Jimmy Macharia

The Nairobi Hospital (A)

On June 19th, 2004, as the Boeing 747 circled and climbed westwards of Bombay airport, Cleopas Mailu, the CEO of The Nairobi Hospital, began to unwind after undertaking intensive evaluations and site visits in India and South Africa in relation to three short-listed hospital management information systems. Cleopas and his team of three had visited two sites in India; the first to evaluate the JEEVA online medical system which had been developed by the Indian company Karishma Software Limited; the second to evaluate the CARE 2000 system, a management information system which had been proposed by Symphony Limited, a Kenyan based company. The third site visited had been in Johannesburg, South Africa and there Cleopas and his colleagues were able to assess Medical Information Technology SA (Pty) Ltd's, MEDITECH Health Care Information System.

Cleopas and his team had spent two long weeks undertaking evaluations of the proposals, assessing their respective vendors and the corresponding site system implementation and operations. While some members of his team continued with the evaluations, Cleopas was flying back to Nairobi to give his final verdict on the three proposals.

Since the computer had not placed anyone in the seat next to him, Cleopas was left to his own thoughts as he sipped a glass of red wine while flying 10 kilometers above sea level. Not surprisingly his thoughts jumped to the evaluation of the three systems and the findings from the site visits. What surprised him, in the relative quiet of the first class cabin where there was no immediate pressure, was that his thoughts drilled to the consequences of selecting an unsuitable solution bearing in mind that this was his first major assignment after joining The Nairobi Hospital as CEO three months ago. The reflections which filled his head were mildly disturbing because he began to wonder, if, in spite of the thorough analysis of the three proposals and the local and oversees site visits that had cost the hospital close to Kenya Shillings 3,000,000, he was going to select the wrong system for the hospital. "When I land in Nairobi, the board is expecting a decision on the suitable solution among MEDITECH HCIS, JEEVA, or CARE 2000. Am I going to choose a system just to waste our time and money just like Mater Hospital did three months ago?" Cleopas wondered.

History of The Nairobi Hospital

Western medicine trickled slowly into Kenya with the first little colonial hospitals erected in the bush, most of them near missions. During the 1914 -18 world war, larger hospitals appeared on Nairobi Hill to serve military needs. By the mid-thirties, Nairobi had numerous peripheral Government Dispensaries, a European Hospital serving the Civil Service, a native hospital with an Asian wing and a few private Nursing homes for the settlers.

After the war, the Government built the King George VI Hospital. It had some 600 beds for the African population and a larger Asian wing was added, the funds for this being donated by the Asian Community. The European Hospital was also enlarged, but could not cope with the great demands made by the post war flood of immigrants. The colonial Government set up a scheme for the enlargement of many social amenities such as hospitals, schools etc. by putting up funds. Consequently, The Nairobi European Hospital Association was set up to oversee the funds set for the development of the hospital services.

The Nairobi European Hospital Association bought the Maia Carberry Nursing home (now the Kenya School of Law) and built the Princess Elizabeth Hospital (now the Government Dental School). The Princess Elizabeth was opened in 1952. Further demand and the impending closure of the old Government European Hospital, led to the acquisition of the old Polo ground on the opposite side of the Hurlingham Road where the new European Hospital was built. Later on the European only restriction was dropped and the name was changed to the "Nairobi Hospital". A School of Nursing was established and named after Cicely McDonnell, a pioneer nurse.

The Nairobi Hospital, established in 1956, provided health services throughout East Africa region. The aim of The Nairobi Hospital was to provide first class patient care through highly qualified professionals and advanced diagnostic and treatment facilities, with patient privacy and confidentiality being key imperatives in health service delivery.

Following independence in 1963, there was an exodus of Europeans. The Nairobi Hospital patient population dropped dramatically, however the economy readjusted and this together with the sale of Maia Carberry Nursing Home and the closing of the Princess Elizabeth Hospital resulted in the reinstatement of patient throughput at The Nairobi Hospital to present levels.

By 2001, The Nairobi Hospital was a world-class referral hospital in the heart of Nairobi, providing health care services to people of all classes. However, the rapidly expanding capabilities of information technology had shortened the hospital's current system, MEDAX's life cycle and hence was due to be discarded. Consequently, there was a critical need to develop a new information system or the hospital would soon be at a competitive disadvantage as a result of its obsolete information systems. The Nairobi Hospital needed relevant and timely information to support hospital management in decision making, to aid health professionals in the management of patients, to provide of data storage and accurate processing of patients records, and to manage and report hospital finances and operations. The increasing market competition, in the rapidly changing environment, made the requirement for a new healthcare system even more urgent and it was now a strategic priority.

In the third quarter of 2003 the Executive Management of The Nairobi Hospital compiled and published a six-year business strategic plan. Key to the success of the plan was a new and modern information system. The hospital therefore embarked on a project to develop a comprehensive Information Technology (IT) plan for the period 2003 — 2008 as a means of improving information and communication efficiency within its departments. To lead the process was Dr. Cleopus Mailu –the CEO, Mr Eshy Githiaka - Finance Director, and Ms Salome Gitoho- Director Strategic Planning & Development (See Exhibit 1).

Health Information Systems in Kenya

National Health Sector Strategic Plan

The development of the first National Health Sector Strategic Plan (NHSSP-I) for the period 1999-2004 in Kenya was a follow-up to the Ministry of Health's efforts to translate the Ministry of Health policy objectives into an implementable programme. In addition to taking into account past constraints, the document involved key stakeholders in the planning process from the start through consultative workshops within the Ministry itself and with other stakeholders, such as development partners, public sector, districts, and provinces, the private sectors, NGOs, religious groups, professional organizations, communities, users of health services, and teaching and research institutions. The end product thus incorporated the views and priorities of all these groups. The NHSSP-I was evaluated in September 2004 by an external team of independent consultants. The evaluation found that "...despite having well focused national health policies and a reform agenda whose overriding strategies were focused on improving health care delivery services and systems through efficient and effective health management systems and reform, the overall implementation of NHSSP-I (1999-2004) did not manage to make a breakthrough in terms of transforming the critical health sector interventions and operations towards meeting the most significant targets and indicators of health and socio economic development as expected by the plan". This was attributed to a set of factors, most of which were inter-related, including weak management systems that did not benefit from the use of modern information and communications technology that would have offered tremendous opportunity of improving healthcare. According to the findings of the team of experts who carried out the research (and wrote the report: Service Provision Assessment Survey, 2004, for the Ministry of Health), most hospitals in Kenya had only very basic health care information systems.

Competitor Systems

The Nairobi Hospital was one of the major hospitals among the 71 that were in Nairobi and one of a total of 562 hospitals that were in the Nation of Kenya in 2004. Its five key competitors were: The Aghakan; MP Shah; Mater; Metropolitan; and Nairobi West Hospitals, all of which were privately owned and located in the city of Nairobi within a radius of five kilometers of The Nairobi Hospital. The majority of hospitals in Kenya were, however, government owned and none, not even the teaching and referral hospitals such as Kenyatta National (the largest government hospital), and Moi Referral hospitals, had anything more than rudimentary health care information systems in place. The Nairobi Hospital team therefore turned its attention to the private sector to assess the options available in developing an integrated health care information system.

The Nairobi Hospital board constituted a team to visit two local hospitals (the Metropolitan and Nairobi West) where integrated health care information systems had been implemented. However these were 40, and 113 bed size hospitals respectively, and hence their healthcare information systems were not considered adequate for running a 250 bed size health facility

like The Nairobi Hospital, except in a fall back situation. The visiting team to these hospitals included representatives from Finance, Laboratory, Nursing and Information Technology departments. The purpose of the local site visits was (i) To see the functioning of the systems in a live environment, the information process flow from one department to another and the proposed functionalities. (ii) To evaluate the proposed system vis-à-vis The Nairobi Hospital requirements and (iii) To determine the overall integration of the vendor software. As well as meeting requirements in the critical areas of patient accounting, stock management, procurement and pharmacy, the evaluation was to take into account whether the solutions incorporated back-up procedures in the event of problems being experienced by The Nairobi Hospital through the implementation stage.

Nairobi West Hospital System

This was a private 113 bed hospital situated in a residential estate, south east and three kilometers from the centre of Nairobi city. The hospital had used the Check-up system for over 5 years and had implemented all the modules of the system. The system was at the time networked to serve 40 users in the main hospital and 5 more users 3 kilometers way in their Teleposta towers clinic in the centre of Nairobi City. The Information Technology (IT) department comprised of five staff with four of the staff available to do system support work. The system was integrated, and once information was captured at one point, there was no need to enter the data again. This information could pertain to all sorts of hospital health care procedures, from laboratory requests, to patient registrations or any other patient-related matter. The accuracy of the information obtained had a human aspect. The Garbage in Garbage out (GIGO) principal applied to the system. If the user responsible for certain information input did enter erroneous input, the errors were propagated to the system information output.

The system was well developed and could be expanded to meet The Nairobi Hospital requirements. All system modules were integrated but one could choose to install only a few. It was also capable of processing the current Value Added Tax (VAT) requirements, National Health Insurance Fund (NHIF) rebates, reporting, and online procurement. There was no price indication since the system had not been sold to hospitals other than Nairobi West Hospital and Teleposta towers which are part of the same group. However this system was locally developed by the hospital personnel, consequently the hospital was to be the system vendor. They had indicated that if Nairobi Hospital were interested, the pricing and other details could be discussed. Server specifications were to be provided during discussions. It was a comprehensive and a modern solution, which provided relevant functionality to the hospital's requirements. The technical architecture was 2-tier and they were working on a web enabled system. The database platform was Oracle running on a Windows 2000 platform with the front end being run using Oracle Developer 2000. It was fully integrated and user friendly with drop down menus. The main concerns with this system included the fact that the number of support personnel was 4, which was considered inadequate, bearing in mind that they also supported other software run by the hospital. Further, the system was slow, and the implementation experience of the team was insufficient (Exhibit 2).

