Proposals for a Ghana eHealth Strategy

by

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Parts of the material included and adapted herein stems from materials prepared by the author over several years (mid-1990's to the present) of consultancy and support to similar endeavours by the national health authorities of many countries. As some of this material is to appear in a formal publication, *no parts of this document, in total or in part, are to be used by any other party or for any other purpose, without the explicit written consent of the author.*

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Executive Summary

In response to a request by the Ghana Ministry of Health (MoH) through the Ministry of Communications, the ITU sought the Author's services to study the requirements for eHealth Support, with emphasis on the management of the National Health Insurance scheme.

The study was carried out in two parts, in July 2004 and April 2005. The July 2004 Report summarised the users requirements and made broad recommendations for meeting these requirements. With the approval of that report, this is the Author's final Report.

At present, the Ghana health sector, led by the MoH and Ghana Health Services (GHS), is in the middle of a major **reform** of the managerial, technical and clinical aspects of the health sector, especially the delivery and financing of the medical care services. The underlying theme of such reform is to increase the capacity of the health care institutions (hospitals, health centres, Laboratories, etc...) to deliver more and better quality medical care and to gradually strengthen these institutions to independently manage their own human, financial and other resources. These responsibilities were, until hitherto, parts of the MoH's realm; but the MoH is gradually limiting its role to setting national health policy and strategy, monitoring their implementation and progress thereon, and conducting evaluation and audit.

One of the key features of the "ongoing reform", referred to above, is the concerted effort to explore more, and increase the current, uses of "Information & Communication Technologies (ICT)" support to the National Health Care Services, including its clinical, public health and managerial aspects – referred to here briefly as "eHealth support". Cost-effective eHealth support is indeed a most worthwhile avenue for Ghana.

This study started with a rigorous *analysis of the requirements* of a wide range of users in hospitals, health centres and their various technical and administrative support services. It also included an analysis of the existing capacities and their potential for further training to run and manage the technological aspects of a proposed eHealth support.

This study established, and it is *recommended* that the following Users Requirements be adopted as *the priorities* for eHealth Support:

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- to *manage* the day-to-day functions and to reduce the burden of reporting and search for and access to needed data and information;
- to *network* and communicate, over distance and substance, with other parts of the health sector, both as providers and requesters of information and related services;
- to have updated rules and procedures for *information flow* within the health sector and for access to commonly needed *data bases*, a few of which already exist but most need to be developed based on *standards* that are respected nation-wide;
- to launch a *National TeleMedicine Network* to bridge the major shortages of experts, specialists and medical facilities in the under-served areas;
- to access Continuous Professional Development and Continuous Medical Education (*CPD/CME*) formal accredited courses that are increasingly available over the Internet;
- to ascertain the minimum eHealth resources (human resources and technological facilities) are provided for;
- to introduce greater levels of security and confidentiality of data and transactions;
- to update the relevant legislation; and
- to be *informed and truly involved* in eHealth efforts, because it is widely appreciated as a major development affecting the scope and quality of health care services.

It is **recommended** that the realisation of the above requirements be satisfied through the implementation of the following **five priority services**, initially in **12 pilot sites** (the 2 Teaching Hospitals, 5 district or general hospitals and 5 health centres), and then gradually extended nation-wide; chapters 4 to 8, and related annexes III to VII give the *Technical Specifications,* which correspond to the users requirements cited above, and which can be readily quoted to solicit competitive offers when a decision is taken to implement all or any parts of these **recommended priorities**:

- The development of a National Health Care Management Information System, starting with a carefully limited functional scope and comprising mainly of core MISs for hospitals and health centres, and aimed at the direct support of the dayto-day health care services. This NHC/MIS also sets the core for the key national services of Electronic Medical Records & a National Patients Data Base;
- 2) The development of a National Health Information Platform that networks all the Ghana health sector institutions and supports all forms of communications between them; this could be referred to as "Ghana HealthNet" .;
- **3)** The start of a National TeleMedicine Network in each of the same 12 pilot sites, and use these to launch and host the CPD/CME TeleEducation courses;
- **4)** The development of a National Health Data Dictionary to hold, and make publicly available, all the standards of data items and related procedures; and
- 5) The enforcement of a strict Digital Security on all eHealth support.

