental health work, although users are requesting that the list of 19 codes be expanded.

Another problem in classification and coding relates to the need for the system to capture the types of service provided and/or occasions of service. Only some of the systems in New South Wales (for example, DRACIS, CRISP) have proceeded to capture data in a way that allows occasions of service to be quantified. In other systems, procedure codes (for example, 41 in COMCAS) have been developed although they have not been linked to resource use (time, level of intensity). Most developers recognise this need and are currently working towards it. One of the thorny problems that community health faced in this issue is a method for quantifying and coding group work, such as health promotion for groups, group therapy and living skills programs, and intersectoral activities such as accommodation support.

A final related and important issue is information on the outcome of the service delivered. Attempts to handle this have generally only been to record referral to other services. CLININFO has seven broad outcome categories at the closure of a case. Most other systems have not given sufficient importance to developing outcome measures.

Project management issues

In the absence of central policy and technical direction, the goals of most of the community health service information systems developed in New South Wales have not been defined clearly. In most cases they have evolved over time, partly due to the lack of understanding of the issues and problems of community health management. This has led to a rather uncoordinated set of developments, with the onus being placed on the local developer and not the users at both central and local levels to define the needs.

Community health services organisations in New South Wales have been in a state of flux in many of the areas/regions (Bryson, Adamson & Lennie 1992). This has also led to delays in developing and implementing systems. Factors that seem to support 'successful' development of systems as ascertained from the study were:

- community health representation at top management level of areas/regions
- establishment of formal committees for development of systems
- stability of community health services and structures
- 'champions' for the development of community health information systems
- concurrent developments in information systems for other services, that is, hospital systems.

End-user computing in community health is not usually given the same priority as implementing a financial information system or a clinical system in hospitals. Most times the personnel involved in the design have far less experience in IT implementation in community services than hospital services.

Evidence from the study points to unrealistic targets in the time allowed to develop systems. Most areas/regions found that delays were due to the *ad hoc* nature of making resources available for community health in general, in contrast to steady commitment of resources for IS developments in the hospital sector.

Resource constraints have hampered many areas from purchasing the hardware required for smooth implementation. In the field of computer technology, a delay of two to three years would mean that there would be

substantial change in the power and cost of hardware. It was seen that projects with a good business plan had much better resources and commitments than projects without such a plan.

Implementation of the developed systems has been rapid in sites where the management (for example, a committee of community health managers) was involved in overseeing the development. Where the development occurred in other parts of the organisation (as in DRACIS, where the system was developed in the health development unit), the implementation was delayed due to organisational inertia.

The study highlighted deficiencies in training certain user groups. In most training courses the emphasis usually was to provide skills (mostly to clerical staff) to enter and obtain pre-formatted reports from the systems. This precluded end-users (usually nurses) from generating their own information from the system.

Management of organisational change

Introducing computers to organisations involves managing change due to a new technology (Benjamin & Levinson 1993). Community health services in many of the areas/ regions of New South Wales started using computers through office automation applications such as word processing and spreadsheets. Clinical personnel therefore were not usually required to be computer-literate to carry out their tasks. The introduction of computerised information systems therefore brought with it anxiety associated with this change.

Each area/region had different experiences in introducing computers to community health staff. While some, due to a lack of resources, limited the clinical staff's involvement to the supply of data or requests for reports, others required the clinical staff to interact with the computer. Qualitative evidence suggests the reaction to this varied from enthusiasm to resistance.

The study did not come across any extensive efforts to analyse the work processes of community health prior to designing the information system. In some cases, existing manual systems have been computerised, while others have attempted to design new recording forms that have then been the template for computer systems.

New technology is not enough to increase productivity; organisational and process change must also be made (Benjamin & Levinson 1993). In most cases organisations missed the opportunity to introduce change in work practices and improve their productivity. There is still work to be

carried out to rationalise work practices and processes by each discipline and to coordinate the multi-professional nature of community health work. The benefits of new technology will be greatly enhanced when it is linked to improved management information systems (for example, based on development of classifications similar to casemix in the hospitals).

The data from the survey of users highlighted that a majority do not actually use the information from the community health information systems. They use the system mainly to retrieve client information to track clients, answer queries, and so on. Users described the value of computerisation as 'an efficient filing (database) system' for case management. Developers had in most instances directed the design towards providing management information useful for centre managers and higher echelons. However, except in the case of a few managers with developed skills in interrogating the system, they overlooked the potential to use the management information for decision-making. In most cases it helped to speed the process of submitting statistics required by higher echelons.

The study findings are similar to those reported in a recent evaluation of the CRISP system for mental health where the investigators found that 'in spite of statements about the value of data collected, there was little evidence of it being used in any substantial way' (Southon & Yetton 1994, p 8). Most of the recorded uses were to report occasions of service, analyse travel time and reallocate staff time. The only clinical value reported was to provide the lists of patients due for review. Clinicians identified CRISP as an administrative system that did not significantly contribute to their clinical work (Southon & Yetton 1994).

