An Institutional Perspective on Health Sector Reforms and the Process of Reframing Health Information Systems: Case Study From Mozambique

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Health sector reform, including structural and process changes such as the incorporation of feasible information and communication technologies, is a priority in many least developed countries. However, such changes have not been particularly effective, the reasons for which will be explored in this article. Particular attention will be paid to attempts to integrate information systems in HIV/AIDS program in Mozambique. The article draws on new institutional theory to argue that the focus of this program on formal rules (i.e., Sector Wide Approach policy and national plans), which deemphasize the informal constraints at the point of service delivery (i.e., priority given to health care over reporting), has resulted in limited change. Furthermore, the limited overlap between the formal and informal domains raises the need for enhancing incentives and enforcement as key mechanisms through which more effective change can be enabled in the future.

Keywords: health sector reforms; institutional changes; integration of health IS and HIV/AIDS

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INTRODUCTION: THE CHALLENGE OF HEALTH SECTOR REFORMS IN DEVELOPING COUNTRIES

The World Bank and the World Health Organization (WHO) have advocated improvement of health status among least developed countries (LDCs) as a key driver to poverty reduction and socioeconomic development. Many LDCs began to undertake structural socioeconomic reforms, including health sector reforms, at the end of the 1980s. These health sector reforms (HSRs) resulted in the decentralization and privatization of health care services and the pooling of donor funds. They also entailed changes to the monitoring and evaluation of service delivery and the incorporation of appropriate information and communication technologies (ICTs) to support health management processes (Atkinson, 2002; Cassels, 1995; World Bank, 1993). More recently, International Monetary Fund (IMF) and World Bank policy documents, the 2000 Millennium Development Goals Declaration, and the WHO's 2001 Commission on Macroeconomics and Health (CMH) report explicitly regard investments in health services by LDCs as the most effective way to help counter economic deprivation (IMF-World Bank, 1999; WHO-CMH, 2001).

Despite the urgency of reform, efforts to date have not delivered promised benefits in strengthening health service delivery and improving the informational basis to support reform processes (Gilson, 1995; Heeks, 1998). A former Zambian minister of health has emphasized such failings:

> Specific reform strategies and policies were not yet resulting in improvements based on commonly used measures of service coverage. Thus, reform strategies and policies must be inappropriate and should be revised. The reformers were unable to counter such a message because they had no data to back up their strategies or progress expected as a result of reform. (McLaughlin, 2001, p. 2)

This article aims to analyze approaches to health sector reform in LDCs, specifically those related to health information systems (HIS) reform, by focusing on attempts to "integrate" various HIS into reform initiatives. We argue that the key to effective implementation is an understanding of the complexities that underlie HSR

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and examine alternative ways to approach them. This requires better understanding of both the context and process of reform, which go beyond concerns of a purely technical nature. Successful HIS implementation is not merely about introducing new technologies but also managing the organizational change processes that surround it (Webster, 1995).

ICTs are increasingly being implicated in HSR efforts, for example, to strengthen the processes of decentralization of health care delivery. ICT projects introduce their own complexities arising from the needs for infrastructure and trained manpower that transcend mere technical considerations (Mills, 2000). Given this complexity, many ICT-based reforms have over the years ended up as partial or full failures. Heeks, Mundy, and Salazar (1999) have described these failures as arising from "design-reality" gaps, which reflect the gulf between the design assumptions of where ICTs are produced (in the developed world) compared to the reality on the ground where such systems are to be used (in developing countries) (cf. Avgerou, 2000). As a result, organizations often lack the capacity to effectively manage the processes of organizational change surrounding ICT introduction (Anderson, Aydin, & Jay, 1994; Heeks & Kenny, 2002).

Although the introduction of specific ICTs are often problematic, another layer of complexity is added when attempting to "integrate" different HIS that "belong" to different groups of people and are products of varying material and social histories. Their integration also implies a coming together of the actors, their operational procedures, and institutional arrangements. This article's focus is on the integration of parallel HIS in the context of a sectorwide approach to health sector reform, addressing two key research questions: What are the challenges that underlie HSR efforts to integrate HIS, and what are some relevant approaches to practically address these challenges?

The empirical basis of this analysis is the health sector in Mozambique. Specifically, this article focuses on the HIS on the STI (sexually transmitted infections)/HIV/AIDS program, where efforts are under way to integrate various HIS and strengthen program management in the process. The rapid growth in the spread of this disease in most of African countries poses a crucial challenge for the health sector, leading to efforts to reform AIDS health programs (Collins, Green, & Newel, 2002).

The rest of the article is structured as follows. In the next section, we discuss institutional theory, which will be used to analyze developments in the Mozambique health sector. After describing the research methods used, the research context and the case study details will be presented and analyzed.