Metropolitan Hospital

This was a private 40 bed hospital in Buruburu Estate three kilometers from the city centre, and four kilometers from The Nairobi Hospital. The Metropolitan Hospital provided both in and outpatient services and used locally developed software from Afrisoft Technologies. The system had been in use in the hospital for about 1 year and was being used in the following areas: outpatient and inpatient management, billing, pharmacy, procurement and stock management. The hospital system was networked and running a total number of 18

concurrent users. The IT department comprised 5 staff that provided support to the system. Amongst the 5 staff, there was an employee of Afrisoft who looked into the day to day changes and enhancements to the system. The hospital had been able to improve in its scheme management and billing as they were able to capture all billing details as well as track invoices through an inbuilt dispatch system. Their main focus had been on billing, debtors, management of co-operate schemes, doctor's accounts, dispatch of invoices and supplier reconciliations. They were currently running all the modules though some of them were still under development. The system ran on PostGreSql database and Linux operating system software. Some of the areas where they had experienced challenges were in the data migration and initial processing speeds which had improved over time as they introduced other servers. The system had helped to improve on the efficiency of their operations especially in managing debtors.

One of the areas where management had benefited in using the system was that all operations were on-line - transactions could be traced from one's desk. The Metropolitan Hospital was also able to reduce theft since all cash receipts are accounted for and recorded in the system. The materials management for stores and pharmacy were well developed and inventory stock for pharmacy had been reduced to 4 days as they were able to automatically manage stock using the stocks module. It was also worth noting that the operators could handle enquiries e.g. doctor availability, appointments, and cost of services using the system. Future developments that were being worked on included interfacing the laboratory module to laboratory equipment and working on a web interface whereby suppliers could track their accounts and receive payments for services rendered. The main concerns with that system were:- (i) There were only 4 support staff and they also supported other software run by the hospital so they would have limited capacity to support The Nairobi Hospital should it decide to implement their system since Afrisoft depended on the hospital staff and its single support staff stationed at the hospital for both development and new site support. (ii) The system was slow (iii) The implementation experience of the team was limited. The system was named Alliance Medical Systems (AMS) and was developed and owned by Afrisoft Technologies Ltd. who had partnered with The Metropolitan Hospital in developing the system. Afrisoft was keen to capture the commercial potential of the system by marketing it to other hospitals, As well as being used in The Metropolitan Hospital, the system had been adopted by Mwea Hospital, Nairobi Outpatient Centre and Sher Agencies Hospital in a countryside town called Naivasha one hundred kilometers from Nairobi. The AMS architecture was 2-tier and the front end had been developed using Java scripts. The reports within the system used Adobe Acrobat Reader while the modules available were integrated.

The system, like its counterpart in Nairobi West Hospital,was also capable of processing the current VAT requirements, NHIF rebates, National Social Security Fund (NSSF), and online procurement. Afrisoft provided first and second level technical support on either entering a support agreement or on call basis. The client was required to enter into an annual maintenance contract. This was to cover support and system upgrades. The warranty period was 6 months. Customization was chargeable depending on the extent of the amendments or customization required. The implementation period proposed was 6 weeks which was inclusive of training and customizations. Future developments that were being worked on included development of a laboratory module, receipt printing on supplier invoices, connecting to payers, bar code interfacing and smart card interface. The review team identified several concerns with this system. The age of the system in the market was hardly a year, consequently it was still under development. It needed refining, for example, the laboratory billing module required amendments so that billing could be done at other stations

and not in the laboratory alone. The user interfaces were not easy to use neither was the security of data concrete. System support was being done by four people. This level of support staff was considered insufficient taking into account that Afrisoft had only 2 full time employees for second level support for all sites. It was therefore risky for another hospital to implement the system since this might outstretch the capability of this team and that of Afrisoft. Further, the system was slow and the implementation experience of the team seamed inadequate.

Recommendations

In making their recommendations to the board, the site visits review team listed down the following aspects that required to be highlighted when going to a fallback solution: (i) migration would be done twice i.e. to fall back solution and then to the full Hospital Management Information System (HMIS) solution. This would in turn adversely affect the systems availability; (ii) hardware purchasing would be done twice, first for fallback and second, for the full HMIS solution as the current server specifications running MEDAX would not be used and the two solutions would require different server specifications (iii) vendor understanding of The Nairobi Hospital processes and procedures was needed so us to either map or change them for best practices, in addition to capturing and effecting the necessary customizations on the fall back system; (iv) time to implement, do parallel runs and stabilize the systems would be required for both the fallback and the full HMIS solutions; (v) unexpected downtimes due to interruptions of processes were to be expected. These interruptions would further affect capturing of income. (vi) Finally, the investment in both hardware and software for the fallback system required justification, since these costs would be written off when full HMIS solution was implemented.

The review team which had evaluated the two systems prepared a summary of the same in Exhibit 2. They stated to the board that their recommendations were not intended to overwrite those given for the full HMIS solution. The HMIS system selection would be identified after issuance and evaluation of the Request For Proposal (RFP). Negotiations would be done with the winning vendor. lf discussions were not concluded positively with the RFP winning vendor, then the hospital should initiate discussions with the vendor who emerged second in the HMIS tender process. For a fallback alternative solution, the team considered the system that was more developed, and recommended that discussion of the solution product, implementation, support and costing for that system be initiated. In addition, the team gained a wealth of insights on healthcare information systems and vendors. These insights formed a valuable input not only to the site visits to be done abroad to the would be short listed vendors, but also to the remaining stages of the evaluation and selection process of the appropriate full health care information system for the hospital.

Other Competitors

The Agakhan Hospital was the leading competitor to The Nairobi Hospital in 2004. It had implemented a health care information system that had been used in other Agakhan network hospitals. In particular the implementation support came from their sister hospital in Pakistan. This was therefore not considered an option for The Nairobi Hospital since the implementers were not local and were therefore not easy to reach and deal with. Another competitor was MP Shah Hospital which had implemented some in-house developed health care information systems mainly a finance management module. However, the implementers of the system were not easily reachable and the system was not modern. Getrude's Garden Children's Hospital was using an externally sourced application for patient accounting but it was not fully computerized. Kenyatta National Hospital had in early 2002 installed Medtrak system which was in the pilot phase in their accounting department. Mater Hospital was perhaps the

best hospital to compare with in many aspects, it had similar bed capacity, services and it was also local. However, they had in the recent past implemented a US$500,000 health care information system that had failed and were falling back to their old system that was certainly deficient.

Failure Stories of Implementation of Health Care Information Systems

The story of the failed implementation of the new health care information system at Mater Hospital had caused ripples in many hospitals that were considering implementation of health care information systems, including The Nairobi Hospital. As a result the management of The Nairobi Hospital were extremely thorough in all aspects of system acquisition, from needs analysis, RFP development, system selection, evaluation, implementation, testing, and change over. The Nairobi Hospital used this episode to gain insights into some of the major factors that make IT projects fail. In particular Mater Hospital had selected a vendor who had no capacity to customize the system supplied and also they did not follow the project management methodology. In particular "we noted from the site visit team, that Mater Hospital had not adopted a similar approach to The Nairobi Hospital which had included drafting an RFP document for vendor evaluation" stated Elizabeth Ochieng.

Existing Information Systems at The Nairobi Hospital

The Nairobi Hospital had, for over fifteen years, been using MEDAX system supplied by Isoft UK. It was the main patient accounting system being used for patient billing and an external receipting system created and raised receipts. With this setup the hospital continued to experience problems relating to lack of integration of information and in some areas manual processes were the order of the day. The existing support contract for MEDAX was due to expire in October 2004 and a possible extension of the same had been raised with Isoft. The support costs for MEDAX for the six months extension period would also increase. Due to system downtimes and instability, errors continued to be experienced and the posting of patient charges in some areas was incomplete. There was, therefore, a high incidence of reversion to manual processes when system disruptions occurred which resulted in increased inefficiencies, customer complaints, inaccuracies, increased staff costs, and increased time taken to process transactions. As a result of erosion in customer satisfaction levels, revenue and market share had declined. Furthermore, incidental costs, such as those relating to stationery, storage facilities, data security, etc, had increased.

The MEDAX system module functionalities included Billing, Admissions, Accounts, Stocks, Pharmacy, and Patient Administration. The following key issues were associated with the system: (i) support was to cease in October 2004, (ii)high annual maintenance costs amounting to $93,555 as 2nd line technical support was provided by Isoft UK (iii) frequent system downtime resulting in errors and incomplete posting for patient charges (iv) MEDAX system was not flexible in terms of report generation such as the production of summarized reports for management decision making (v) it was not fully integrated with the main functional areas such as laboratory, receipting amongst others hence information was scattered and hence numerous errors were present in patient billing/accounting and (vi) the system had been superseded by new technology e.g web based technology. The need for The Nairobi Hospital to acquire an integrated healthcare system was made acute due to the fact that even in the best scenario where MEDAX would extend support for 6 months, there was to be no further system development available after the expiration of that extension.

Systems Development at The Nairobi Hospital

In the third quarter of 2002 the Executive Management of The Nairobi Hospital compiled and published a six-year business strategic plan. Key to the success of the plan was the need for new and modern information systems. The Hospital therefore embarked on a project to develop a comprehensive Information Technology (IT) plan for the period 2003- 2008 as a means of improving information and communication efficiency within its departments. The key objective of the exercise was to prepare IT blueprints that would guide The Nairobi Hospital towards achieving substantially improved IT infrastructure, applications and information management processes to support the effective and efficient service delivery of health and other supporting services. The strategy had to be relevant and aligned to the business vision, strategy direction and objectives of the hospital. provide a sense of the net benefits that would flow from the implementation of each system; and provide indicative cash-flows that would be needed to action the plan over the six-year period

The deadline for the MEDAX system was coming close in October 2004, while problems of daily operation and user dissatisfaction continued to rise. Trying to control the situation, top management appointed a planning committee to ensure that a system effective for the whole organization could be developed. The Nairobi Hospital System's development process can be classified in four stages that were: (i) Planning & Analysis, (ii) Market Intelligence, (ii) Vendor selection, and (iv) Implementation. In this case, the scope is limited to the first three steps of the decision process which culminate in the final selection of a vendor-supported system.

