A Framework For Assessing HMIS
In Developing Countries:
Latvia As A Case Study

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Abstract

The health systems in many developing countries lag seriously behind the developed world in the use of Health Management Information Systems (HMIS). The World Bank, like other international donor organizations, is increasingly called upon to provide technical and financial assistance in this area, but success stories remain rare. Because HMIS are critical to developing and improving health systems delivery and finance, the Bank must find ways to increase effectiveness of the interventions it supports.

This paper attempts to contribute to this process by proposing a new conceptual framework for the assessment of HMIS interventions, and then demonstrating the framework by applying it to an existing project to support national health insurance in Latvia.

The paper documents the key characteristics of the HMIS project, discusses successes and failures to date, and presents lessons learned that may be applicable to other HMIS projects in developing countries. The case study focuses on a functional classification of the HMIS implementation, and critical success factors that have emerged with regard to systems implementation in developed countries.

1 Background

Health care is the world’s most information- and knowledge-intense industry. Health management information systems (HMIS) direct the flow of information which is the “lifeblood” of today’s functional health system, just as real blood is critical to a functional human body. Many developing countries lag seriously behind the developed world in the coordination and sharing of information. Their information systems are not standardized and most do not offer proper security or privacy. In many cases, information systems simply automate manual processes without changing the underlying business processes or the information collected. Few staff members are properly trained to develop, operate or maintain the systems that are in place.

Against this backdrop, the World Bank is increasingly called upon to provide technical and financial assistance in this area. For example, the Bank’s Europe and Central Asia (ECA) region has devoted $137 million over the last 10 years, or 9% of total Health project loan/credit funds, to HMIS. Despite this influx of funding, success stories in HMIS are rare, as a result of limited capacity (both on the part of the Bank teams involved and the clients), a complex and rapidly changing technological area, limited or non-existent standards, and an industry that is renowned for promising more than it can deliver. Even the relatively successful efforts have been difficult, costly and time-consuming. Yet, HMIS is critical to developing and improving the health systems of the world, so the Bank, as well as others involved in funding development projects, must find ways to increase effectiveness of the interventions it supports.

2. Introduction

This paper proposes a new conceptual framework for the assessment of HMIS interventions in developing countries and then applies this framework to a current project that is currently in the implementation stage: a system to support national health insurance in Latvia, a middle-income country soon to become a member of the EU. The paper documents the key characteristics of the specific HMIS implementation, discusses the successes and failures to date, and presents the lessons learned that
may be applicable to other HMIS projects in developing countries.

The case study focuses on a functional classification of the HMIS implementation, and four key areas that have been shown to be critical success factors (CSFs) in systems implementation in more-developed countries:

- Robust management and governance structures (including change management),
- The use of professional inputs during project concept development and implementation
- The extent to which systems introduction is coupled with pro-active business process redesign
- The complexity of the technical environment and its constraints.

The conceptual framework describes the system in terms of its placement in a Systems Hierarchy and the HMIS uses a taxonomy described by Streveler, and the specific sectors and users which the HMIS is designed to serve. The framework examines both the level of complexity and scope of coverage of the HMIS.

The framework has three axes:

1. The first axis describes “system dimension”, a measure of the complexity of the underlying technologies used, and an attempt to (somewhat) linearly describe how progress in HMIS can best be produced.

2. The second axis describes “system uses”. This is the general taxonomy of HMIS applications described by Streveler. Each category of “system use” can be further decomposed to whatever level desired. For example, patient management systems are composed of clinic information systems, hospital information systems, laboratory information systems, radiology information systems, and so on.

3. The third and final axis, contributed by Haazen, categories users and stakeholders who will be impacted by the implementation – either by directly impacting their job duties, or possibly by changing the outputs which result from those duties.

From this framework, we can propose two hypotheses:

1. Simpler, more focused information systems (as measured on a combination of the three scales) should be easier to implement. (Notwithstanding that simpler systems may be expected to provide

2. There is an optimum sequence in which information systems should be built, from “the ground up” ideally progressing through the scales in an orderly, if not completely linearly, way. (Conversely, if one begins by implementing very complex systems, one may be dramatically increasing the risk of failure.)