AN INSTITUTIONAL-BASED THEORETICAL PERSPECTIVE

Writing from a new institutional theoretical perspective, North (1990) emphasizes the distinction between organizations and institutions, arguing "If institutions are the rules of the game, organizations are the players" (p. 3). Institutions consist of formal rules and informal constraints (norms of behavior and self-imposed codes of conduct) that individuals follow in their daily lives. Organizations enable human agency to be articulated and expressed through structures of work, control mechanisms, reward

systems, and ownership. However, health organizations are rarely "standalone," being formally and informally linked with a variety of entities, such as international agencies, nongovernmental organizations (NGOs), church missions, and the community. These different organizations and their linkages are referred to as organization fields, creating multiple institutional influences on the reform efforts. Avgerou (2002) writes,

> An organizational field is understood to be constituted by organizational actors competing in the production of similar products or services . . . consumers and regulatory agents. The participant in an organizational field may be located in the same geographic location or dispersed. Apart from the technical exchanges among them, such as contract based or financial transactions, they exert normative or cognitive influences upon each other, sharing similar sets of activities. (p. 38)

The aforementioned conceptualization does not however include the role of ICTs and their material and symbolic roles in linking organizations. We thus broaden our conceptualization of organizational fields to also include ICTs and the formal and informal practices that surround their definitions and uses.

Institutions play the following three interconnected roles: helping to frame the behavior of individuals by structuring incentives they face in their everyday activities, facilitating social action, and reducing the uncertainty of social interaction by providing a structure where people can act and be understood. Institutions can be formal and explicit, such as a national constitution, and informal and culturally agreed on, such as respect afforded to the elderly within a community. The difference between formal and informal is one of degree, with the formal arising with increasing specialization and division of labor. Formal rules may sometimes complement and increase the effectiveness of informal constraints by lowering the information needs and enforcement costs. Typically, laws to enforce informal constraints are costlier than the formal rules, but the latter does not always imply efficiency. The institutional constraints that define the opportunity sets of individuals are a complex array of formal rules and informal constraints, which in turn reflect the costliness of measurement and enforcement. The higher these costs, the more will the exchanging parties invoke informal constraints to shape the exchange.

In situations where there is little overlap between the formal and informal institutions and the formal cannot be enforced adequately, the informal constraints, which are more difficult and costly to enforce, take priority. Madon, Sahay, and Sahay (2004) describe the formal and informal constraints shaping the functioning of property tax in Bangalore, India. Informal constraints based on interpersonal relationships between the property owners and tax collectors were a prevalent mechanism for assessing property tax, often overriding the formal calculation for assessment. Both the systems existed in parallel, and their lack of overlap made the process of introducing reforms extremely complex and time-consuming. Sautet (2005) provides a simple model of the relationship between the domains of the formal and the informal institutions that has implications for understanding organizational change (see Figure 1).

The implication of this model is that with greater overlap between formal and informal institutions, organizational change will be enabled more easily. Some questions however arise. Namely, what are the mechanisms for enabling these changes? How can the overlap between the formal and informal be increased? How can the mismatch

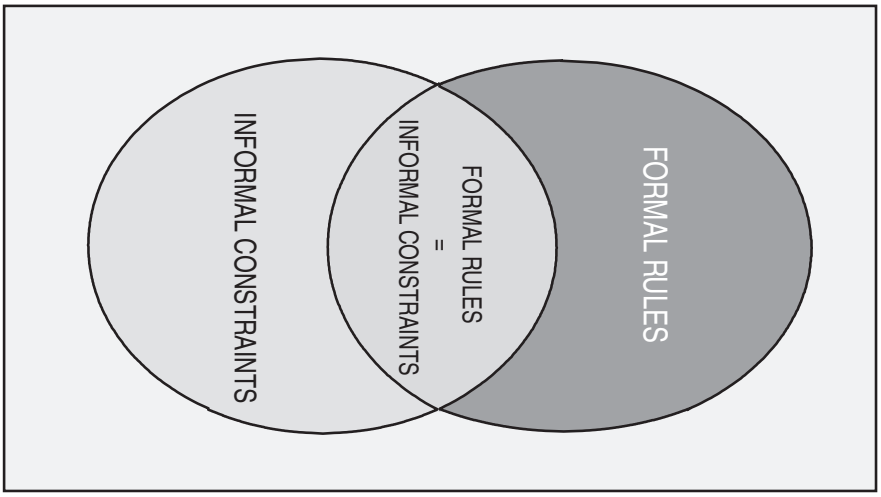

FIGURE 1: The Greater the Overlap Between the Formal and Informal, the Easier Organization Change Will Be to Enable

be reduced? Although Figure 1 is useful and parsimonious, it is rather limited as it refers to a single organization and its underlying institutions, ignoring the role of the relevant organizational field. Furthermore, it takes a static view of the formal and the informal, deemphasizing how informal institutions can become formal with time and vice versa.

Contemporary process-oriented approaches argue that institutions not only constitute actors but also constrain them. Institutions do not simply reflect "the preferences and power of the units constituting them; [they] themselves shape the preferences and that power" (Keohane, 1984, p. 388). Rather than looking at informal practices as the "shadowland," Friedland and Alford (1992) argue that society is composed of several institutional orders, each with its own central logic, comprised of a set of material practices and symbolic constructions that constitutes organizing principles that individuals and organizations draw on to resolve contradictions. Institutional environments are pluralistic, with inherent inconsistencies among the institutionalized units. Various levels within organizations, each with different institutional influences, often contradict each other (Jepperson, 1992). Contradictions also arise because institutional rules are couched at very high levels of generalization, making it difficult for them to be interpreted similarly by different people in practical settings. Although contradictions provide a theoretical lens to understand the sources and potential for change, how this potential gets realized (or not) and the nature of these changes remain largely empirical questions.