Planning & Systems Analysis and Design

It was decided that the first action required towards obtaining new systems was the development of an Information Systems (IS) Strategy which would act as a blueprint for the future and would also provide the route to follow and the mechanism by which progress could be monitored. To develop the strategy was a project team which comprised the Management and IT Staff from The Nairobi Hospital, plus support from the Health Care Consulting Services of Ernst & Young in Kenya. The project was named 'UTENGEMANO' to demonstrate the value and changes expected to be delivered by information systems to achieve the set targets of The Nairobi Hospital's six-year business strategic plan.

The Planning Phase of the method route followed by Project 'UTENGEMANO' consisted of eight stages. All of the stages in the Planning Phase were broken down into specific tasks and scheduled into the work plan for Project 'UTENGEMANO'. The eight stages in the planning phase comprised of Start-up & Preparation, Business Plan Analysis, Current Information Systems Assessment, Current Business Operations Assessment, Business In formation System Identification In formation Architecture Development, Strategic In formation Systems Plan Development and Project Review (see Figure 1 of Exhibit 3).The project charter was agreed and compiled during the start-up and preparation stage of the project. In addition a detailed SWOT analysis was conducted.

Throughout Project 'UTENGEMANO' a variety of techniques were used to analyze assess and develop business operations, systems and requirements. The most popular techniques applied were: executive and senior management structured interviews; workshops and facilitated sessions; documentation reviews; systems demonstrations; brainstorming sessions; site visits and observation; secondary research analysis;

flowcharting and data flow analysis; prioritization matrices. Data was gathered on the state of business processes, existing systems, IT skills and the positioning of the hospital within the market.

Market Intelligence

The project team conducted several studies, and local site visits as mentioned above to find out the available products in the market and corresponding user opinions. Figure 2 of Exhibit 3 shows the *four* steps taken by the team. At the beginning, the team members reviewed trade journals for relevant publications on the area of healthcare information systems. Among the literature and searching the Internet, a list of the top 10 healthcare information systems for hospitals based on annual sales was discovered from the internet and journal studies. The market review provided the team members with general knowledge of the popular products and their corresponding vendors in the market. In order to gain detailed information; the project team discussed various products with several industry consultants. The project team also selected several hospitals for investigative visits. Team members physically observed various hospital systems in operation and had in-depth discussions with responsible executives. The Nairobi Hospital board reviewed the reports compiled by the development team that included the results of studies done, consultants' opinions, and local on-site visits.

The outcome of planning, analysis and design and the market intelligence were used as input for the new system and RFP design work required in Figure 3 of Exhibit 3. Thirty eight (38) key functional areas for the design of the new system were identified as shown in Exhibit 4. Further, the outcome was used in the development of the Request for Proposal (RFP) document and also in the design of a scoring model for information systems evaluation shown in Exhibit 5. The RFP was issued and ten proposals were received and opened on January 17, 2003 according to The Nairobi Hospital guidelines for acquisition. All proposals were submitted in both hard and softcopy from Apollo Health Street, Software Technologies Ltd. Meditech Ltd., Symphony, Soluziona (SAP), Softscript Ltd., Finsoft Ltd., Microhouse.Net Ltd., Karishma Ltd., and Net Solutions Ltd. After lengthy board discussions for pros and cons of each proposal, the board decided that Meditech Ltd, Karishma Ltd. And Symphony Ltd. were the three short listed vendors for further evaluation including demonstrations and site visits.

Vendor Selection Alternatives

Meditech HCIS System proposal
Brief history
Medical Information Technology SA (Pty) Ltd, a private limited liability company in the republic of South Africa, proposed the MEDITECH solution. The company had eight principals namely Medical Information Technology Inc, Tresling Family Trust, G Yarwood, T.E. Saunders, G.H. Otto, C. Lotz, L.C.M Kierznowski, and J.R. O'Mahony. Their Mission was to serve the information needs of the healthcare industry with high quality, cost effective healthcare information system solutions and allied services that would assist their client organizations function efficiently as cohesive enterprises. The South African Meditech SA and the Boston division of Meditech USA had over 90 and over 1800 employees respectively. The employees in SA were distributed as follows :Sales & Marketing 10%, Hardware 6%,Client Support & Development 62%, and Administration & Office Support 22%. From inception Meditech SA selected to operate as a technology transfer organization using well proven solutions as a platform from which to generate solutions specific to local

conditions. Meditech SA began as a commercial laboratory system vendor in the early 1980's, and has grown to encompass more than 90% of the commercial laboratory system market in South Africa. Their Laboratory Application software powered most commercial laboratories throughout South Africa i.e. Drs Mauff, Zail Skudowitz and Partners, Drs Du Bussion and Partners, Dr Van Drimmelin and Ass, Lancet Laboratories, Medlab to mention but a few. Drs Mauff, Zail, Skudowitz and Partners were currently one of the three largest private Pathology Laboratory Groups in South Africa. Approximately 340 sites spread throughout South Africa processed three million specimens per month with the largest group processing 1.25 million specimens per month being serviced and supported from MEDITECH SA in Midrand. MEDITECH SA had implemented and supported a total integrated healthcare information systems with comprehensive hospital applications, occupational health centers, primary care clinics, rural health clinics, and total laboratory information systems. Their financial position for three years showing the gross and net income are shown in Exhibit 6, which show a significant decline in 2000.

In their submission they explained that orders for products had increased at an unusually high rate during 1999 as customers expedited their normal buying decisions to ensure Y2K compliance. New order levels dropped significantly during 2000, as a result. Financial audited statements such as the balance sheet were not submitted in their proposal. They gave the reason that "It is Meditech policy not to include financial statements in tender documents due to the fact that, Meditech SA is private company and holds confidential information about private individuals". However their proposal suggested that "Should it be required financial statements could be provided during contract negotiations".

Meditech Modules

In response to the Request for Proposal (RFP) and the Detailed Requirement Matrix, Meditech SA understood that the selected hospital management information system must comprise primarily, but not be limited to: Electronic patient and medical records, Clinical, patient and diagnostic management, Core financials management, Materials management, and Hospital administration **&** operation support applications.

Meditech SA's proposed solution was designed to address all the above aspects through one system that was modular as well as scalable to assist with a phased approach without losing any functionality or efficiency in addressing the different areas where information processing and access was required. In their proposal they suggested that: (i)The Nairobi Hospital embarks on a 2 to 3 years programme to implement an integrated Hospital Management Information System by means of a phased approach. Their proposed solution did not force a fixed phasing onto The Nairobi Hospital. It was up to the client to determine which modules to implement next. The phased approach proposal was based on Meditech SA's opinion that it was not achievable to implement the full system before 30th September 2004 and also not advisable to do a big bang implementation. (ii) For the initial implementation the following MEDITECH modules were proposed to establish a core Hospital Information Management System: Registrations/Admissions, Electronic Patient Index (EPI), Electronic Medical Record, Billing, Accounts Receivable, General Ledger, Accounts Payable, Order Entry, NPR Report Writer and Community Wide Scheduling (iii) Pharmacy, Laboratory, Nursing and Decision Support requirements would be addressed during subsequent phases as and when it was economically viable from a business and resource point of view. (iv) The modular characteristic of the MEDITECH suite of products, allows for a very flexible rollout of modules into an integrated solution. (v) The complete patient record would be available once the Patient Care Inquiry (PCI) Module had been implemented. The MEDITECH system

modules provided for an integrated Healthcare Information System that was then one of the most comprehensive Healthcare Information Systems in the world. The financial modules of the Core Hospital Management Information System proposed would replace the current functionality offered by MEDAX.

Meditech SA Solution Overview

Meditech SA was founded in 1981 and began as laboratory system vendor. It had grown to provide total health care information solutions. Meditech Inc USA has 20% share interest in Meditech SA. It had over 90 skilled IT professionals and unlike Symphony, Meditech SA focused its solutions and services only in Health Care Information Systems. Consequently it had only one product MEDITECH HCIS that was spread in South Africa. Their experience sanned a period of 20 years in the health care industry. They had comprehensive reference sites in S.A and Nigeria. The total cost of the solution proposed by Meditech SA was US$ 1,408,190 which was inclusive of software license costs, implementation and training. The Nairobi Hospital was required to enter into an Annual Maintenance Contract (AMC) that would cost US$ 190,512, with Meditech SA for support. Since they had no representative in Kenya, support was to be provided by Meditech SA on AMC.

The Meditech SA solution was to offer the following modules: *Basic Modules*- Patient registration/Admissions, Electronic Patient Index & Medical Record, Patient Billing Account Receivable Module, general Ledger, Account Payable, Order entry, Community Wide Scheduling, NPR Report Writer Training, Operations Training. *Physician Module*-Patient Care Inquiry module. *Pharmacy Modules*-Pharmacy, Materials Management. *Laboratory*-Laboratory Module, Microbiology. *Other modules*-Case mix Management, Fixed Assets, Budget & Forecasting, Cost Accounting, Executive Support module, Departmental, Anatomical Pathology, Blood Bank, Data Repository. *Customisations* to be agreed upon during negotiations. *Updates* were to be provided in an Annual Maintenance Contract.