<table>
<thead>
<tr>
<th>System Dimensions</th>
<th>System Uses</th>
<th>System Sectors/Stakeholders</th>
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<tbody>
<tr>
<td>8 Advanced Technologies</td>
<td>A. Patient Management</td>
<td>i. Ministry of Health (national/regional)</td>
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<td>7 Electronic Record Keeping</td>
<td>B. Population Management</td>
<td>ii. Health Insurance Agency</td>
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<tr>
<td>6 Health Insurance Systems</td>
<td>C. Disease State Management</td>
<td>iii. Secondary Health Care/Hospitals</td>
</tr>
<tr>
<td>5 Clinical Venue Systems</td>
<td>D. Resource Management</td>
<td>iv. Specialist Ambulatory Care</td>
</tr>
<tr>
<td>4 Management &amp; Planning Tools</td>
<td>E. Utilization Management</td>
<td>v. Primary Health Care</td>
</tr>
<tr>
<td>3 Resource Management</td>
<td>F. Financial Management</td>
<td>vi. Emergency Medical Services</td>
</tr>
<tr>
<td>2 Accounting &amp; Inventory</td>
<td>G. Quality Management</td>
<td>vii. Pharmacies</td>
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<td>1 Health Statistics</td>
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<td>viii. Public Health</td>
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<td>0 Standard Setting and Master Planning</td>
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Figure 1. Proposed conceptual framework showing its three axes

3. Overview of Latvia and the Latvian Project

Latvia is a relatively small (64,000 square kilometers) country of 2.3 million people, situated in Europe on the eastern end of the Baltic Sea between Estonia to the north and Lithuania to the south (Figure 2). It was previously a republic of the Soviet Union, until it declared independence in 1990.

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The Republic of Latvia expects to join the European Union in 2004, has a per-capita GDP of US $3,260, and spends $120 per-capita on health care. It is at the lower end of its neighboring countries in terms of life expectancy (70.6 years), and fairly high, compared to its neighbors, in terms of maternal (38 per 100,000 live births) and infant mortality (10.4 1,000 live births). The population is declining, having dropped by 200,000 persons in the last five years.

The Republic of Latvia received a loan of $12.0 million from the World Bank to assist in implementing a Health Reform Project. About one-third of the project funds were allocated to the development and implementation of HMIS in the State Compulsory Health Insurance Agency (SCHIA). The major functions of SCHIA are to identify and analyze the health care needs of the population, distribute resources to the Regional Sickness Funds, monitor and control how the resources are used within the Regional Sickness Funds and to supervise and control the contracted services providers within the health care sector.

3.1 Project Purpose and Components

The objective of the HMIS is to provide the Latvian health care system with information supporting strategic decision-making. Once fully implemented, it would support health care managers in making decisions about the allocation of funds to each of the regions and to the medical institutions in Latvia, and be an input into planning the number and type of different types of health care providers. It was expected that managers would be able to summarize, analyze and present information about the input and output of the health care process, as well as the efficiency of the process itself, in a faster and more flexible way.

The over-all purpose of the project is to develop and implement a patient-oriented, efficient health care system that would be accessible to the populace.

The Project overall has four components:

- **Health Care Financing Reform**, designed to ensure a rational and transparent financial flow with respect to the quality health care services required by the patient. *(HMIS is included in this component)*
- **Restructuring of Health Care Services**, designed to (a) develop an effective and efficient investment policy that facilitates cost-efficiency and service quality; (b) rationalize the service provider structure to ensure cost-efficiency and service quality.
- **Implementation of the Health Reform Communication Strategy**, with the objective of informing the public regarding the process of health reform by informing both medical experts and society generally.
- **Project Coordination**, including project management, monitoring, procurement, financial management and office management.

3.2 Amount earmarked for the HMIS component

The original budget for the HMIS activity was $3.99 million. In addition, a total of $969,200 was allocated from a complementary grant from the Swedish International Development Agency (SIDA), out of a total grant of $2.0 million, for requirements definition and ongoing development/implementation monitoring and support.

3.3 Schedule for the HMIS project and other components

The project was approved in the late autumn of 1998, and became effective (operational) in March of 1999. It was expected to close at the end of 2001 (i.e., less than 3 years after effectiveness). The original project documentation anticipated an effective date that was two months earlier, and projected the release of bidding documents in June of 1999 and a contract award in October of the same year. This was expected to be one of the first major procurement processes to be undertaken by the new Project Management Unit (PMU). The timing of the expected SIDA support was not specified. Significant civil works, equipment and consulting services procurement was also expected to take place during roughly the same timeframe.

3.4 Scope of HMIS project and its objectives

The system specifications describe the following as the scope of the HMIS project:
“The **Objective** of the [Health] Management Information System is to create an effective health care information and statistics system – the collection, the availability, the processing and the analyses of data - for the Latvian health care managers, based on modern IT.”