In summary, an institutionalist position helps to emphasize the complexity of introducing health reforms arising from a multiplicity of interconnected influences, their inherent contradictions, and the potential they create for emergent changes (Hanseth, Jacucci, Grisot, & Aanestad, in press). It becomes important to consider reforms as not

only having anticipated and opportunity-based effects but also having emergent consequences. These three forms of change often coexist over time and are linked to both intraorganizational and broader social contexts (Orlikowski & Hofman, 1997). Change is thus not a straightforward, rational process but a complex, analytical, and political process that is historically situated (Walsham, 1993). Change processes are shaped by a *situated rationality*, which Simon (1982) describes as representing "a style of human behavior that is appropriate to the achievement of given goals, within the limits imposed by given conditions and constraints" (p. 408). The formal and informal structures within a historical context help to define an "organizational regime" within which this situated rationality is played out (Avgerou, 2002).

RESEARCH APPROACH

The study was interpretive in that the focus was to understand the subjective interpretations of the various actors involved with the HIS integration efforts in Mozambique. An interpretive perspective seeks to understand social contexts and how this relates to the reasons why an actor takes a particular course of action (Walsham, 1993). The empirical work is based on the assumption "that people create and associate their own subjective and inter-subjective meanings as they interact with the world around them" (Orlikowski & Baroudi, 1991, p. 15). Our study was multilevel in that data gathering was carried out at the national, provincial, district, and community levels. This approach was required to gain insight into issues of integration. Finally, the study was longitudinal, carried out over a 4-year period (2001 to 2004), with the initial efforts aimed at understanding the challenges to the Mozambique HIS and a subsequent focus on the HIS of the HIV/AIDS health program. This design helped to follow the phenomenon over time, such as the expectations of the Ministry of Health (MISAU) officials, how these were met (or otherwise), and how they were subsequently redefined.

The fieldwork was carried out over five time periods (June-July 2001, May-September 2002, March 2003, August-September 2003, and October 2004), in 2 (out of 11) provinces of Mozambique, namely Gaza and Inhambane, where computerization efforts at the district and provincial levels were ongoing. In addition to the provinces, extensive work was also conducted in the MISAU headquarters in Maputo, with a view to understand the strategic aims of integration, the nature of the donor influences, and how the national HIV/AIDS status reports were developed.

A multiplicity of methods was employed in the data gathering process, including 88 semistructured and in-depth interviews with staff from different functional areas and administrative levels, participant observation during the processes of HIV testing and recording, and an analysis of secondary data, including official reports (e.g., the national HIS strategy) and the registers and forms used to collect, analyze, and transmit data from one administrative level to another. A research diary was maintained to document interview notes and observations. All interviews were conducted in Portuguese and subsequently translated into English. In addition to these notes, various photographs were taken (after gaining prior approval) to strengthen the interpretive analysis.

The analysis of data took place through a continuous process of data collection in the field to identify important themes and relate them to theory. Initially, the focus was on understanding and documenting the health information flows across various organizational levels and the challenges experienced. Where pertinent, we discussed with some respondents their impressions of the coherence of our interpretations. The analysis continued to evolve through an ongoing review of the relevant research literature and theories, thus representing an evolving "conversation" between data and theory.

Study Context

The focus of this study of the Mozambique health sector is on the reforms to the HIV/AIDS program concerning HIS integration. The organizational context is provided by MISAU, and we identify at least five formal and interrelated institutions as relevant in shaping the reform efforts, namely, the National Health Service (NHS), the Sector Wide Approach policy (SWAp), the Health Sector Strategic Plan (HSSP), the Strategic Plan for Fighting STI/HIV/AIDS, and the Monitoring and Evaluation (M&E) Strategic Plan on STI/HIV/AIDS.

MISAU's headquarters and subordinate institutions are based in the Mozambican capital, Maputo, and its intermediate bodies are located in the 11 provincial capitals and 144 districts. The different directorates and departments are organized according the general functions of funding, planning, directing, and controlling the programs and activities of public, private, and NGO entities. MISAU has for several years been attempting to implement HSR related to decentralization, care quality improvement, and coordination and integration. The governance is enacted through various formal rules and procedures.

The NHS defines the contractual relationship between the government and the population and the structures of governance. Nine short articles of law describe its structures, objectives, and major functions, including the definition of four levels of health service delivery from the primary to the quaternary (ultraspecialized assistance). It is a complex institution comprising various and sometimes conflicting interest groups, such as public administrators, health managers, and health professionals.

The SWAp is aimed at coordinating donor support coming from 23 bilateral and 23 multilateral agencies operating in Mozambique. MISAU adopted SWAp and signed a Memorandum of Understanding (MISAU, 2000) with different stakeholders. SWAp focuses on health policy and strategy and is made operational through medium-term plans and collaborative programs, including arrangements on three key areas: planning, financing, and monitoring. Working groups and decision-making meetings are governed by formal rules, whereas appropriate conduct during meetings, a silent hierarchy in precedence of speeches, and the use of language are informally regulated. SWAp has also been involved in efforts to integrate the HIV/AIDS program through its recommendation that "vertical" activities be avoided.