It is **recommended** to start the implementation of the above five priorities with Ghana's own resources, so that it could speedily provide the evidence that eHealth support can have a significant contribution to cost-effective, equitable access to quality health care services. Such "evidence" could then be used to solicit additional external funding for Nation-wide implementation which could take 10-15 years. Estimated cost of the pilot implementation is approximately US\$ 3.68 million (para 9.1). Much of the actual development work should be outsourced to contractors and local service enterprises. But, it is necessary and thus it is **recommended** that the MoH and GHS IT Team be strengthened in calibre and in number of professionals, to be the competent professional counterparts to the eventual contractors and services providers.

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1. INTRODUCTION

Through the ITU and the Ministry of Communications (MoC) of Ghana, the Author was requested by the Ministry of Health (MoH), Ghana, to advise on the development of a Ghana e-Health Strategy. The main objective of eHealth support would be the provision of better quality health care services especially to the under-served areas, through better uses of resources and better day-to-day management of the health care services through improved information flow between its institutions.

The Study was to be conducted in two parts. The first part, which was carried out in July 2004, established the overall requirements and related existing capacities and facilities in Ghana, and outlined a conceptual view and an approach to develop the required eHealth Strategy. The first report by the Author, which was entitled *"Ghana eHealth Solutions: The main pillars and a Strategy for the Way Forward, July 2004"*, will be referred to hereafter as the *"July 2004 Report"*. This document is the Report on the second part of the Study - Terms of Reference are shown in **Annex I**.

Ghana has been undergoing a quiet but significant managerial reform of its health care services, particularly on three aspects. **First**, the actual delivery of the health care services, and their management, have been delegated to a Ghana Health Services (GHS) authority, and the MoH is gradually concentrating on the overall national policy, strategy, legislation, monitoring and audit. **Second**, the health care institutions, e.g. the hospitals, are having more authority to run their own affairs particularly their finances even though they still highly depend on a major annual government budgetary allocation. **Third**, Health Insurance schemes are being rapidly introduced and developed as a complementary, and in some cases as the means of financing the health care of individuals and whole communities.

A **fourth**, though different, aspect of the ongoing "reform" is that the health care institutions, GHS and the MoH, are consciously seeking to increase their uses of "Information & Communication Technologies (ICT)" support to the clinical, public health and managerial aspects of the health sector.

The Author visited Accra, Ghana, from 18 to 24 April 2005, to meet with the

MoH decision-makers and its "Information Technology (IT) team", as well as with representatives of GHS and the institutions providing the health care services – hospitals, health centres, pharmacies, etc... The Author also met the Management of the National Health Insurance Scheme and Ghana Telecom - the main national Networking and Telecom operator. A list of the individuals met and institutions visited this second part of the assignment is given in *Annex II*. The Author wishes to thank all the colleagues in the health sector in Ghana who contributed to this study. Their views on, and enthusiasm for eHealth support have enhanced the scope and quality of this study.

Some developments and progress have been achieved in making uses of the Information and Communication Technologies (ICT) services in Ghana. However, there are many problems and impediments relating to eHealth for which, fortunately, excellent solutions exist. These are mostly strategic, technical and resources issues, as well as how to rally various ideas, efforts and resources to work together towards realistic nation-wide solutions and their practical implementation.

Extensive discussions on the various aspects of the potential eHealth Support were held by the Author. These three presentations to differing audiences on: what eHealth priorities for Ghana, why and examples of other countries; TeleMedicine and its relevance to Ghana; and the rationale for and design of a Ghana HealthNet. Some additional requirements were triggered by the Author by citing an issue or a problem or a lack of progress, and hinting at its likely solution or solutions, and then obtaining reactions and often follow-up questions/answers. This led to a better understanding of the Requirements and eventually to the articulation of the potential Solutions.