The Management Information System is intended to:

- Support the health care reform by providing the decision-makers with the information they need in terms of medical and economic statistic data.
- Improve the data collecting methods.
- Ensure usage of the national and international standards (uniform metrics) in classification, methodology and data processing.
- Make it possible to link the health care statistics to its economic indicators.

In the future, the Management Information System must adapt to changes and renewals of the information needs, and thus flexibility is an important feature.

The tasks connected to the objectives described above are to: (a) provide hardware, (b) develop software, (c) provide training, and (d) provide maintenance and support; for the SCHIA, the Regional Sickness Funds (RSF’s), the Institution of Medical Statistics and the statistical departments of the major hospitals. The Medical Institutions, the hospitals and the primary health care, are included in this Information System as data providers.

The data collected is of interest to other parties, for example the Environmental Health Centre. It is intended that they will get relevant data from the System, but the contract does not cover the hardware and software needs of these external parties.

### 3.4.1 Technical platform

To accomplish these myriad objectives, the following infrastructure components were involved:

- An Internet connection would serve for alternative data input when the permanent telecommunications connections are not available

The system should be able to handle 500 concurrent users from five very distinct backgrounds, skill levels, and perspectives:

1. Medical institutions, PHC institutions, dentists, pharmacies and other suppliers of healthcare services,
2. Regional sickness funds (RSFs),
3. Branch offices of regional sickness funds,
4. SCHIA, and
5. The HMIS support group.

The specific processes to be supported include:

- Collecting data from the Latvian healthcare providers
- Maintenance of registers about the healthcare providers
- Storing information about contracts between the RSFs and the medical institutions
- Calculate and store information about payments from the RSFs to the medical institutions
- Storing information about contracts between the RSFs and the pharmacies
- Calculate and store information about payments from the RSFs to the pharmacies
- Provide information and analysis for budgeting
- Store information about the budgets
- Provide data for quality assurance on prescriptions and patient cases
- Provide standard reports on key indicators and possibilities of making ad-hoc reports
- Provide standard and ad-hoc statistical reports

Using the framework described in Section 1, the Latvia system can be categorized along the following dimensions:
3.4.2 Related activities being undertaken to support HMIS

Important complementary activities to the main HMIS development included:

- The establishment of the SCHIA, including management structures, and facilities;
- Training of SCHIA staff in health insurance operations and management;
- Technical assistance for the development of technical specifications and the monitoring of the systems development process;
- Technical assistance in the areas of quality assurance, medical audit and financial management/audit.

To some extent, these activities should mitigate some of the potential problems and potential risks described above, provided that they are undertaken in a timely manner, and are of high quality.

4. Progress to date

It is fair to say that the magnitude of the task to be undertaken in terms of planning and procurement was greatly underestimated. In addition, other events contributed to a slow down in the procurement process. The loan started very slowly because of the front-end loading of a large amount of procurement activity, previously discussed, relatively weak project management capacity at the PMU level and disagreements or indecision regarding a number of key activities, including HMIS. Another key constraint was a government-wide review of information technology (IT) activity which was conducted by the Ministry of Transport. While likely a worthwhile endeavor in its own right, this process delayed the finalization of the HMIS tender documents by 12-18 months. Such impediments are typical of those which are experienced in many countries when attempting to implement HMIS.

The external consultants, the Bank experts and the SCHIA were able ultimately to finalize the bidding documents in February, 2001. However, in the intervening period significant problems became apparent in another IT-related activity in the Welfare and Pensions part of the Ministry of Welfare (which also housed the Health Department). The first-hand knowledge of these problems, as well as the substantial efforts undertaken to rectify them, probably had a positive impact on the quality of the bidding documents, including the technical specifications, as well as contract provisions and project management and control structures. (This is discussed further below.)

The bidding documents were finally made available to bidders on February 22, 2001, and the bids were opened on July 25, 2001. Five bids were received. The final bid evaluation report was completed on October 5, 2001, although a number of issues with respect to the validity of several of the bids needed to be resolved, which took more time. The contract was signed on February 18, 2002, and is expected to be completed by the end of 2003. The
final contract price was within about 10 percent of the original estimate.

4.2 Some early results
As of May 2003, substantial progress has been made. Most of the equipment has been installed, and many of the software modules have been written. Module-level testing is being done, and an initial run of qualification test produced 1,688 errors to be corrected. However, as these errors were fixed, the queue of new errors and changes stopped growing, which is a generally positive indicator of how stable the environment has become and likely demonstrates the effectiveness of the initial efforts which were directed at developing a robust testing protocol. The next major challenge will be testing the module interfaces, load tests, and testing of the queue management module.