The Health Sector Strategic Plan was approved in 2001 and represents a formal instrument for guiding the implementation of SWAp, together with the adoption of a single common fund (PRO HEALTH). The plan provides a basis for discussions and elaboration of operational annual plans at the central and provincial levels. Its section

dealing with M&E and HIS explicitly recommends, "the establishing of an integrated information system is essential for monitoring and evaluating the performance of the overall health sector" (MISAU, 2001, p. 67). Many formal objectives, such as integration of subsystems or establishing a common database for programs and projects, are still far from being achieved. Nevertheless, this plan is crucial in understanding the institutional influences on the HIV/AIDS program HIS integration efforts.

The Strategic Plan for Fighting STI/HIV/AIDS, approved in 2004, specifically relates to the integration of various components of health care interventions into one coherent national service delivery. The strategic plan establishes 15 components, among them the promotion and distribution of condoms, Voluntary Counseling and Testing services (VCT), Prevention of Mother-to-Child Transmission (PMTCT), treatment of Opportunistic Infections (OI), Anti-Retroviral Therapy (ART), and safe blood transfusions. Each of these components has a coordinating team that is located in the directorates of different provincial and national departments. For example, whereas the PMTCT is coordinated by the Community Health Department, the VCT component is coordinated by the Department of Epidemiology and the components of ART and safe blood transfusions by the Medical Assistance Department. The overall coordination is done by an HIV/AIDS Technical Group that meets every week and is comprised of one or more members of each component, planners from the National Directorate of Planning and Cooperation, donors, and representatives of international aid agencies.

The M&E Strategic Plan on STI/HIV/AIDS (M&E Plan on AIDS) was approved in 2004 after a broad participative process at central and provincial levels. To avoid duplication and fragmentation, a majority of the bilateral and multilateral agencies agreed, as per the "Three Ones" commitment (DFID Health Systems Resource Centre, 2005), on an agreed HIV/AIDS Action Framework to provide the basis for coordinating partners; a national AIDS coordinating authority, with a broad-based multisectoral mandate; and an agreed country-level M&E system, including the development of a common set of indicators and an integrated Information System (IS) for the program as a whole. The following section provides details of how these formal institutions act in practice and the informal constraints that shape them.

The Ongoing Efforts Toward the Integration of Information Systems of STI/HIV/AIDS Program in Mozambique

Health care services in low-income countries like Mozambique are usually provided through the collaboration of national authorities, foreign aid agencies, and NGOs. Mandatory requirements to demonstrate funding accountability and short-term results have often led donors to promote vertical programs operating "outside" a sectoral framework centered on specific diseases (e.g., malaria, HIV/AIDS, and TB control) or health services (e.g., Expanded Program of Immunization; Oliveira-Cruz, Kurowski, & Mills, 2003). Such vertical programs, which tend to oppose an integrated approach to health care delivery, contribute to a state of fragmentation and redundancy (Cassels & Janovsky, 1998; Hutton, 2002). The vertical and integrated approaches usually compete for the same human resources working at peripheral levels, which

serve as the common point of service delivery (Mills, 2005). Whereas vertical services seek to strengthen particular programs, integrated services tend to promote more holistic health care, creating dilemmas in the allocation of resources (Elzinga, 2005). To address these dilemmas, many influential donors have tried to orient their development assistance toward a SWAp initiative. However, achieving this integration in practice is a complex undertaking (Oliveira-Cruz et al., 2003), and many donors continue channeling funds within a vertical structure (Martinez, Lizana, Ferreira, Mole, & Chissano, 2005).

Within the institutional framework of SWAp, MISAU has attempted to establish an integrated structure of service delivery and reporting. As one MISAU official said,

> Integration is one of the greatest preoccupations in the Ministry of Health. . . . Strategic creation of one single database seems desirable. We feel that the introduction of SIS.D [a Portuguese acronym of *Sistema de Informação de Saúde Distrital*, meaning district health information system] is the solution. All subsystems or components not included in SIS.D can be designed and incorporated in this application as modules. For example, the system for STI/HIV/AIDS. (Head, Department of Information for Health, October 2004)

Integration is also being planned by MISAU through various mechanisms (MISAU-Health Information Department, 2003), such as

1. a standardized collection system in the rural-district, provincial, and central hospitals and the private sector by 2006;
2. health care and services selected information included into the flexible database established at central, provincial, and district directorates and their gradual integration;
3. electronic communication (e-mail and Internet) at the district and provincial directorates, including a Web site, LAN-WAN, and intranet at the Ministry of Health.

The Mozambique national STI/HIV/AIDS program has centered on informing individuals and institutions of a range of preventive measures and to improve care to infected people by enhancing the availability and accessibility of antiretroviral drugs (Barnett & Whiteside, 2002). To monitor the performance of all components, an "integrated" information system has been proposed in the M&E Plan on AIDS (MISAU, 2004) as depicted in Figure 2.