This report is organised such that *chapter (2)* briefly cites the overall findings. Then each of *chapters (3) to (8)* re-states main requirements or issues, discusses their relevance to eHealth Support and recommends remedies or actions leading to their fulfilment. Related main Technical Specifications are summarised separately in *Annexes III to VII*. Then *chapters (9) & (10)* address the Human and Financial resources initial requirements, *chapter (11)* recalls the main recommendations into an overall Strategy and related a step-by-step Work Plan.

A brief, oral report, highlighting the gist of the findings and recommendations cited in this report, was presented at a **conclusive meeting** attended by about 20 staff members representing a cross-section of MoH and GHS departments.

2. THE CURRENT SITUATION

2.1 OVERALL FINDINGS

The eHealth efforts enjoy strong support and endorsement by the decisionmakers at the highest levels. The eHealth development rests on a competent but relatively few professionals who are stretched between their numerous tasks. They need to be enriched in numbers, expertise and remuneration.

The health care institutions, especially hospitals, are anxious to make many justified uses of eHealth support because they appreciate the positive impact it could make to the cost-effectiveness and efficacy of their health care work. They expect and believe in a nation-wide effort towards that aim.

Some "data standards" that would apply nation-wide have been established, but there are still quite a few standards that need to be developed and agreed upon. More fundamental, there is a need to appreciate what constitutes Nation-wide Compatibility, and how such compatibility dramatically influences the efficiency and economy of the eHealth support sought by all levels of the health care services.

One disappointing fact is the number of responsible staff, in both the MoH and GHS, who should have received the Author's July 2004 Report but did not, even though the responsible Director confirmed that he had sent the report to all.

2.2 Ghana Health Services - Hospital MIS

GHS was an important counterpart of the first part of this Study (July 2004), and the Author solicited and obtained their views on the Users Requirements and the required National eHealth Strategy which, the Author clearly stressed, would include a Hospital MIS.

Yet, the Author was informed in the course of this second part of the Study that GHS has issued in January 2005 an "invitation to tender" for a Hospital MIS, and has received bids which they are currently assessing. Despite several requests, via the senior colleagues met and who confirmed this action by GHS, it was not possible to obtain a copy of such a document so that the Author may ascertain:

- whether it actually included actual Statements of Requirements?
- Technical Specifications? and
- whether it actually included the requisites of Nation-wide Compatibility?

2.3 National Health Insurance Scheme (NHInsS)

This is the most significant development in recent years on the *"financing"* of the health care services in Ghana. A *"National Health Insurance Scheme"* has been introduced as a key measure for enhancing Equity to all Ghanaians and as a part of the Ghana Poverty Reduction Strategy. The aim is to ensure access to a set package of quality essential health services without out-of-pocket payment being required at the point of service.

It is widely appreciated that the NHInsS requires a powerful, nation-wide information system to support its overall management and day-to-day operations.

Individual registration into the Scheme has already started nation-wide. Within 5-years, every resident of Ghana must belong to a health insurance scheme, of which there are two types: social and commercial. The social type is expected to be the most applied and will comprise mainly of a *"District Mutual Health Insurance"* scheme on a district by district basis. This will require an annual contribution from the Insured but the scheme will also receive Government subsidy to top up the premium for the poor and vulnerable population groups. In addition, any group of citizens in Ghana who may be community, occupational or faith-based, may establish their own *"Private Mutual Health Insurance"* scheme but will not receive Government subsidy. Children aged 17 years or under are exempt from payment of contributions provided that both parents have paid the minimum contribution.

Health care providers, from Teaching Hospitals to Health Centres, and from Private Hospitals to Clinics, Pharmacies and Drug Stores, are to be duly accredited and formally registered. Pre-determined tariffs, drug lists and standard treatment protocols are being developed and intended to simplify the practice of the schemes including its financial charging and accountability. The Author attended part of a rather lively *"National Medicine Pricing Stakeholders Workshop"*.