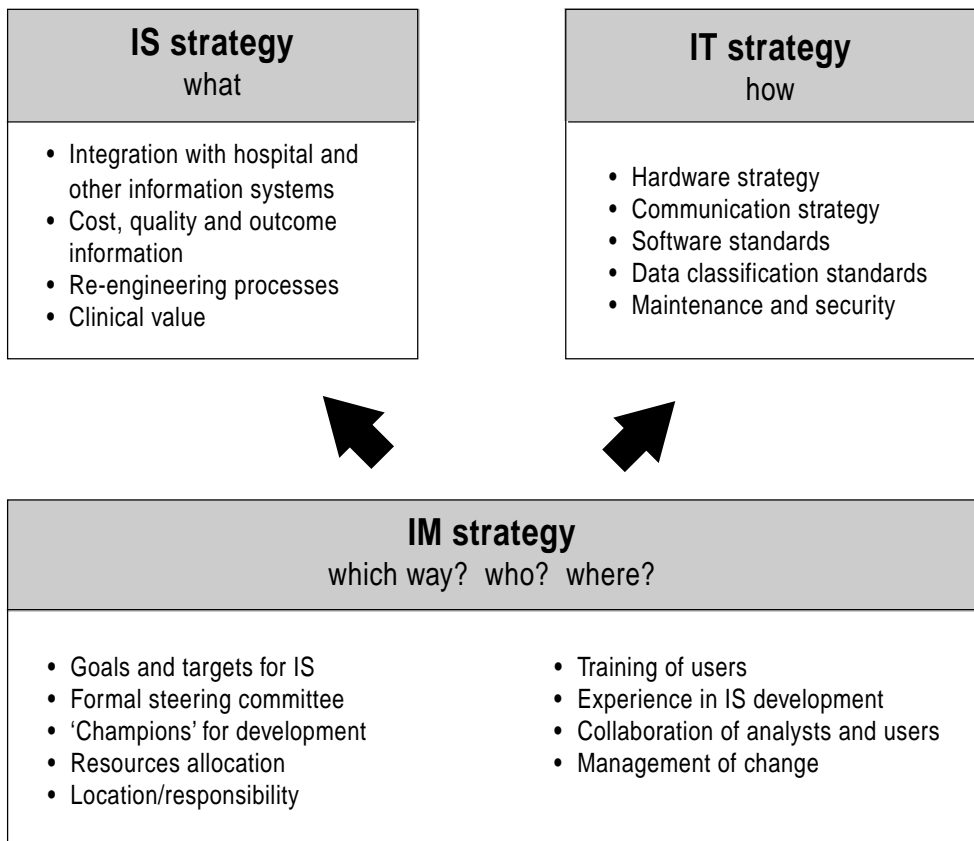
Discussion

The case studies identify issues that are similar to those typically faced in information systems development in other sectors. On the other hand, the nature of work in community health imposes certain issues unique to it. The average community health worker works at many locations and carries out a number of services. Over time there has been a tendency for staff to specialise (for example, early childhood nursing, palliative care). In addition, as it is a service that is predominantly staffed with professional workers, composed of multidisciplinary teams and reactive to changes in the external environment, it provides further complexities for the design and implementation of information systems.

An unresolved issue that underlies development of information systems in community health in Australia is the unclear definition and scope of community health and the variety of services provided from site to site. Community mental health services have probably the closest to a common scope among sites in New South Wales. Such specialised services have tended to develop their own (undisciplinary) information systems (for example, CRISP). However, there are still issues of integration with other community health services and vertical integration with hospital information systems.

The issues identified for failure and success in the case studies have been categorised into the three components of Earl's model (figure 1). When the issues that belong to IM strategy are listed, they are seen to be closely related to issues that need to be dealt with in IS and IT strategies.

Figure 1



Half of the issues that reflect a poor IM strategy relate to actions that could have been addressed at a planning phase of the systems development. They are logically linked to the question: What? For instance, the decision to integrate community health with hospitals would impinge heavily on the goals and targets for information systems, composition of the steering committee and resource allocation for the development. Taking an example from the United Kingdom, where the National Health Service strategy is to have 'information person-based', leads to the translation of the strategy to have the data on an individual patient at one place near the point of service (Keen 1994). This has wider implications for an IT strategy (How do you do it?) and for an IM strategy (Which way? Who does it?). This illustrates the close link between all three levels of strategy during the planning phase.

Closer analysis of the information management issues that are logically linked to an IT strategy, such as training of staff and experience in implementing systems, again underscores the lack of sufficient attention given to planning the implementation of the system and change management.