The external consultants/experts have indicated that they are impressed by the productivity thus far, especially recently, but they continue to raise issues and questions in an attempt to improve the process and pro-actively deal with potential problems. One of these is the appropriate approach for implementation and roll-out. Variations of pilot implementation and operating parallel systems are being discussed, but the large number of different users is obviously a complicating factor. The project does appear to be on track for finishing by the end of December, 2003.

4.3 Impact of project interventions
It is somewhat early to be certain about the impact of the new system and its operational characteristics. The current opinion of the external consultants/advisors – who have been fairly pessimistic in the past – is that a functional system is very likely to be implemented, although the design and development approach chosen will probably make it fairly expensive and time-consuming to maintain. It is also thought that the system will have a useful life of 5-7 years before a major overhaul is needed. Of course, the true test will be the extent to which the variety of users (see Figure 2) actually utilize the system, and the quality of the decisions that result from this use. In this regard, it is still much too early to tell. However, the level of professionalism with which the system development process was handled, especially at the senior management level, bodes well for this aspect of the project impact as well.

4.3 Other effects of project – positive and negative
One of the great concerns of many of those involved in the project at the early stages was its complexity and scope. These concerns were heightened by the experience in the welfare information system, where litigation is still ongoing! The positive impact of this situation is the amount of attention devoted to planning, including the development of detailed data models and technical specifications. The relatively small number of HMIS, as well as other, staff in the SCHIA meant that a great deal of this activity fell to consultants. While this ensured high levels of technical input, the extent of the “technology transfer” and capacity building that resulted from this approach is not clear. The timelines and staff availability also meant that those working on the project were not able to be trained in systems design and process re-design before the detailed development work started. Aside from the likely frustrations felt by those involved, there is also a danger that the resulting designs are less than optimal. Time will tell.

5. Evaluation with respect to postulated critical success factors (CSFs)
Both in the literature, and in the review that was done of Bank-funded HMIS interventions for the ECA Business Plan, several critical success factors appear to stand out. The following sections will describe the factors, and indicate how the Latvia project fares with respect to each at this point.

5.1 CSF: Robust management and governance structures (including change management)
The management control structures set up for this project is one of the more interesting and innovative features of the project. The HMIS project operated within the overall framework of the Health Care Reform program. Supporting this program are the Minister of Health and senior management, as well as a project steering committee. The chair of the steering committee is the project manager, who is also a senior manager within the MOH. At the operational and implementation level, the program is supported by the Project Management Unit (PMU). This Unit manages the day-to-day implementation, including the procurement of various goods and services, and the monitoring of contract progress.

An HMIS Control Group was established, including senior managers from the MOH, the SCHIA, and the Medical Statistics and Health Technologies Agency, plus the PMU director, the IT Department Chief, and the HMIS project coordinator. This group was responsible for all of the major decisions regarding HMIS project implementation. An evaluation commission was set up during the bidding process to review and advise on the most appropriate technical and financial proposal. The Project Director, who chaired the Control Group is also the Director of SCHIA, and thus had responsibilities for both the HMIS implementation and other health reform initiatives related to SCHIA.
The HMIS implementation group consisted of a specially assigned Project Coordinator, plus a software development testing manager, a business requirement control group, and various work groups drawn from both technical and operational staff. The IT department chief and his maintenance and development units were formally outside the implementation structure, because of the need to keep the existing systems going. The supplier was also considered part of the overall project implementation. To address the inevitable changes, a Change Management Board, consisting of both supplier and purchaser representatives, was constituted. A formal change management protocol was included in the contract and followed rigorously, with formal sign-off by the HMIS control group, as well as the Steering Committee and the Bank, as necessary.

Overall, there is a consensus of opinion that the relatively smooth implementation thus far has been in large measure a result of the careful attention to the management structures, contract construction and change management procedures. No major disagreements have occurred between the supplier and the purchaser, and the project is (relatively) on schedule. It will be some time before the impact on the final product can be assessed.

5.2 CSF: The Use of Professional Inputs during Development and Implementation

The Latvia HMIS project also scored high on both the use and the effectiveness of additional professional inputs during both development and implementation. During the development of the technical specifications, the independent consultants were able to advise on technical issues, and were also able to ensure that the resulting specifications were useful and understandable to the international IT community. The addition of substantial Bank technical expertise also ensured that the specifications met the appropriate Bank standards, and would result in a fair and competitive tender process. Despite this, four sets of questions from bidders and amendments were made through the course of the bidding process. Again the various technical experts provided advice and assistance.