General Technical Issues

Meditech S.A. proposed that The Nairobi Hospital implement the MEDITECH Magic version that uses the Microsoft Windows 2000 operating system on the Database/Application server platform and on the Client workstation. The system proposed was a 2 tier architecture with a comprehensive security system and relevant functionalities. The database used was proprietary and hence could be limiting. The system as described in the proposal was in use at different sites and was therefore not a proposed system that was still in development. Meditech proposed that Nairobi Hospital implement the system at a central computer centre and connect to all other sites via a router based TCP/IP local area network (LAN). Depending on the required system availability at sites remote from the data centre, provision should be made for alternative connectivity should any component of the network fail. A centralized computing environment had obvious advantages in the centralization of System management and the provision of scarce skilled staff. Depending on the existing LAN infrastructure, there could be a need for print servers, bar code readers, bar code printers and printers. Cabling for laboratory instruments were also to be provide by client. However no LAN diagram was included. The proposal stated that such a diagram could be provided once The Nairobi Hospital had decided what modules they would require.

The solution enabled customers to design their own "bolt-on" screens by means of Customer Defined Screens. The client could create new fields that became part of the database. NPR report writer comes standard with the MEDITECH system. Archival was seamlessly integrated into the MEDITECH solution — this had not been quoted for. Third party backup software would also be required. The operating system would schedule mirror image

backups. However no partial restores were possible. MEDITECH had a self-maintained database to keep the decentralized databases in sync. Batch jobs scheduling was **a**utomated within   MEDITECH.

All MEDITECH Systems were implemented with fault tolerant hardware configurations using high quality servers with redundant hardware and disks in Raid arrays. In addition Meditech made provision for two copies of the System to ensure availability. Thus MEDITECH System availability was provided for. Meditech could assist The Nairobi Hospital with the development of a full IT Business Continuity plan and the technological facilities to support the plan. No provision had been made in the proposal for business continuity planning or hardware for a disaster recovery site other than the MEDITECH System fault tolerance mentioned above. Meditech assumed that The Nairobi Hospital was to provide a complete computer environment inclusive of Meditech certified servers, computer room with air conditioning, uninterruptible power systems and appropriate networks.

Vendors of MEDITECH HCIS
MEDITECH clients were served from Mindrand in South Africa. In Kenya they had not established a clientele and a service base.

Strengths & weaknesses of the Meditech S.A Solution
Meditech SA had established itself as a leader in its field. It had a reputation for providing quality products and excellent service levels. Their 100% client retention rate spoke for itself. Meditech SA's clients were assured of the highest level of support, service and security when making a sound, long-term investment in MEDITECH's technology. Although the database used was proprietary and hence limiting, it had one big advantage, no database software license fees would be required. Unlike the other proposals, Meditech SA had a user group MIX (Meditech Information eXchange), that met once annually and exchanged information on applications between end-users. Further, a range of training was available for the MEDITECH modules (per module) namely: <u>Dictionary Training</u>; <u>Application Training</u>, and <u>Parameter (Toolbox) Training.</u> The Client received training during the implementation process, all other training courses were chargeable. MEDITECH pricing was based on number of hospital beds .With the phased approach that MEDITECH proposed, The Nairobi Hospital could decide on the phases and the MEDITECH modules that they would like to combine to address business requirements. This offered the flexibility to grow The Nairobi Hospital's Information Management System over time as finance allowed for it. On the issues of discount terms and conditions**.** MEDITECH did not have a formal discount policy, but were willing to discuss the topic during contract negotiations. When a client upgrades hardware, upgrades the operating system or upgrades the software and its documentation, no fees would be charged. System costs are detailed in Exhibit **7.**

JEEVA System Proposal

Brief History
Karishma Software Limited was established in the year 1996 as a products and services limited liability company and focused on healthcare solutions and financial services solutions. The principal shareholders were Mr. V. Giridharan and Mr. R Guru Moorthy. Karishma had a repository of highly trained software developers and domain experts. In their pool of 95 employees they had three doctors. One qualified medical doctor works as an associate of the company and the other worked as a consultant. The management team consisted of Managing Director, Executive Director, Director of Management Services and Nominee Director. The other 93 employees were distributed among the other departments as

follows: Software Dev. (R&D) -28, Implementation Training -35, Marketing-7, Quality Mgt -6 , Administration -3, Human Resources-2 , and Finance & Accounting -2 and Support -10.

At Karishma, it was their mission to constantly endeavor to pursue excellence in providing quality solutions, preparing client business for the future, through sustained long-term commitment, and their goal was enhancing the value of client IT investments as well as keeping pace with technology & delivering responsive, efficient, proven solutions. Their slogan was that "we are the solutions people". Karishma's state-of-the-art infrastructure and technology helped them meet the most critical of customer needs. They provided innovative solutions that allowed their customers to better manage critical information, control costs, and improve performance and efficiency through technology. Karishma was consistently ranked as one of the best health care information system integrators and program managers. Decision support systems add value to the data integration process. Imaging and record systems enable the conversion of paper and film-based medical records, such as computerized axial tomography (CAT scans) or magnetic resonance imaging (MRIs), into an electronic format. This, in turn, facilitated the introduction and use of computerized patient records, in which a person's medical history was to be consolidated into an electronic medium versus scattered pieces of paper. Karishma Software solutions were tailored to fit individual customers' needs and goals. As the healthcare industry begun to assess and deploy Health Level Seven (HL7) compliant initiatives, Karishma Software was to be a natural progression in an industry where the integrity, confidentiality and availability of its electronic data were paramount. Karishma Software had an unparalleled capability and reputation for assessing the business needs of the enterprise, and working with top management to develop an enterprise- wide architecture for knowledge management, information technology, and information communications. Karishma Software, with domain expertise in healthcare, was to help healthcare organisations to build a seamless exchange, management and integration of data that supported clinical patient care and the management, delivery and evaluation of healthcare services that met the International standards. Their financial position in US $ is revealed in the Table 1 of Exhibit 6.

JEEVA Modules
JEEVA was a high performance user-friendly online healthcare information system which covered all the areas of operation in the healthcare industry like Patient Management, Clinical Management, Resource Management, Financial Management and Management Information System. JEEVA - Healthcare Information Solution, had been designed to address the growing needs of health services industry. From a healthcare industry focused company, and being a process oriented, parameter driven, enterprise management solution' JEEVA aimed at a fine balance between quality of care and efficiency of information turnaround. Information turnaround that would deliver information needed for decision making to the appropriate levels of the organization..
JEEVA Online Hospital Management System broadly comprised of the following features: (i) Videoconferencing (Video+Audio) (ii)Electronic Patient Records (iii) Medical Imaging (DICOM Images) (iv)Medical Equipment connectivity and (v) Expert Consultation . Depending on *the* medical equipment, the following information in form of records or in streaming mode could be linked up (i)Radiology (X-rays, Ultrasound, CT-Scan, MRJ, Mammography, Nuclear Scans, etc.) (ii)Pathology (iii)ECG/EKG, Echo and (iv) Stress Test, Coronary Angiography. There were five user perspectives for the Jeeva project : Patient : who would use the service from home or a Primary centre, Primary Healthcare Center **:** which has trained medical person, Expert Center or Super Specialty Hospital: which gives consultation, Medical Administrators **:** Who administers the network and Expert or Doctor **:** who gives opinions

and interfaces with patient. This product addressed the information requirements for processes that handle the doctor - patient direct interface, patient management and administration of resources in a physician's office or a polyclinic. The Manage Health Physician Office Practice application helps to record and disseminate information for day-to-day operations of clinics such as: - appointment and registration, patient visit profile, consultation & clinical notes, - billing, referral letters, and electronic medical records. Recording and reporting of patient diagnostic requests and investigation results formed the key operation for managing a diagnostic center. The Manage Health Diagnostic Management module catered for all the operational, diagnostic and administrative functional needs of any medium /large size diagnostic center. A real-time interactive system facilitated improved performance of the diagnostic center and quality of patient investigations and on-line reporting. Interfacing with microprocessor based medical equipment it captured test results directly and multi-user support, catering for large diagnostic centers, was available as an option.

Karishma Solution Overview
Karishma was a young start-up (1996) company with several reference sites in India. The number of personnel was 95 with 60 in product development. They had 7 years experience in the healthcare IT industry with a customer base in India. Their industry experience ranged from health care information system, financials, banking solutions and other adhoc systems. The total cost of the solution proposed by Karishma was US$ 853,600 which was inclusive of software license costs, implementation and training. To be able to support their clients in Kenya, Karishma had partnered with Xllent Technologies Kenya Limited who were to provide 1st level technical support and 2nd line level of support was to be provided by Karishma India. Support was to be on a 24 hr x 7days a week x 365 days a year. The Nairobi Hospital was required to enter into an annual maintenance contract charged at 15% of the cost of server, workstations and JEEVA application which totaled to US$ 113700 annually. This would cover support and system upgrades. The fee for enhancements was to be based on man month efforts at the rate of US$ 5000 per man month.

The Karishma solution was to offer the following modules: *Patient* Management which included)Electronic Patient Records , Medical Imaging (DICOM Images) , Medical Equipment connectivity and Expert Consultation . Clinical Management, which include Radiology (X-rays, Ultrasound, CT-Scan, MRJ, Mammography, Nuclear Scans, etc.) Laboratory tests, Pathology , ECG/EKG, Echo, Stress Test and , Coronary Angiography. Financial Management which included Account Receivable Module, general Ledger, Account Payable, and Order entry. The solution also included Resource Management, and Management Information System. *Customisations* was to be agreed upon during negotiations. *Updates* were to be provided in an Annual Maintenance Contract. There were four areas which were to be provided for from other bespoke developments and integrations namely: Library, School of Nursing, Catering and Transport.

General Technical Issues
The application had been built to be extremely flexible and could be used in client server and multi-tier environments. The standard network (certified by Cisco or equivalent) was to be used for the application. The organization was actively investing in R & D to develop products and intelligent smart solutions for the health care industry in underdeveloped countries. They were developing smart card technology to store the biometric information and personal health records of patients, which was integrated with the healthcare information system and other applications in the industry. One of the future targets was the health insurance and health education sector. They were developing products to aid educational institutions in administrative management, E-learning, knowledge gathering and sharing.