Unfortunately, the implementation of this model is problematic because the existing compartmentalized information systems are still working in practice (see Figure 3).

There are several existing parallel flows of data, which will now be discussed.

Prevention of Mother-to-Child Transmission Reporting Flows

In March 2005, there were 62 health facilities with PMTCT services established (MISAU-M&E Task Force, 2005), where every pregnant woman in her first contact with the NHS was counseled to perform an HIV test. Those found positive were admitted to the PMTCT services. The data from PMTCT include the activities of health centers (follow-up of HIV women during pregnancy) and maternity wards (prophylaxis of HIV transmission during the labor). Data originating from the health centers are

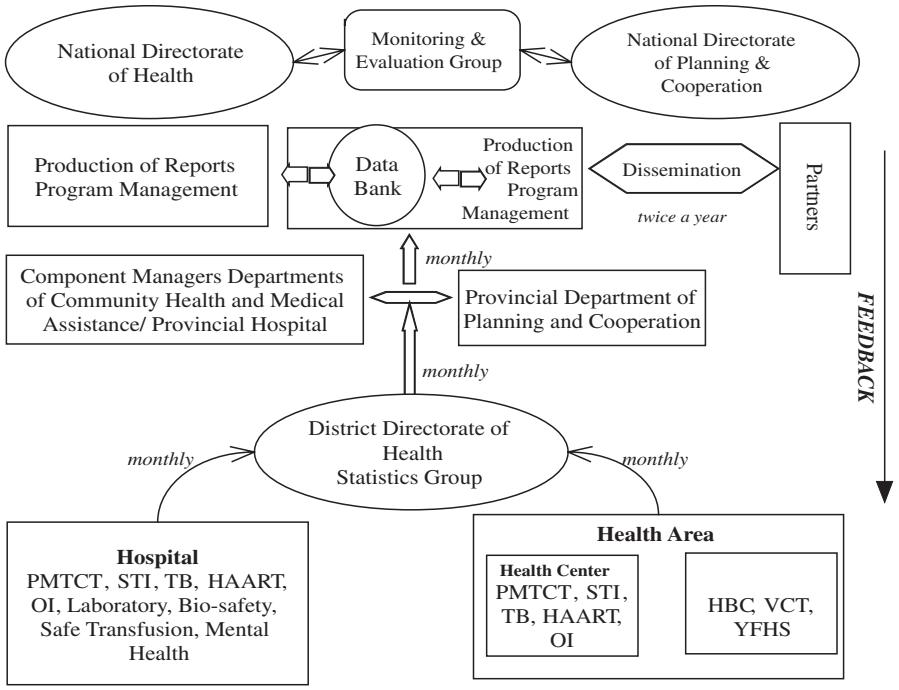

FIGURE 2: The Ambitious Routine "Integrated" Information System for STI/HIV/AIDS.
SOURCE: Ministry of Health (2004).
NOTE: Nongovernmental organizations report to the hospital level and the health center level. PMTCT = prevention of mother-to-child transmission; STI = sexually transmitted infections; TB = tuberculosis; HAART = highly active anti-retroviral therapy; OI = opportunistic infections; HBC = home-based care; VCT = voluntary, counseling, and testing; YFHS = youth friendly health services.

sent monthly to the district and provincial offices and then to the MISAU headquarters. These vertical flows imply that data are shared minimally between district and provincial managers. Planners at the National Directorate of Planning can only access the data by requesting the PMTCT component, located in the Community Health Department (part of the National Directorate of Health).

Voluntary Counseling and Testing Information Flows

VCT services collect and report data from people who voluntarily seek their HIV status. The counselor has a register book that identifies the client using a number instead of the name, gender, status of pregnancy (if any), age group, test result, and education level. Because VCTs are mainly run by NGOs, there are varying reporting routines. For example, a VCT center in Chokwe district was sending the monthly form in two ways, namely to the province (paper based) and to the national level (computer based) through another channel. Other VCT centers were sending data either directly