An IS strategy for community health in New South Wales needs to reflect the priorities of New South Wales Health. The current health strategy focuses on implementing an outcomes approach; managing health gains by monitoring cost, quality and effectiveness; increasing the emphasis on health prevention and promotion; and focusing on groups with special health needs (New South Wales Health 1994). None of the systems reviewed are congruent with these strategies. Only a few have attempted to incorporate health outcomes. They do not address issues of cost, quality and effectiveness. The predominant preoccupation has been to measure output, based on occasions of service (to an extent influenced by an archaic system of information required by the centre called DOHRS), which does not reflect the nature or intensity of work in community health. Information to monitor health promotion is still rudimentary.

The National Health Service reveals a similar mismatch in IS strategy and organisational strategy. The strategic vision for the information management and technology strategy released in 1992 identifies that 'information will be derived from operational systems'. However, with the advent of the National Health Service purchaser-provider agreements, much of the data for contracting cannot be obtained from operational systems but only from population surveys and data from a variety of local government and voluntary organisations (Keen 1994).

Implications for future development

Most of the issues described in this study could be attributed to poor planning of information systems at area/region level. In large complex organisations there may be several IS strategies, typically 'the IS strategy is formulated at the level of the strategic business units' (Earl 1989, p 63). One may argue that for New South Wales the strategic business units are at the area/region level and therefore the IS strategy needs to be formulated at that level. Most areas/regions have developed plans for community health services but only a few for information systems. To align an IS strategy with the organisational strategy, there is a need for an explicit community health strategy. In the last few years some attempt has been made to formulate a strategic plan for community health at State level to set policy and give direction. However, this is yet to come to fruition.

In response to the current situation of fragmented and uncoordinated information systems in community health among the areas/regions, the centre has recently taken the initiative to develop a statewide system. However, the dangers of strategy viewed from an IT perspective have been well documented (Davenport 1994). The major shortcomings of an IT-driven development are outlined below.

1. Systems design based on information architecture has never achieved its promise. One reason is that 'system planners believe that the total information environment can be designed for the entire organisation without reflection to the individuals'.
2. Given the rate of change in the environment (which is true in the case of health systems), the delay in preparing such enterprise models makes them outdated by the time they are finished.
3. Diverse company experiences suggest that grand IT models and schemes do not reflect what the rank and file users want and they simply will not work (for example, Xerox did data modelling and administration for 20 years but, in the words of the Director of Information Management, 'We got nowhere.') (Davenport 1994).

Centrally designed systems also face another issue. When lower level workers are instructed to 'share' information with those at higher echelons, the culture of meddling micro management can result (Davenport 1994). In addition, professionalism has prevailed in the health sector and traditionally there is little sharing of information among the professions.

The importance of organisational politics is often underrated and is one of the reasons why information systems developments are delayed or not integrated. Davenport, Eccles and Prasak (1992) showed that the problem with IS designers is that they ignore the politics of the organisation. They used the studies of large corporations to identify five models of information politics. The IT view of the world is reflected in the 'technological utopianism' model. This model ignores politics and interprets information management as a problem capable of solution through technical means where the emphasis is on data definitions and modelling. They value highly emerging hardware and software technologies and believe that the organisation's entire information inventory needs to be addressed. A common example is the creation of an 'enterprise model'. However, there is evidence that such modelling exercises take years and often yield little value (Goodhue, Quillard & Rockart 1988). If a parallel can be drawn with the experience in the United Kingdom, a modified form of the federalism model, where it is incumbent on the centre to encourage as much as it directs the development of systems, has been favoured for the National Health Service (Keen 1994).

When the National Health Service published its information management and technology strategy, it also spelt out strategy initiatives. One of these initiatives was to fund six projects for community information systems for providers. One such developmental project has taken a different approach, given that the requirements for information were changing rapidly (Morgan 1995, unpublished observations). Instead of exploring functionality using traditional techniques, they placed the emphasis on allowing the user to configure the information they need using a toolkit. The main advantage espoused by the developers is that the system is flexible to respond to the changing needs of the environment in community health.

Given the experiences from the business sector and the National Health Service, designers of information systems in community health need to give priority to determining the IS strategy. The issues that have led to failure of health information systems could be attributed largely to poor information systems planning and implementation. However, given the evidence from the field studies (such as this) that the rank and file do not use the information when the implementation problems have been overcome, there is an urgent need to answer the question: What information? at the beginning. The IS strategy needs to be spelt out and

this would be a task for the decentralised level. The strategy needs to answer the questions: Why are we doing it? What do we want to achieve? However, if the political motivation for such systems is to satisfy the needs of management (at local and central levels), the systems would not be of much value to the majority of the staff in community health.

The case of community health highlights the issues that arise and questions the methods and strategies that central levels use which are typically IT-led. It illustrates that in complex, information-intensive organisations, design of information systems needs to pay careful attention to a number of organisational and cultural issues. The IS strategy needs to be congruent with the needs of the organisation. Politics of such organisations indicate that information systems need to respond to service personnel needs and not predominantly to the needs of management. Finally, a form of modified federalism works best, where the centre encourages decentralised innovations but directs overall strategy, being aware that it does not impose an 'IT view' to direct these developments.

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