Karishma was a Partner with IBM, SUN and Microsoft for developing and delivering turnkey solutions. "We are IBM World partners in development of the healthcare Industry" Mr. Guru stated. The purpose of the relationship was easier access to the IBM technology worldwide, and the IBM marketing network world wide. The relationship also provided benefits for their customers in relation to competitive pricing. Of the existing base of 17 implemented software clients for the health care information system all of them were major hospitals and were connected with the health care industry. There were five clients who were at the implementation stage for health care information system. There were 6 clients who had telemedicine. There were 11 clients who had Managehealth Physician Office Practice (POP) or Managehealth diagnostic. In one months time more than 500 physicians were to have their POP. Of the existing clients almost all of them were either public limited companies or deemed public limited companies or deemed registered trusts.

Vendors
Karishma Software Limited had their headquarters at Archana Arcade, 10-3-189, St. John's Road, Secunderabad, India. Their local representatives was Mr. R. Guru Moorthy *I* Exe. Director under the Xllent Technologies Limited, situated at Cmusian Place Hurlingam, Nairobi .

Strengths And Weaknesses of the Karishma Solution
The company had invested close to 180 man-years of effort in the development of the healthcare products. They had been dealing with clients from the healthcare sector for close to 7 years. They had had excellent rapport with the clients. "We have consistently treated our clients as our partner and feel that clients also treat us with due respect for the ability to deliver and keep up the commitment" said Mr Guru . The social content of the whole sector was what attracted us. "We feel that the overall cooperation we have received from the clients has been excellent" Mr. Guru continued.

Karishma current R & D efforts were primarily aimed at the following segments in the healthcare industry: (i) Developing a system for integrating medical schools with major hospitals for knowledge gathering, sharing and learning (ii) Enhancing and adding functionalities to the existing telemedicine product which was effective and affordable using the latest technologies and communication infrastructure available and (iii) Developing a clinical decision support system to aid doctors in difficult to diagnose cases using artificial intelligence and probabilistic techniques. The JEEVA application had been built with the following interfaces: SMS, PDA, Smart Card, and Internet Interface. The system could be configured to make use of the Internet where the stakeholders could log into the system and access data as and when required. Further some of the functionalities of the telemedicine system such as store and forward mechanism of transferring discrete data like images from CT, ECG, EEG and EKG could be transmitted using the Internet. System costs are detailed in Exhibit **8.**

CARE 2000 System Proposal

Brief History
Symphony was formed as a limited liability company in December 1999, but its roots went back to 1979, when businessman and lawyer Horatius Da Gama Rose and IT Executive Mike Eldon launched Computer Applications Ltd (CAL). Over the 20 years of IT activity in the region, it constantly reinvented itself to adjust to the dramatic changes in technology and market expectations that had occurred. New products and services required new skills, both technical and managerial. They brought forth new partnerships, both locally and

internationally, while others faded. If survival of the fittest was the way of life for the IT industry, then Symphony had proved it was among the fittest. The Indian Branch had sites for the CARE 2000, but one was implemented in Kenya. Their products were proven both in India and internationally. Thus, The Nairobi Hospital had the benefit of implementing a product that supports and offers a best practice model in healthcare facilities. It provided quality information on patients that would help improve patient care and assist in vital decision making. This factor was especially important for The Nairobi Hospital since it addressed the healthcare needs of the wide cross section of patients in the country. In addition, the powerful integration of various applications of their product offered tight validations, imposition of Business rules and vital management information that would help The Nairobi Hospital to monitor performance, control costs and improve operational efficiency leading to improvement in patient care. Table 3 of Exhibit 6 shows Symphony Financial position for the years 2000 to 2001.

Care 2000 Modules
With an objective of meeting the stated requirements of The Nairobi Hospital, Symphony proposed a complete suite of integrated applications covering the enterprise needs of The Nairobi Hospital. They had offered a turnkey applications solution approach. They offered not only the integrated suite of healthcare applications, but also optional interfaces with Bio-medical equipment and other devices and an integration option with Oracle Discoverer 2000. They had offered all the associated services that The Nairobi Hospital needed for a successful implementation. This covered services related to requirements analysis, design, customization/construction, installation, training, implementation assistance, knowledge transfer, warranty coverage and on going support. A detailed description of services provided by them was entailed in Scope of Work. CARE 2000 package contained the following additional modules/interfaces: CARE 2000 Billing system interface with PABX System for automatically capturing Telephone charges, CARE 2000 Attendance Recording system interface with Payroll, CARE 2000 interface with Patient Monitoring System, CARE 2000 interface with Anesthesia system, CARE 2000 interface with Digital Syringe Pump system, CARE 2000 Patient Web Page, All the above were integrated with health care information system that was being proposed. However, The Nairobi Hospital could implement them in future.

Their proposed software architecture offered growth and scalability to The Nairobi Hospital. CARE 2000 was comprehensive and fully integrated product that was proven. In addition, CARE 2000 interfaced with Tele Medicine. A brief write-up of salient features of the product and other benefits to senior management were provided in their proposal.

Symphony Solution Overview
Symphony in Kenya was part of the Da Gama Rose Group of Companies. Symphony Global PLC had 99% share interest in Symphony Kenya. In Kenya it was a consortium of seven IT companies namely CAL, IAT, Legend Systems, Impact, TSL, SRL and Action Plus. It had 250 skilled IT professionals and its solutions comprised a wide array of applications, including ERP systems, financial services, e-business, and health care information system. It also offered services that ranged from Strategic IT consulting to IT literacy training. The company offered solutions and brands in software, hardware and the service sector. Symphony had spread its services throughout Kenya, Eastern Africa and Asia, where it had 22 years of experience in the services, solutions and brands mentioned above. The total cost of the solution of the Symphony CARE 2000 was US$ 731,650 which included software license costs, implementation and training. The Nairobi Hospital was required to enter into an

Annual Maintenance Contract that would cost US$ 79,910 which is 20% of the annual license fees of US$ 399,550, during the one year warranty period and thereafter 38% which amounts to US $151,829 annually. The Support was to be provided by Symphony Kenya on Annual Maintenance Contract (AMC).

The symphony solution was to offer the following modules: *Clinical Modules-* Patient Master Index & Medical Record, Patient registration, Appointment Scheduling, Consultants Clinics, Patient Clinical profile, A&E, A DT, OT & Scheduling, Wards Module, Medical Records, Patient Acct/Billing, Health Ins. Mgt., Nursing Procedures, Pharmacy Information System for IP/OP; *Diagnostic Modules-*Lab Information System, Radiology Information System; *Financial Modules-*General Ledger, Accounts Receivable, Accounts Payable, Fixed Assets, Payroll; *Materials Management-*Purchasing, Inventory Control; *Admin & Operation Support Modules-* MIS, Housekeeping, Dietary/Nutrition, Linen & Laundry, CSSD, Bio-medical& Equipment Mnt., Blood Bank, Orders Entry, Mother & child; *Customisations* to be agreed upon during negotiations; *Updates* (Product Enhancements & Additions) were to be covered on the Annual Maintenance Contract, while the a*dd on modules namely* Transport, HRM, KHA, School of Nursing, and Library modules were to be bespoke.

General Technical Issues
Symphony proposed software architecture which offered growth and scalability to The Nairobi Hospital. CARE 2000 was a comprehensive and fully integrated product that was proven. In addition, CARE 2000 interfaced with Tele Medicine System that could service the long-term interests of The Nairobi Hospital. The system was to run on Windows 2000 server, in a local area network. The database for the system was to be Oracle 9.

Vendors
Symphony had its head office in Nairobi, Kenya. The number of IT personnel was 250 and globally the number of personnel was more than 450. They had 25 years experience in the IT industry with a customer base in India, Kenya and Middle East. Their industry experience ranges from hardware solutions, enterprise resource planning (ERP), word processing, Health Care Information System, e-commerce, groupware solutions such as lotus notes, on-line banking, and IT strategy forums for IT management personnel including IT consulting.

Symphony Kenya would provide 1st level technical support and 2nd line level of support would be provided by Symphony India. Support would be on a 24 hr x 7days a week x 365 days a year. The annual maintenance contract offered by Symphony covered support and system upgrades. Upgrades were done at least once in every two years and when rolled out client may get some basic training on the upgraded components. The CARE 2000 System was scalable and one could add more beds, wards and users without changing the system performance.

Strengths and Weaknesses of the Symphony Solution
Unlike the other vendors Symphony had given a balance sheet for the years 2000 and 2001. However, the proposal quality indicated that the implementer had problems in quality management of the document (i.e. 'cut and paste' approach led to sections that were not readable.) Moreover the implementation plan lacked sufficient details. Although mentioned in the document, a reference site in Kenya could not be confirmed. The systems did not have connection to Personal Digital Assistant (PDA's) or Disaster Management. These were to be developed bespoke. The system database was Oracle as opposed to an open system. The company had the largest number of IT professionals, however, the fact that their services were

spread between hardware, software and service sector made it very hard to determine the IT staff dedicated to CARE 2000. A detailed product cost description is included in Exhibit 9.

Implementation

The implementation phase would commence once the Board had decided the wining system and vendor from the alternatives above.

Conclusion

CEO, board opinions over the system and the vendors

The short listed vendors were invited to make presentations, the first was Meditech on 11/3/03, then Symphony on 17/3/03, and finally Karishma on 17/3/03. Invitations were sent out to all Senior Management, Head's of Departments, Board IT Steering Committee and Medical Advisory Committee representatives.