Legislation, regulations and a nation-wide structure is in place for the governance of the health insurance schemes at all levels (national, district, ...) and forms (policy, legal, administrative, financial, ...). A Secretariat headed by a senior Executive Director has already been established in an office building dedicated to the support and management of the NHInsS.

Simple computer-supported applications were piloted in several districts to support the management of the District Mutual Health Insurance scheme. And a simple bar-coded Health Insurance ID Card, with the Insured photo and address, has been introduced.

One of the most important *recommendations* of the July 2004 Report, which has since been *approved* is that the development of a Management Information System for the NHInsS cannot be a separate effort but should be a part of the development of the overall National Health Care MIS and its related infra-structure, in particular as a part of the proposed Ghana HealthNet (*chapter 6*) and the proposed NHC/MIS (*chapter 4*), and of the basic technical tools upon which they would be based (*chapters 7 and 8*).

In brief, it was not recommended to develop the NHInsS MIS separately, but developed as a priority system under the technical umbrella of the National eHealth Strategy, which is covered in this document and the July 2004 Report by the Author. The importance of this *national approach* stems from many related facts, including: the widespread need for information support in other areas including the Hospital MISs; the need for nation-wide networking to satisfy other inter-linkage requirements and purposes within and outside the health sector; the need for common tools such as a fully operational National ID system and a house numbering system at the District level; etc... *It would have made little sense to develop "a solution" uniquely*

for the insurance scheme when it would have required tools that are also needed by and for other key common systems and services.

The proposed national strategy, therefore, hinges on the development of the essential pillars that would serve several major systems and services which are needed nation-wide and which are also requisites for the development of the NHInsS MIS. For example, the proposed national strategy recommends the development and start of operation of a few core functions for Hospital MISs, which also comprise the proposed NHC/MIS (*chapter 4*), and one of the recommended six core functions of the Hospital MIS is "Patient Billing", which ties directly into the financial aspects of the necessary NHInsS MIS.

2.4 CHIMS - Health Statistics & Information

This is currently by far the largest "health data/information" operation in Ghana. Data is mostly acquired through Reporting from all levels of the health care services, primarily via periodically filled forms which are then computerised. Some such data are being received on CDs or diskettes. Direct downloading from the sources is severely limited by the lack of nation-wide networking of the health institutions.

All data, after validation, are fed into the National Health Statistics Data Base and processed. A few applications process such data to produce periodic reports (e.g. with Health Indicators) and to serve Surveillance purposes. Sometimes, and when possible, it is used to respond to specific queries.

An important remark has to be added. Whereas the health care indicators are well-prepared and serve the needs of Surveillance, they also need to be related to indicators on Finances and Human Resources in order to provide the pointers for the Managerial actions that would influence the scope, quality and economy of the health care practice in the Ghana. This improvement is called for by the *Financial Controller* of the MoH who critically views the current system as a "100% financial system" when it also needs to be a "managerial system" that relates the finances to the indicators on the actual quality and coverage of health care and its services.

2.5 National MoH

The past three years witnessed a noticeable increase in the introduction and uses of computing support by the various departments and services of the MoH, but relatively little networking and telecommunications. These uses were summarised in *para* (4.2) of the July 2004 Report.

2.6 Ghana Telecom (GT) Networking & Communications Services

The main actual and potential services provided by GT to its clientele, including the Ghana health sector, were described in chapter (11) of the July 2004 Report. During this second part of the Study, the Author again met with the GT senior staff responsible for the development, marketing and pricing of GT services, and discussed:

- The broad outline of the proposed eHealth Strategy including the required Ghana Health Intranet, or Ghana HealthNet (chapter 6);
- The proposed pilot networking of 12 sites, that is the two Teaching Hospitals, 5 general or district hospitals and 5 health centres;
- The nature of the applications to be activated and the types of data involved including multi-media data (e.g. for TeleMedicine and TeleEducation links);
- The potential implications of the above on the types, volume and performance of the services expected from GT to the health care institutions involved;
- The approximate time-scale for the above development;
- and,
- Requested indicative GT pricing information so as to enable the preparation of budgetary estimates.