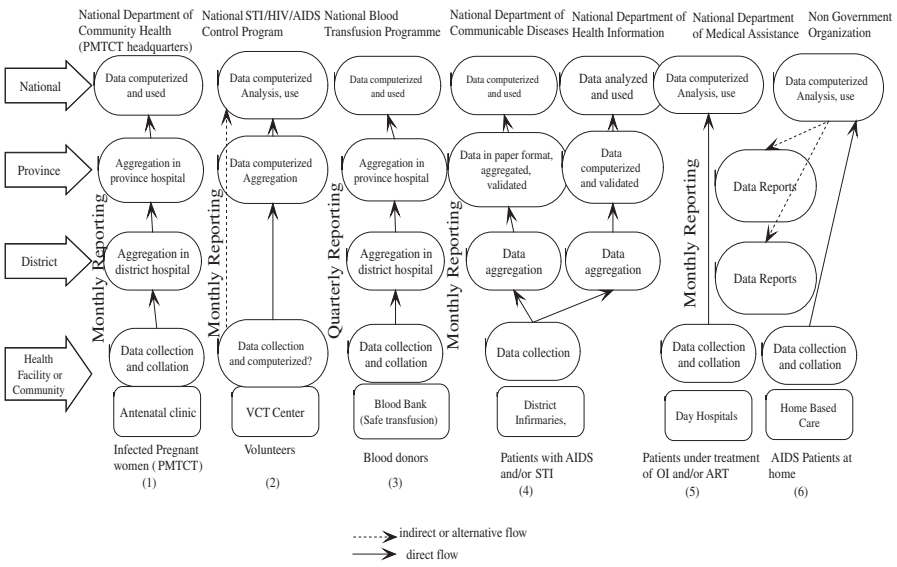

FIGURE 3: The "Unruly Mélange" of the Existing Information Systems for STI/HIV/AIDS Program in Mozambique
SOURCE: Adapted from Chilundo and Aanestad (2004).
NOTE: PMTCT = prevention of mother-to-child transmission; ART = anti-retroviral therapy; OI = opportunistic infections; VCT = voluntary, counseling, and testing.

to the province or to the MISAU national level, both without any systematic data validation. Despite many VCT services being equipped with new computers, we found VCT workers uncomfortable in entering data into the existing EPI-INFO 6 software.

Blood Transfusion Services Reporting Flows

Blood donors are categorized as benevolent (voluntary charity) and restorers (replacing the blood used to treat relatives). In spite of a different degree of HIV infection risk between the two groups, both need to be routinely screened prior to blood transfusion. All samples collected are registered in specific register books improvised from ordinary exercise books that contain no defined report formats. This commonly results in mistakes resulting from illegible handwriting or incomplete entries. The absence of standardized reporting formats led to a number of problems such as blood donation data being reported without HIV screening data and discrepancies between the totals of positive HIV and syphilis cases and that of discarded blood.

Blood banks at the district level compile quarterly summary reports and submit them to the provincial blood bank, where the manager is responsible for data aggregation and submission to the National Program of Blood Transfusion. These reports were observed to be untimely because of delays at the district level. To compensate for the errors in the figures received, national managers applied a correction factor of 40%

when compiling the annual report. This ad hoc correction distorted the representation of the HIV prevalence rates from blood donors.

Rural-District AIDS Inpatients Reporting Flows

Patients hospitalized due to AIDS are routinely reported on a monthly basis from the rural-district hospitals through two parallel "standardized" reporting systems: the AIDS inpatients reporting system and the monthly summary for inpatients from rural-district hospitals. This contributes to duplication of efforts, additional time, and incompleteness of data. Central and provincial hospitals report the data in an ad hoc manner because no formal system to report AIDS cases is in place. These are therefore not part of the officially reported data (MISAU, Directorate of Planning & Cooperation, 2003).

The AIDS inpatients reporting system (individual cases) includes both the confirmed cases from the laboratories and the clinically suspected AIDS patients admitted in medicine, pediatrics, or surgery wards. Monthly paper forms from the hospital wards go up to the district, provincial, and national levels (Department of Epidemiology), where data from paper are entered in the computer (EPI-INFO system) before they are sent to the National HIV/AIDS Control Program.

The monthly summary for inpatients (aggregated case) is an integral part of the main HIS within the National Directorate of Planning and Cooperation. The form includes data from inpatient surgery, maternity, pediatric, and medicine wards with diagnoses of malaria, diarrhea, and tuberculosis. These data are first aggregated in a paper format at district level and then computerized at the provincial level and sent electronically to the National Department of Information for further aggregation and analysis.

Many mistakes were observed. For example, in 2001 out of a total 82,192 expected new AIDS cases, the AIDS patients ward had reported 10,772 cases, but the monthly summary form had only reported about 2,600 cases (MISAU, 2003). Some of the health managers interviewed confirmed that these reports were of limited value as they were grossly underreporting and misleading the size of the hospital burden.

AIDS Patients Under Follow-Up for Treatment of Opportunistic Infections and/or Antiretroviral Therapy

Data to report the number of HIV patients under ART and those treated for OI at the Day Hospitals are registered and collected by clinical staff and submitted every month directly to the Department of Medical Assistance (DAM)-MISAU headquarters. There were approximately 30 public clinics providing ART as of March 2005, accounting for around 10,000 patients (MISAU-M&E Task Force, 2005). The availability of treatment is still well below the levels of patient demand. An entire set of forms has been developed for the variety of activities (clinical, laboratory, and pharmaceutical) required by chronic patients. A major difficulty acknowledged by MISAU is the incompleteness of national-level data for ART-related activities. The NGO-related reporting channels are often more effective than the corresponding MISAU ones.

AIDS Patients Under Follow-Up for Home-Based Care (HBC)

At the end of 2004, 47 NGOs, 79 public clinics, and approximately 18,000 patients were involved in HBC (MISAU-DAM, 2005). Usually NGOs collect data during care delivery. Data contents are sufficiently uniform countrywide, but the tool formats used in the collation of such data are not yet standardized. The first stages of the data coordination process are the adoption of common guidelines for delivering care and running the home visits, the introduction of common kits of drugs, and standardized staff training methods. The data flow process is still from the field workers to the NGOs and then to district and province MISAU bodies. Figure 3 shows the overlapping data flows, which is in tension with the efforts to develop an integrated information analysis. This situation is aggravated by the inability to perform "horizontal" data analysis at the district and provincial levels. The sheer inadequacy of the human capacity at most peripheral levels and their central-oriented, "vertical" flow hampers disaggregated analysis and focused intervention.