Meditech

Meditech had a professional submission but lacked the required detail and attention to The Nairobi Hospital's requirements. The overview *of the* proposed system was interesting and the fact that the implementer was targeting health care organizations only was of great interest. However, the reference sites did not confirm this specialization as it included only a few hospitals of significant size. In Kenya, Meditech claimed to have only one reference site which appeared to be a laboratory. Some concerns were raised as to whether the use of proprietary technology could be restraining to The Nairobi Hospital in terms of scalability, flexibility and future proof. Emerging technologies such as telemedicine, PDAs, etc. were not addressed to the expected level of detail. The submitted plan was workable and realistic but provided only an overview for the long term implementation of the project. The plan indicated a relatively long installation and implementation period, where the system would be completed after two to three years. The team and their experience record was not provided, although it was stated that they had long-standing experience of over 20 years in the health care sector

Karishma

The Karishma proposal was the most comprehensive and modern system among the contenders**. The s**ystem proposed had the relevant functionalities. It was open and could operate on different operating systems and databases. **T**he submission was professional although it also lacked the required and expected detail, and in places did not appear to be viable. Karishma was a young startup (1996) with several reference sites in India. The system was fully integrated and provided a fair 1evel of detail on the clinical solution. However, interfacing to laboratory and radiology devices required more detail. The system used the obsolete 2-tier architecture model although plans were in place to move to a 3-tier architecture soon (J2EE Platforms are limited to either DB2 on AS/400 or MS SQL Server on Windows). It was commendable that the system embraced functionality and interfaces for emerging technologies such as Telemedicine, PDAs, Smart Cards, Internet, SMS transactions etc. Relevant experience of team members was not apparent. The role of the local agent for implementation and support was vague and required clarification.

Symphony

Symphony delivered a substantial proposal including a comprehensive product capability document which included even interfaces to and from laboratory and radiology devices. However, the proposal quality indicated that the implementer had problems in quality

management of the document (i.e. 'cut and paste' approach led to sections that were not readable.) In evaluating the response from Symphony, it became clear that the clinical system proposed (Care2000) provided relevant functionality to the Hospital's requirements, including standard as well as emerging technologies such as PDAs, and Telemedicine. The most significant shortcoming appeared to be the system's obsolete 2-tier architecture. A 3-tier architecture was envisaged for release in June 2004 and the implementer would provide this upgrade free of charge. The submitted project implementation plan was detailed (covering a timeframe for implementation of 452.5 days) and looked meaningful, but it still lacked some essential detail, and left considerable scope for misinterpretation, additional charging for poorly defined tasks, and slippage. There was only just sufficient detail to approximate implementation resourcing costs to those quoted in their proposal. A more detailed and customized project implementation plan was needed which would also assist in cost reduction for modules not needed and over-budgeted hours of implementation. The proposed team summary was very basic and did not provide sufficient information on the relevant experience of key consultants. Reference sites were impressive and included hospitals in India and also in the Middle East, some of them large hospitals with multiple locations. Although mentioned in the document, a reference site in Kenya could not be confirmed. The proposed solution for the PACS system was not clear and integration with the clinical and financial systems was vague, as it appeared to be a commercial off-the-shelf product.

Decision Time

"It is risky to make a decision based on the written proposals and demonstration evaluations alone we need to do site visits and see live system for ourselves" The CEO Dr. Cleopas advised the board. Ernst & Young reported that most of the risks on the IT project are related to customization. They advised that a project risk matrix template should be developed where all the risks associated with the project would be captured, and stated that, with a strong contract and a strong management team, customization and other project risks would be managed. "Why didn't Mater Hospital manage their risks that made their $500,000 investment in a health care information system to fail? Ms Salome asked. After 2 minutes silence in the board with no answer, the Finance Director Mr Eshy thundered " We have no option but to spent Kenya shillings 3 million for local and overseas site visits".

The sites to be visited were to include South Africa for Meditech, and India for Symphony and Karishma. The team for the site visits included the CEO, the IT Projects Manager, representatives from Nursing,   Finance, Medical Advisory Committee and Information Technology, as well as a   consultant from Ernst & Young. For Meditech they visited their office and a 298 bed Anglogold Health hospital at S.A/ Johannesburg Anglo, Western Deep Levels, Carletonville, 2499, while for Symphony they visited 351 bed Hinduja hospital at Bombay India. Finally they visited Care Hospital at 10-3-189, St. John's Rd Secunderabad 500025, India to see the JEEVA system by Karishma.

After two weeks,the CEO, Dr. Cleopas and his team had a typed a 50 page site visit notes and evaluation report on the three short listed systems. In his team the nursing and finance representatives considered Karishma the better system, the Ernst & Young representative favored the Meditech system (and Ernst & Young branch in Canada had been involved in helping hospitals implement the Meditech system). The CEO,on the other hand, liked the Symphony system, while the IT manager Elizabeth was undecided and wished to return to Nairobi to review the demonstration notes as well as the RFP evaluations in order to advise the CEO accordingly. The Strategic, Planning and Development Director Ms. Salome was concerned that the proposals' implementation solutions scheduled the project over a period of

3 years. On the other hand the Finance Director Mr. Eshy had struggled to use the best of his expertise in finance by doing a cost benefit analysis (see Exhibit 7,8,9) of each of the proposed solutions. He had used financial models as well as scoring models to evaluate the three systems. However, he was unable to make a clear cut decision, leaving the CEO and the board without adequate advice and hence vulnerable to making a wrong decision over the selection of a new health care information system for the hospital.

The board meeting was in three days time. The CEO had not been convinced that there was any significant difference in either the vendors capabilities or their respective system functionalities except for pricing. He knew this was a multimillion dollar project, and the first of its kind since he joined the hospital three months ago. " Which is the right solution for our hospital, MEDITECH HCIS, JEEVA, or CARE 2000?" Cleopas wondered as he landed at the Jommo Kenyatta International Airport, Nairobi, returning from the rigorous site visit and evaluations that had taken him away from his busy office for two weeks.

Exhibits

Exhibit 1: Brief Profiles of CEO, Finance Director, and Strategy & Business Development Director

Dr. Cleopa Mailu – Chief Executive Office (CEO)
Dr. Cleopa Mailu had a Bachelor of Medicine Surgery degree from the University of Nairobi, a Masters of Science degree from the University of Glasgow. He has various certificates in Management and Healthcare Systems from United States of America, United Kingdom, and Kenya Institute of Administration in Kenya. He was appointed the CEO of The Nairobi Hospital in 2003 having gained a wealth of experience from consultancy world and also from the full time employment he had had with World Health Organization (WHO) and UNICEF. His last duty station was Delhi in India. Prior to this Dr. Mailu worked at the Kenyatta National Teaching and Referral Hospital as a Medical Practitioner where in his early years he headed the General outpatient and Accident and Emergency department. He is known for having started the Quality Assurance department at the Kenyatta National Hospital. Dr. Mailu subsequently headed the Kenya Expanded Programme on Immunization (KEPI) division of Family Health and the Health Sector Reform Programme Secretariat at the Ministry of Health headquarters in Nairobi. His experience in health care management, quality improvement and reform initiatives in the health sector has been an asset to the Nairobi Hospital. In his own words Dr. Mailu is happy to meet the challenges facing this noble institution.

Mr. Eshy Githiaka - Finance Director
Eshy Githiaka has over 30 years experience in Finance, Business Management and Consultancy. He has previously held the positions of Assistant Chief Accountant of Nairobi City Council, Financial Controller of Central Holding Ltd., Finance Director and Deputy MD of ICL Kenya Ltd., Group Financial Controller of the Nation Media Group of companies and is currently the Finance Director of the Nairobi Hospital. He also runs several businesses and is a director and Chairman of several companies. In addition, he has extensive consultancy experience in corporate planning, business restructuring, investment management and IT strategy and implementation. Mr. Githiaka is a fellow of the Chartered Institute of Management (UK), the Kenya Institute of Management, Fellow of the Chartered Institute of Secretaries and Administrators (UK) and is also a Certified Public Accountant and Certified Public Secretary. He has had extensive management training in Africa, Europe, UK and USA.

Mrs. Salome W. Gitoho- Director, Strategy &. Business Development
Mrs. Salome W. Gitoho has an MBA in Strategic Management from the United States International University in Nairobi (USIU), a Bachelors in Public Administration from Punjab University India, a Post Graduate Diploma in Personnel Management &. Industrial Relations and is a Certified Public Secretary of Kenya CPS (K). She joined The Nairobi Hospital in December 1998 is the Director Strategy &. Business Development, from her previous position at ICRAF an International NGO. Before then, she had worked in the Hotel industry, Kenya National Library Services Board, a State Corporation and in the Government, where she started her career as a Personnel Officer. Starting off as a Human Resources Manager, Mrs. Gitoho set up the HR function from a Personnel Department dealing mainly with unionisable staff. During her tenure as HR Manager; Salome facilitated a number of activities some of which included Job evaluations, Introduction of Performance Related Pay (PRP), Introduction of Personal Development Plans (PDP), Management Forums, Process Re-engineering and Process Mapping, Salary &. Benefits surveys, Staff satisfaction survey and Organization Audit. Salome was also responsible for Catering and food services, Maintenance, Transport &. Security, Communication, Housekeeping and Laundry operations. An experience she says was invaluable in terms on understanding the support operations of the Hospital.

Her portfolio includes Strategy, Marketing, Customer Service, Public Relations, Accreditation and the Hospital's CSR agenda. Her core activities revolve around the Hospital Strategy and Business Development. She was determined to see that The Hospital six year strategy was successfully implemented ahead of schedule. Further she was charged with the Accreditation and attainment of Hospital Quality Management System HQMS ISO 9001 by 2008, while ISO 14001:2004 Environment Management System and ISO 22,000:2005 Food Management System certification were both scheduled for 2007 as part of the six year business strategy. In the Marketing portfolio Salome is in charge of Brand management and was instrumental in the production and release of The Nairobi Hospital Brand Book. The production of calendars, brochures, information booklets, fact sheets, fliers and other communication material in readiness for developing hospital business to new frontiers and marketing the Hospital existing products and services to the existing customers. Under the PR tasks, in addition to managing the image of the Hospital and ensuring positive publicity and coverage, she is also charged with production and release of The Nairobi Hospital News, a quarterly newsletter.