During the project implementation the external advisors played a different role. Two types of advisors were used. A local accounting firm, a subsidiary of one of the “Big Four”, provided advice on financial and business process issues. This first is also the SCHIA auditor, so knows the operations quite well. The other advisor, which also assisted in the development of the technical specifications, served as a type of “technical conscience”, flagging issues, timelines and other technical considerations that could potentially have an impact on the success of the development and implementation process. Although this latter consultancy proved more controversial, there is growing acceptance of the value of these inputs. It is fairly clear that these various professional inputs have had a major positive impact on the success of both the procurement and development phases of the project. As in the previous criterion, the final impact will only be obvious down the road.

5.3 CSF: Pro-active business process redesign

From the very outset, everyone involved in the project expressed the desire that the system not just automate existing processes, but help to support new and more effective ways of doing business. However, it became clear early into the implementation that limited capacity existed to conceptualize and define new and better business processes. Part of this was due to the fact that the State Compulsory Health Insurance Agency itself was still quite new, having been established in its present form only in 1998. Moreover, although the staff members of the Agency are very motivated, the organizational culture in the country is not one that easily promotes actively exploring new and better ways of doing things. Finally, the number of existing staff in the Agency is barely sufficient handle the day-to-day business processing needs, leaving little additional time to devote to process redesign. It is clear that some of these issues could have been addressed through additional technical assistance and training prior to the commencement of the HMIS project, but the staffing/availability issue is a conundrum, especially given the low level of available funding and administrative overhead for the Agency.

5.4 The technical environment and its constraints

The technical environment proved to be the least controversial during the development process, although it may play a major role in the longer-term sustainability and flexibility of the system. Early on in the process, the government-wide IT review did have an impact on the overall timing of the project, but the impact was not permanent. A Latvian company made up large part of the development team, and it is not clear that they had as complete an understanding of “object-oriented programming” as might have been hoped. As a result, there is some concern that the systems code may be more difficult to maintain and/or modify to meet changing needs. For example, the SCHIA has indicated a desire to move to a more comprehensive DRG-based payment system for hospital and to make changes to the capitation approach for paying family doctors. It is not yet clear how easy it will be to implement such significant changes.

There is also an interaction between this factor and the previous one, since the relatively limited amount of process redesign that was done increases the likelihood
that both process and system redesign will be needed sooner in the future. A less flexible code base could increase the cost and time required for making these changes.

5.5 Overall Evaluation on Critical Success Factors

Figure 4 summarizes the Latvia HMIS project along each of the CSF dimensions, as well as on the “success dimensions” – on predicting how likely the project is expected to be delivered on time and on budget, and the overall project functionality and sustainability.

It seems fairly certain that the management structures and use of external advice have contributed greatly to the expected success, although the more limited attention to process redesign, together with potential technical limitations could have adverse implications for longer-term sustainability and yet-to-be-realized costs.

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<thead>
<tr>
<th>Dimension</th>
<th>Low</th>
<th>High</th>
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<tr>
<td><strong>Critical Success Factors</strong></td>
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<td>Management Structures</td>
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<td>Professional Advice</td>
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<td>Process Redesign</td>
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<td>Technical Considerations</td>
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<td><strong>Success Dimensions</strong></td>
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<td>Adherence to Timeline</td>
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<td>Adherence to Budget</td>
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<td>Functionality robustness</td>
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<td>Sustainability</td>
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Figure 4. Preliminary Project Evaluation (including Critical Success Factors and Success Dimensions)

6. Summary and Conclusions

In this monograph, we proposed a new framework for assessing relative risks and relative benefits of implementing HMIS components in countries with developing economies. Many of our conclusions about the frameworks efficacy and usefulness remain to be empirically tested and validated. However, early anecdotal evidence seems to indicate that the framework’s highly concentrated manner of presentation, and the intuitive relative scales which it uses, may provide project designers with some insight into the nature of HMIS complexity about to be undertaken. Likewise, the output from the framework can be used to compare projects in different countries, and thus to see if there are patterns which emerge.

Much remains to be done in this area, which is consistent with the overall lag in progress made in the HMIS area overall. But we are hopeful that this effort is heading us in the right direction – that it will contribute to reducing the failure rate of such HMIS projects as they are undertaken in the developing world.

The Latvian case study presented here has shown that despite some elements of complexity, in terms of the number and types of users, and the inclusion of quality management components, the proper attention to the critical success factors has, based on the evidence to date, helped to improve the likelihood of a successful HMIS implementation in that country. It will be very useful to further explore this relationship as this project progresses; and to see if the application of this framework to other HMIS projects might serve as an approach for both identifying and mitigating implementation risks.