In response, GT took note of the above and:

- expressed their delight at these potential developments;
- expressed their readiness to collaborate with the MoH in its realisation;
- confirmed that GT services will provide all the technical performance implied in the above requirements "by October and certainly by end 2005"; and
- indicated that their "Price List is being updated" and would be issued "in 2-4 weeks" and "a copy would then be sent to Dr Akor" to forward to the Author.

3. USERS' MAIN REQUIREMENTS

This chapter echoes the main requirements stated by individuals or groups of individuals carefully selected as a representative cross-section of the health sector and who were met, and their stated requirements analysed by the Author. Each of the following paragraphs covers a main requirement and ends with a corresponding recommendation or, where that is not the case, the requirement concerned is dealt with in one of the main *chapters (3) to (8)* of this report.

3.1 One eHealth Policy and Strategy

Whereas the *"de-centralisation of managerial authority"* is part of the sensible ongoing health sector reform, it would be a mistake, technically and economically, if that is also interpreted to lead to a multiplicity of competing or uncoordinated computerised systems and applications. Ghana should vehemently avoid that.

Most of the users met during this study readily appreciate the importance of Nation-wide Compatibility, and are ready to respect and or adapt to what is needed to ascertain that. But, and that is understandable for medical professionals, they do not understand what eHealth technical measures, apart from "common data standards", are to be ascertained so as to lead to such a vital compatibility. A specific para is therefore included in this Report on the "meaning of Nation-wide Compatibility" (*para 7.3*).

During the second part of this Study, the Author was informed that GHS has already issued an "invitation to tender" for offers of "hospital management information systems". Does that copy and pre-empt one of the key aspects of the proposed eHealth Strategy? Despite repeated requests, through senior colleagues met and who confirmed this action by GHS, it was not possible to obtain a copy of such a document. It was therefore not possible to ascertain whether the GHS invitation-to-tender actually included a clear Statement of Requirements <u>and</u> the related Technical Specifications of what the health care institutions actually require <u>and</u> the minimum requisites of Nation-wide Compatibility?

It is *recommended* that those responsible for the Ghana health sector – whether it is the MoH, GHS or both - ascertain one eHealth Policy and Strategy, and that should be openly declared, clearly understood and respected, and for which there is a national commitment. This Report and the July 2004 Report together provide all the essential elements for such a National eHealth Policy and Strategy.

3.2 Support to day-to-day Management

Information support for the day-to-day management of Health Care services is poor and archaic. It has to be realised that that is the source of all health data and information because it is where the individual comes into first contact with the health care services. The information support to the day-to-day management of the Health Care services requires a major modernisation such that:

- first and foremost, the health care services are cost-effectively delivered;
- the data to be periodically "reported" by the health care services are readily and automatically extracted instead of remaining a form-filling workload for the health care staff;
- the time of the professional health care staff is dedicated to patient care.

It is **recommended** that a National Health Care Management Information System be developed, initially aimed at a cost-effective improved support to the dayto-day services, and its operation launched as soon as possible; this is further covered in *chapter (4) and Annex IV* of this report.

3.3 Infra-structure for Networking & Communications

The existing network of the MoH is largely used for eMail and access to the Internet. Whereas these are well appreciated services and improvements, the effective links between the various health institutions are still poor, manual, slow and prone to a great deal of losses and errors.

What is required is a Nation-wide platform for health information flow, exchange, sharing and uses by all levels of the health care services. Such a platform is also essential now that the health care delivery services are gradually encouraged to be autonomous, whereas the MoH maintains policy, progress monitoring, coordination and audit.

It is **recommended** that a National Health Platform be developed as the Health Intranet of Ghana and to be recognised, respected and trusted as <u>the</u> secure national platform for all Health Information activities. Such a platform could be referred to a **Ghana HealthNet**, and its design and technical specifications are further covered in *chapter (6) and Annex III* of this report.