Exhibit 2: Fall Back systems site visit notes: Overall Assessment

Criteria/system Characteristics	Details for Evaluation	
	Metropolitan Hospital	Nairobi west Hospital
1. Background	(Afrisoft System)	(Checkup System)
1.1. Number of implementations	4	2
1.2. Product Age at Hospital	1 Yr	> 5Yrs
1.3. Number of Support Personnel and proximity	Afrisoft 6 — local (some are based at Metropolitan Hospital) Nairobi West 4 - local	4 Local
1.4. Expansion and Future developments	System is currently under development	System is well developed and can be expanded and enhanced
1.5. Conceptual architecture	Two Tier	Two Tier
1.6. Operating software and Data Storage Software	Post GreSql database on Linux	Oracle on Windows 2000 server
1.7. Healthcare industry Standards	Not fully compliant i.e. lCD 10, DRG, HL7 and DICOM	Not fully compliant i.e. lCD 10, DRG, HL7 and DICOM
1.8. Implementation	6 weeks	Not Provided
1.9. Structure of Training and Approach	No structure Provided	o structure Provided
2. Maintenance and upgrades		
2.1. Warranty period	6 months	Not provided can be discussed
2.2. Upgrades and Enhancements charges	Paid for Separately . Covered in Annual Support	To be discussed
3. Implementation costs		
3.1. Software costs	6,000,000	Not provide , to discuss
3.2. Training costs	1, 5,000	Not provided
3.3. Total (software & training) costs	6,125,000	Not provided
3.4. Annual maintenance costs	10% of order value	Not provided
3.5. Hardware costs	To provide specs	To provide specs

Exhibit 3: Conceptual Systems Development at The Nairobi Hospital

Figure 1: ICT Strategy Development

1. Start-up & Preparation

2. Business Plan Analysis,

3. Current Information Systems Assessment,

4. Current Business Operations Assessment,

5. Business Information System Identification

6. Information Architecture Development,

7. Strategic Information systems

8. Plan Development and Project Review
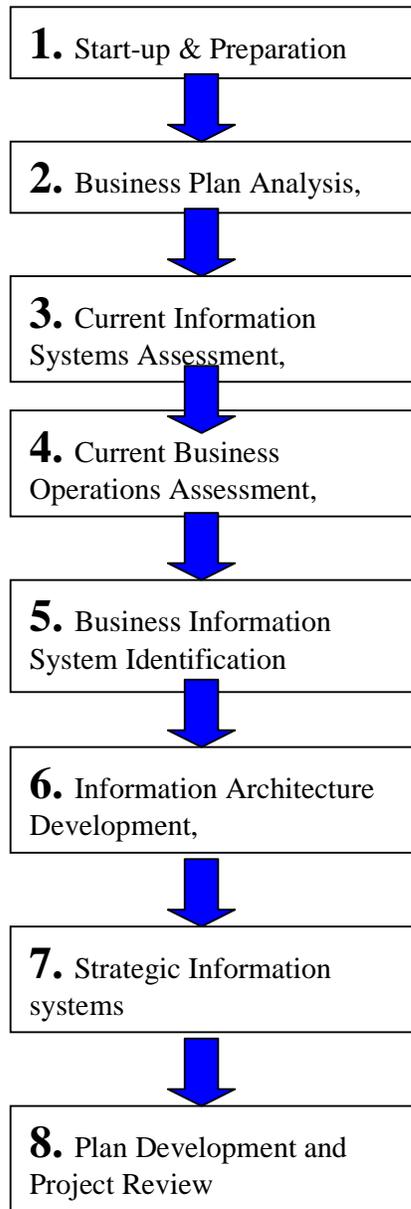
Figure 2: Market research & Intelligence

1. Review Trade & Medical Informatics Journals to find out Market conditions

2. Discuss with stakeholders and Industry Consultants

3. On-site visits to competitors hospitals to Identify fall back system

4. Analyze and conclude the market study

Figure 3: Vendor Selection

1. Prepare Request For Proposal (RFP)

2. Shortlist Prospective Vendors

3. Develop a methods to evaluate vendor systems & proposals

4. On-site hospital visits for short listed vendor system

5. Evaluate vendor proposal/systems after vendor Demonstration and on-site visits

6. GAP analysis, Select a vendor and system components,
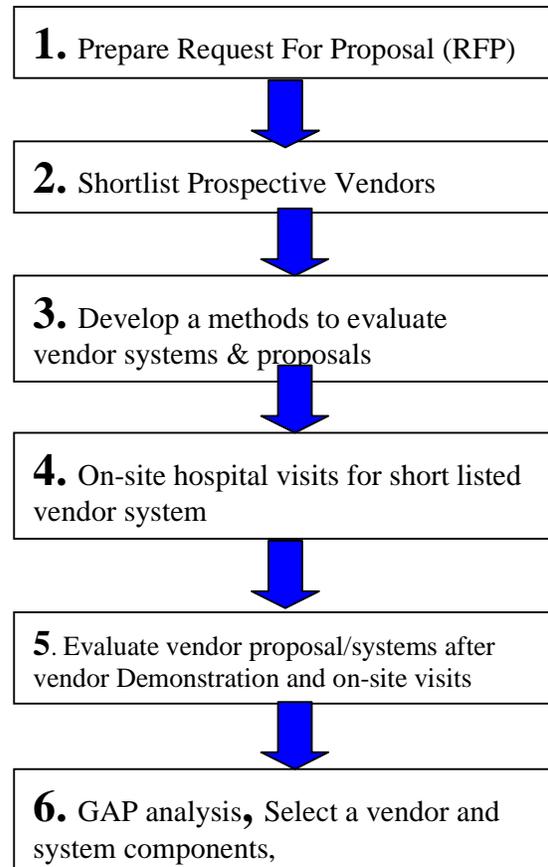
Exhibit 4: RFP Strategic Applications Requirements

The detailed Requirement Analysis document contained 38 functionality areas which had been grouped for ease of reporting. The suggested grouping was as follows:

Master Grouping	Functionality Areas
Global Patient Master Index (GPMI)	Electronic Patient Registration and Index
Registration I Encounter / Tracking	Admissions & Discharges A&E Wards Operations Theatre DSU Staff Clinic Radiology Laboratory Physiotherapy Pharmacy
Clinical Documentation	Radiology Laboratory Physiotherapy Blood Bank Medical Records Pharmacy
Scheduling	Nursing Administration Radiology Laboratory Physiotherapy A&E Wards Operations Theatre DSU Staff Clinic
Care Pathways and Management	Nursing Administration Radiology Laboratory Physiotherapy A&E Wards Operations Theatre DSU Staff Clinic CHS
HR I Payroll / Finance	HR General Accounting Management Accounting Fixed Assets Credit Control AR Billing
	Cash Book AP Budgeting and Forecasting
Transcription	Pharmacy Wards Operations Theatre DSU
Contract Management	KHA HMO CHS Customer Service CHS
Claims I Payment	KI-IA CHS
Charging / Coding / Billing	Purchasing and Stores Credit Control AR Billing Cash Book
Outcomes I Utilisation Management	Social Work Radiology Laboratory Physiotherapy Blood Bank Medical Records Wards Operations Theatre DSU
Medical Research	Infection Control Library Social Work
Clinical Orders	Purchasing and Stores Cash Book AP Maintenance Laundry / Central Sterile Supply Department
Support Systems	Maintenance Hotel and Support Transport Catering Laundry / Central Sterile Supply Department School of Nursing
Business Rules (Workflow)	Administration I Decision Support Systems

Exhibit 5: Scoring Models for Information System Evaluation

		JEEVA	MEDITECH	CARE 2000
Vendor/System Characteristic	**Weight**	**Raw Score**	**Raw Score**	**Raw Score**
1. Conformity with	**600**	49	56	58
2. Background				
2.1. Number of Implementers	**20**	10	10	10
2.2. Location & Proximity	**5**	0	0	10
2.3. Industry Experience	**10**	10	10	10
2.4. Product Age	**20**	10	10	10
2.5. Turnover & Net Income	**5**	10	10	10
2.6. Number of Professional	**5**	10	10	10
2.7. Future Outlook e.g. R &	**10**	10	5	10
3. Technical Architecture	**75**	**60**	**55**	**70**
3.1. Conceptual Architecture	**40**	5	5	5
3.2. System Integration	**40**	10	10	10
3.3. Scalability & Flexibility	**10**	10	0	10
3.4. Data Storage Software	**10**	10	0	10
3.5. Auxiliary Data Storage	**5**	0	0	0
3.6. Commonality of Database	**10**	10	10	10
3.7. Data Warehousing & DSS	**10**	10	5	5
3.8. Data Dictionary	**10**	10	10	10
3.9. Database Flexibility	**10**	10	0	10
3.10. Data Validation &	**10**	5	10	10
3.11. Batch Job Scheduling	**5**	10	10	10
3.12. The UN/Edifact Standard	**10**	0	0	0
3.13. Support for XML	**10**	0	0	0
4. References	**180**	**90**	**60**	**90**
4.1. HMIS Used In Kenya	**20**	0	5	5
4.2. Portfolio Distribution	**20**	0	10	10
4.3. Number of References	**20**	10	10	10
5. Healthcare Industry	**60**	**10**	**25**	**25**
5.1. ICD-10	**20**	10	10	10
5.2. DRG	**20**	0	0	0
5.3. HL7	**20**	10	10	10
5.4. DICOM	**20**	10	0	2
6. Implementation Plan	**80**	**30**	**20**	**22**
6.1. Migration Plan	**15**	10	10	10
6.2. Methodology & Approach	**30**	5	5	10
6.3. Project Schedule	**30**	10	10	10
7. Project Staffing	**75**	**25**	**25**	**30**
7.1. Number of Personnel	**10**	10	10	10
7.2. Competence of Personnel	**20**	5	10	5
8. Training & Documentation	**30**	**15**	**20**	**15**
8.1. "Train-the-trainers"	**20**	7.5	10	10
8.2. Basic Computer Training	**20**	0	0	0
8.3. Structure of Training	**20**	0	10	10
8.4. Technical Manual	**10**	10	10	10
9. Support & Maintenance	**70**	**17.5**	**30**	**30**
9.1. Length of Warranty Period	**10**	10	0	5
9.2. Upgrade Cost	**10**	10	10	10
9.3. Frequency of Upgrades	**10**	10	10	10
9.4. Proximity of Support	**20**	5	0	5
10. User Friendliness	**50**	**35**	**20**	**30**
10.1. Easy to use	**20**	10	5	7.5
10.2. Online Help	**20**	10	10	10
10.3. Context-Sensitive Help	**20**	10	10	10
Total Weight Aggregate	**60**	**30**	**25**	**27.5**