ANALYSIS AND DISCUSSION

Despite formal instruments to support the reform efforts to integrate the HIV/AIDS HIS, empirical results indicate a multiplicity of HIS, each with their own practices and processes. Why is this the case, and how can this be changed? To try and address these issues, the analysis focuses on the following questions: What is the nature of the complexity that is inherent in this reform effort, what institutional influences are in place, and what potential for change exists?

The Nature of Complexity

Complexity arises from the interdependencies among components of a system and varies with the kinds of linkages and the speed of change. The notion of history is important in understanding complexity as it shapes processes of path dependence (Urry, 2003) and inertial influences to change (North, 1990). Hanseth et al. (in press) quoting Paul Cillier describe complexity relating to an Electronic Patient Record (EPR) system as follows:

> A complex system is made up of a large number of elements interacting in a dynamic and non-linear fashion, forming loops and recurrent patterns which involve both positive and negative feedback; it is open in the sense that it is difficult to define the borders between it and other systems; it has "history": its past is co-responsible for its present as well as its future; and each element is ignorant of the system as a whole, responding only to information available locally. (p. 5)

The formal institution of the NHS mandates HIS to be designed and implemented to build health indicators, which helps to convert day-to-day observations into useful information. The value of a health indicator relies on the quality of data used and the capacity of making meaningful interpretations. The principal aim of a HIS is specifically to collect essential data at the facility and community levels that enable the calcu-

lation of these indicators. The baseline is thus the community and the health facility where health-related events occur. The "bridges" are the districts and provincial levels, which are intermediaries to the national levels of MISAU.

For the selected key indicators (e.g., percentage of ambulatory patients under ART, treatment drop-out rates, etc.), data quality is negatively affected by the multiplicity of data flows, time delay, and staff work practices. The poor coordination between various channels implies that the integrated analysis of data and information is not really possible.

The HIS is shaped by various informal constraints that tend to counter the formal rules. For example, health workers responsible for the HIS have as their primary task to attend and treat patients under conditions of acute staff shortages and high workloads (Economic Commission for Africa, 2003). The informal convention of giving primacy to patient care makes registration and reporting less important and contributes to poor data quality. Often, data on the number of patients seen or of condoms distributed are mere approximations compiled at the end of the day (Mosse & Sahay, 2003). The limited value attached to registering and reporting is reinforced by informal norms of the HIS being viewed as a bureaucratic task despite what the formal institutions mandate (Chilundo & Aanestad, 2004).

The divide between care and administration becomes magnified by the rapid increase of HIV/AIDS cases. In 2000, prevalence rate among adults (15 to 49 years of age) in Mozambique was 13.0% (Central Statistics Office et al., 2002) and in 2004 16.2% (MISAU National Control Program ITS/HIV-SIDA, 2005). In addition to the increased clinical workload, the data requested have also become more extensive and sophisticated. The formal rules advocate an increased volume of information, as is the case of the STI/HIV/AIDS plan, which established 15 components requiring 98 indicators to be routinely calculated through new data collection tools to be filled in by inadequately trained health staff. With very weak enforcement mechanisms (e.g., supervision) in place, there is limited overlap between the formal rules and informal constraints.

The HIS in Mozambique is historically uncoordinated, as shown for example by malaria data (Chilundo, Sundby, & Aanestad, 2004) and the introduction of ICT-based HIS (Kimaro & Nhampossa, 2005). The formal institutions mandating integration tend to be unmindful of the historical fragmentation and informal constraints embedded in the local work practices. The ambitious plans of reformers are made in a formal and top-down manner, conceiving the ICT introduction primarily as a technical process. Although efforts to harmonize at the "top" are a helpful step, appropriate enforcement mechanisms and incentives at the lower levels are needed to reduce the gap between formal and informal domains to make change feasible. For example, efforts are needed to increase the information handling capacities of staff and to ease some of their work pressures so that they can actively engage in the change efforts. Often the main interests of donors appear to be ensuring financial control through formal budgetary mechanisms, largely ignoring the informal constraints (Chilundo & Aanestad, 2004).

There is a divergence and lack of overlap between formal and informal institutions that contributes to poor results in integrating the HIV/AIDS reporting systems (see