3.4 "Reporting", Nation-wide Data Flow and Data Bases

The existing "reporting system" is supposedly the core of data collection, flow, uses and feedback. In reality, it is not a coherent system but a mix of long-standing reporting requirements, supplementary instructions and rules, and special ad hoc reporting. Feedback is rare and drowned in aggregate reports that do not cover or reach all concerned. Access to past reports, indicators and other information is almost entirely manual, and is difficult for Accra-based staff and almost impossible for those in remote areas.

It is **recommended** that, as an integral part of the design and introduction of Ghana HealthNet (see *para 3.3 and chapter 6* of this report), the eHealth Strategy includes the introduction of new/revised procedures and rules for information and data flow. These should partly be a direct product of the proposed National Health Care Management Information System (NHC/MIS) covered in *chapter (4) and Annex IV* of this report.

3.5 Continuous Professional Development & Medical Education

All health professionals, particularly the medical cadre, require and demand the opportunities for further professional training, development and education, particularly on new procedures, techniques and technologies. These are referred to as Continuous Professional Development and Continuous Medical Education (CPD/CME). Indeed, over 50 countries today require proof of "attendance of CME courses" as a pre-requisite for the re-Licensure of a medical practice. For the Ghanaians, travel to courses abroad has significantly decreased in recent years because of cost increases and travel inconvenience.

The Internet has acutely increased the awareness of the Ghana health care professional staff of the availability and sources of professional development and educational courses, and equally increased the opportunities for access to such courses. Throughout this study, they have consistently stressed their requirement for an environment that facilitates and encourages access to such courses.

It is *recommended* to:

- a) include in the eHealth Strategy a strong support and encouragement for Ghana health and medical care staff to benefit from CPD/CME courses;
- b) initiate a survey to solicit the extent and the relative priority of the specific subjects and topics for which CPD/CME courses may be started; the *Ghana College of Physicians & Surgeons* stands ready to collaborate on that;
- c) start an active survey of the availability of relevant courses and the conditions for benefiting from these, noting that some of these courses are free-of-charge and some are at-a-charge; and
- d) whereas the Ghana HealthNet links would be adequate for such CPD/CME courses, it is worthwhile to plan that certain sites cater for groups of trainees to simultaneously benefit from a course.

3.6 Ascertaining the Minimum Human Resources

One of the most basic requirements that have to be met to ensure that eHealth support will meet its objectives, are those related to the human expertise – and in particular as it concerns the "staffing" in health centres and hospitals, and at both the national and district levels. The "expertise" here refers to both the managerial and technological capacities. This is covered in *chapter (8)* of this report.

3.7 Security & Confidentiality

Security and confidentiality in the health sector are as old as the field of Medicine. Indeed, the pre-computing manual practices have been and remain subject to strict rules, regulations and legislation aimed in large measure at respecting the security of medical data and the confidentiality of the patients.

In the proposed eHealth support, the "security and confidentiality" issues are best addressed at two related levels, the physical and the digital. The *physical* is that concerned with securing the physical safety of all the facilities proposed against theft, malicious or accidental damage, etc... Such facilities include the users' peripheral equipment, the networking infra-structure and the servers which host the data bases and services.

Digital security is concerned with the transactions and related data flow within and between users computers and over network links. The harm that could result from a digital security breach spreads and multiplies exponentially quicker than in the manual environment, and it is for this reason that it is potentially more damaging.

The Author's interviews with the current and potential eHealth users revealed little awareness of the importance of Digital Security, or even of the limitations of "Password Protection" in ensuring the security of computing facilities, applications and their information content.

It is **recommended** that Digital Security be ascertained prior to initiating the formal, operational eHealth services. This is further covered in *chapter (8) and Annex VII* of this report.

3.8 Up-to-date Legislation

Experience to-date in a number of countries shows that the development, drafting and passage of the Legislation necessary for eHealth support always lags behind the actual development of the relevant support.