Exhibit 6: Summary of Financial Positions of Short Listed Solution Vendors

Table 1: Karishma Financial Position

Year	Gross Income	Net Profit	% Healthcare	% others
1998-1999	*$749,056*	$48,909	78%	22%
1999-2000	$1,572,842	$130,824	74%	26%
2000-2001	$2,051,622	$190,107	69%	31%

Table 2: MEDITECH S.A Financial Position

Year	Turnover	Net income
1997	$193m	$50m
1998	$203m	$53m
1999	$225m	$59m
2000	**$210m**	$55m
2001	**$217m**	

Order for products had increased at an unusually high rate during *1999* as customers expedited their normal buying decisions to ensure Y2K compliance. New order levels dropped significantly during 2000, as a result.

Table 3: Symphony Financial position

Year	Gross Profit	Net profit
2000	Kshs 186980861	Kshs 72330695
2001	Kshs 119320641	Kshs 83524449

Year	Gross Profit	Net profit
2000	$2.7 m	$ 1.0 m
2001	$ 1.7 m	$ 1.2 m

Exhibit 7: Meditech S.A. Estimated Costs & Benefits

ITEMS	Units	Unit Price	2003	2004	2005	2006	2007	2008	
Cost of Hardware									
Server			32,000	5,000	5,000	5,000	5,000	5,000	
Client Station	38	1,300	49,400	1,000	1,000	1,000	1,000	1,000	
View station	200	1,100	220,000	2,500	2,500	2,500	2,500	2,500	
Laser Printer	6	400	2,400	240	240	240	240	240	
Desk Jet Printer	15	100	1,500	150	150	150	150	150	
Backup tape drive	1	4,500	4,500	-	-	-	-	-	
Telecommunications									
Router	1		5,000	50	50	50	50	50	
Firewall	1	3,800	3,800	800	800	800	800	800	
Cabling			1,030,000	-	-	-	-	-	
Software									
MEDITECH			1,058,400	-	-	-	-	-	
Oracle database 9i			26,000						
Service									
Professional service			349,790	35,000	35,000	35,000	35,000	35,000	
Annual Maintenance			190,512	80,000	80,000	80,000	80,000	80,000	
System Personnel				-	-	-	-	-	
TOTAL COST			2,973,302	124,740	124,740	124,740	124,740	124,740	3,597,002
Benefits									
1. Billing enhancement			400,000	480,000	576,000	748,800	973,440	1,265,472	
2. Reduced Paramedic			50,000	60,000	69,000	79,350	91,253	104,940	
3. Reduced Clerical			50,000	60,000	69,000	79,350	91,253	104,940	
4. Reduced Messenger			15,000	18,000	20,700	23,805	27,376	31,482	
5. Reduced Communications			15,000	18,000	20,700	23,805	27,376	31,482	
6 Reduced stock			240,000	288,000	331,200	380,880	438,012	503,714	
TOTAL BENEFITS			770,000	924,000	1,086,600	1,335,990	,648,709	2,042,031	7,807,329
Assumed Rate billing enhancement income: 20% for years 2004 and 2005; 30% for years 2006 to 2008.									
Assumed Growth Rate for other cost reductions revenue: 20% for year 2004; 15% increases for each additional year.									
Cash flows			(2,203,302)	688,748	851,348	1,100,738	1,413,457	1,806,779	

Exhibit 8: Karishma JEEVA- Estimated Costs & Benefits

ITEMS	Units	Unit Price	2003	2004	2005	2006	2007	2008	
Cost of Hardware									
IBM AS/400	1	98,000	98,000	17,000	17,000	17,000	17,000	17,000	
Viewing Station	48	1,300	62,400	1,000	1,000	1,000	1,000	1,000	
Workstation	200	1,100	220,000	2,500	2,500	2,500	2,500	2,500	
Laser Printer	6	400	2,400	2,000	2,000	2,000	2,000	2,000	
Desk Jet Printer	15	100	1,500	1,500	1,500	1,500	1,500	1,500	
Backup tape drive	1	4,500	4,500	-	-	-	-	-	
Telecommunications									
Dicom Object	1	5,000	5,000	1,000	1,000	1,000	1,000	1,000	
Firewall	1	3,800	3,800	800	800	800	800	800	
Cabling			1,030,000	-	-	-	-	-	
Software									
Application Software	1	440,000	440,000	9,000	9,000	9,000	9,000	9,000	
Database Software		-	-	-	-	-	-	-	
Service									
Training			40,000	16,000	16,000	16,000	16,000	16,000	
System Personnel	2	70,000	140,000	140,000	140,000	140,000	140,000	140,000	
System Manager	1	100,000	100,000	100,000	100,000	100,000	100,000	100,000	
AMC(server,work station,application)			113,700	13,700	13,700	113,700	113,700	113,700	
TOTAL COSTS			2,261,300	404,500	404,500	404,500	404,500	404,500	4,283,800
Benefits									
1. Billing enhancement			400,000	480,000	576,000	748,800	973,440	1,265,472	
2. Reduced Paramedic			50,000	60,000	69,000	79,350	91,253	104,940	
3. Reduced Clerical			50,000	60,000	69,000	79,350	91,253	104,940	
4. Reduced Messenger			15,000	18,000	20,700	23,805	27,376	31,482	
5. Reduced Communications			15,000	18,000	20,700	23,805	27,376	31,482	
6 Reduced stock			240,000	288,000	331,200	380,880	438,012	503,714	
TOTAL BENEFITS			770,000	924,000	1,086,600	1,335,990	1,648,709	2,042,031	7,807,329
Assumed Rate billing enhancement income: 20% for years 2004 and 2005; 30% for years 2006 to 2008.									
Assumed Growth Rate for other cost reductions revenue: 20% for year 2004; 15% increases for each additional year.									
Cash flows			(1,491,300)	519,500	682,100	931,490	1,244,209	1,637,531	

Exhibit 9: Symphony CARE 2000- Estimated Costs & Benefits

ITEMS	Units	Unit Price	2003	2004	2005	2006	2007	2008	
Cost of Hardware									
Infrastructure			114,668	20,000	20,000	20,000	20,000	20,000	
Sun Server	1		48,147	8,000	8,000	8,000	8,000	8,000	
Training Server	1		2,628	450	450	450	450	450	
PC Clients	1		1,181	10	10	10	10	10	
UPS	3		19,263	200	200	200	200	200	
Telecommunications									
3 Com Switch	3		4,491	50	50	50	50	50	
Firewall	1	3,800	3,800	800	800	800	800	800	
Cabling			1,030,000	-	-	-	-	-	
Software									
CARE 2000			238,090	5,000	5,000	5,000	5,000	5,000	
MS Exchange			10,544	200	200	200	200	200	
Oracle Database			39,112	1,000	1,000	1,000	1,000	1,000	
Service									
Oracle Training			39,650	16,000	16,000	16,000	16,000	16,000	
Consultant - Project Mgnt.			8,000	3,200	1,280	512	205	82	
System Personnel			60,000	60,000	60,000	60,000	60,000	60,000	
Insurance	1	19,000	19,000	19,000	19,000	19,000	19,000	19,000	
Disaster Management	1	5,000	5,000	5,000	5,000	5,000	5,000	5,000	
Service fee			50,000	50,000	50,000	50,000	50,000	50,000	
Windows2000 Server/Licenses	1		800	800	800	800	800	800	
Product License fee	125	480	60,000	60,000	60,000	60,000	60,000	60,000	
Total Licenses			399,550	399,550	399,550	399,550	399,550	399,550	
TOTAL COST			2,153,924	649,260	647,340	646,572	646,265	646,142	5,389,502
Benefits									
1. Billing enhancement			400,000	480,000	576,000	748,800	973,440	1,265,472	
2. Reduced Paramedic			50,000	60,000	69,000	79,350	91,253	104,940	
3. Reduced Clerical			50,000	60,000	69,000	79,350	91,253	104,940	
4. Reduced Messenger			15,000	18,000	20,700	23,805	27,376	31,482	
5. Reduced Communications			15,000	18,000	20,700	23,805	27,376	31,482	
6 Reduced stock			240,000	288,000	331,200	380,880	438,012	503,714	
TOTAL BENEFITS			770,000	924,000	1,086,600	1,335,990	1,648,709	2,042,031	7,807,329
Assumed Rate billing enhancement income: 20% for years 2004 and 2005; 30% for years 2006 to 2008.									
Assumed Growth Rate for other cost reductions revenue: 20% for year 2004; 15% increases for each additional year.									
Cash flows			(1,463,834)	122,911	287,431	537,589	850,615	1,244,060	