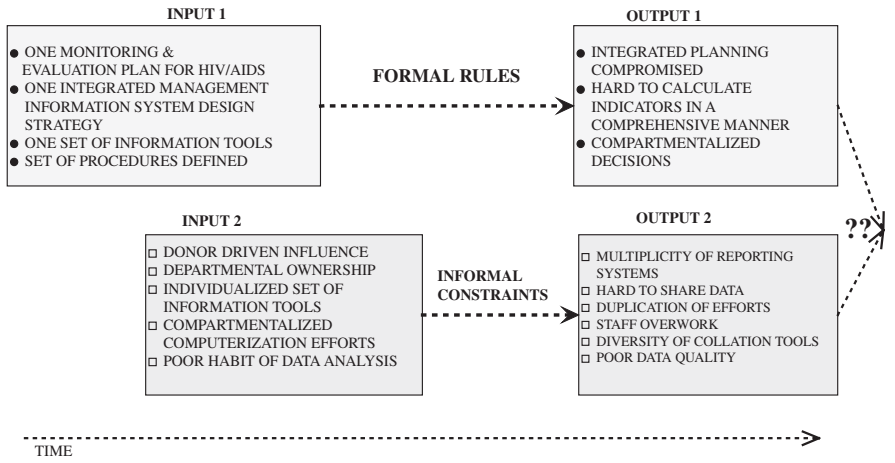

FIGURE 4: The Lack of Overlap Between the Formal Rules and Informal Constraints in the Implementation of Information Systems of the Various Components of the HIV/AIDS Program

Figure 4). During the implementation of the M&E Plan on AIDS, MISAU managers failed to take into account the different information tools due to donor influences, departmental ownership, a weak culture around data analysis and use, and the influence of various informal constraints and norms.

The Potential for Change

Institutional theory points to the role of contradictions arising from different institutional influences within the context of an organizational field as providing the potential for change. However, how this potential is or is not realized in practice remains largely an empirical question. Health sector reform is an ongoing process of reorganizing administration by challenging the institutional bureaucracies in MISAU by establishing formal rules such as plans and budgetary provisions and defining M&E indicators. These formal rules are developed through the involvement of various national and international organizations and enforced through different bilateral and multilateral arrangements.

Formal institutions engaged in reforms provide the potential for change by enabling decentralization of human resources, capacity-building efforts, and rationalizing information handling processes. For example, a formal structure of information officers at every level of health care delivery needs to be established and career incentives provided to the clinical and administrative staff to engage in information activities. Databases at provincial and district levels can be installed and appropriate ICTs drawn on to increase the linkage between the peripheral facilities and the provincial- and national-level management. However, in the current top-down structure, with high monitoring and enforcement costs and nonexistent incentives, the informal constraints continue to hold sway.

Change, both planned and emergent, guides the ongoing reform processes. The excessive focus on planned change divorced from the local realities provides limited potential for emergent changes. For example, although formal institutions presuppose data from all components to be integrated at the districts and further levels, the emergent situation shows data being sent through different channels and required information officers not yet in place. Despite SWAp's agreed platform of strengthening HIS, investments on human resources and communication instruments have been kept low. The development of databases has suffered delays, and the computerized data collection tools for the HIV/AIDS program have been unequally distributed.

CONCLUSIONS

Many low-income countries are experiencing a rapid increase in disease and persistent levels of poverty with no commensurate increase in human and financial resources. For these countries, effective management of health reform processes is crucial. However, strengthening these reform efforts is a nontrivial task given its inherent complexity, which requires the relationship between reform and organizational change to be more sensitively understood. To understand this historically situated complexity, we have drawn on an institutional perspective, coupled with insights about HIS and ICT-mediated organizational change processes. This research highlights at least four key issues that need to be addressed if change is to be effective: increased participation, a cultivation approach, providing space for flexibility and emergent changes, and strengthening the formal incentives and enforcement processes.

The participation of peripheral staff was negligible in the formulation of the instruments to enable integration of HIS. For information system changes to be effectively implemented, there is the fundamental need to understand local work practices of field workers involved in data collection, analysis, use, and transmission. Puri (2003) argues for the need to draw on local knowledge and integrate it with the more formal and scientific knowledge related to the technology and application domain. HIS-related reform efforts need to be harmonized with the direct involvement of the staff.

Current research in IS (e.g., Aanestad, 2002) has emphasized the importance of a cultivation approach to evolve complex interconnected systems such as HIS. Given the interconnected nature of the HIS, it becomes important not to be too ambitious and radical to design from scratch but to approach it in an incremental manner, making changes at the margins (North, 1990) and taking into consideration existing history (i.e., the existing ICT and multiple database of the national HIS). Thus, we have to avoid the use of a construction approach reflected in this case, which explicitly aims to design an integrated system from scratch, not respecting the power of the material—the installed base—comprised of the existing situated rationalities of the work practices, donor influences, and the particularities of the diseases. The cultivation approach implies an inherent need for flexibility both in the technical systems and in the institutional structures that provide the space and incentives for emergent changes to develop.

Incentives and enforcement mechanisms are almost nonexistent within the existing institutional structures. Although the formal instruments raise the demands on health staff to enhance their information handling capacities, they are provided little incentives to do so. Although providing monetary incentives within a public sector setting is difficult, there is the potential to develop formal rules to support career advancement. The primary structure for enforcement is supervision, which still remains a neglected practice and needs to be conceived more as a provision of effective support rather than a reprimand exercise.

The formal institutions operating in the context of Mozambican HIV-AIDS program traced plans and formal rules for implementing HIS changes, but the historical legacy of preexisting IS shapes different results. The implications of this analysis, we believe, go beyond Mozambique and apply more broadly for other low-income countries involved in ongoing processes of HSR and ICT-mediated organizational change.

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