For Ghana to avoid future delays it is **recommended** to involve and engage, from the outset, the services of a dedicated legal person charged with the review of existing Legislation and Regulations, and verifying which of these would still apply for eTransactions and which would require updating or replacement. Particular attention is drawn to these two related issues:

- Electronic Medical Records: their content, who has the right to update, who has the right to access, and who is its ultimate owner?
- What 'Medical Data' is accessible by third parties, e.g. Health Insurance schemes? At what stage of the relevant transaction? How? And for how long?

3.9 To be Informed and truly Involved

The eHealth support influences, and thus its development should involve, a wide range of units and individuals, from within and outside the MoH and GHS, and at the local, district and national levels, and indeed from outside the health sector.

It is therefore quite important and is **recommended** to carefully inform, involve and be seen to involve all known and anticipated collaborators, and particularly the eventual Users of the emerging systems and services. This is further covered in *para* (8.3) of this report.

3.10 Specific Essential Support Tools

3.10.1 Declared and Explained Standards

In the Ghana health sector, there is ample awareness of the need to base health systems and services, including the proposed eHealth support, on international **Standards** which cater for national needs and which are recognised and respected nation-wide.

It is **recommended** that a concerted effort be made to establish or reconfirm and explain the national eHealth standards and the benefits of adhering to these, and to even stress that funding would only be provided for activities that respect national standards and Nation-wide Compatibility. This is further discussed in *chapter (7)* of this Report.

3.10.2 A National Health Data Dictionary

One of the most important ingredients for Nation-wide Compatibility is adherence to common data definitions, coding schemes and actual codes. These should be technically agreed to, and then widely and readily availed in a National Health Data Dictionary - both as a look-up service and as a data base to which suggested additions or changes may be submitted.

In practice, there are already data items that are commonly adopted and used, and these are mostly in the administration and finance areas. This is also the case with Ghana MoH and GHS. The proposed eHealth support includes a major information system development, and part of the software needed to do so will be based on a Data Base Management System (DBMS). Any of the best DBMSs comes with what is known as a "data dictionary" application, which is parameterised and developed as an integral part of the required information system.

It is **recommended** that, with the development of the NHC/MIS (see *chapter 4*), a National Health Data Dictionary (NHDD) be conceived and based on that specifically related to the NHC/MIS. To do so, it is **recommended** that the eventual supplier for the NHC/MIS be also charged with the development of the NHDD - would comprise initially of the data items and entities of the NHC/MIS, and gradually enriched with those of other needs and applications.

3.10.3 Technical Specifications

The relevant requirements and related technical specifications for the proposed NHDD are summarised in **Annex V** of this Report. This Annex recalls why is the NHDD important; what is it meant to contain; and how to

specify it as a technical requirement for development as an integral part of the proposed NHC/MIS (*chapter 4*).

3.11 Ascertain the Minimum Funding required

Another commonly expressed concern is that of the routine disappointment of *"no funding"* for enthusiastically drawn plans and designs. Sometimes this appears to have led to a *"go it alone"* attitude on the development of solutions that should be, and are technically and cost-effectively best conceived nationally. It is in Ghana's best interests that its eHealth support is conceived and developed in a coordinated and cohesive manner. Hence, the factors that lead to a *"go it alone"* situation should be avoided, and the minimum funding must be guaranteed for the pillars, that is the basic building blocks, of the priority eHealth solutions identified and *recommended* in this report, namely:

- Ghana HealthNet (chapter 6);
- NHC/MIS (chapter 4);
- NHDD (para 3.10.2);
- the extended of the TeleMedicine Network (para 2.2); and
- the CPD/CME services (para 3.5).

Chapter (10) of this Report gives budgetary estimates for the above.

4. NATIONAL HEALTH CARE MANAGEMENT INFORMATION SYSTEM (NHC/MIS)

4.1 An Overview of The Requirements

This was initially cited in *para* 3.2 above as a part of the main requirements stated by the main potential users of the eHealth support.

Government and private hospitals, health centres and clinics in Ghana have either very little or no computing support to their administrative or clinical work. Many government hospitals benefit from basic computing support to their accounting and personnel operations. Nearly all other data/information activities are manual. Data is collected on a wide range of paper forms, validated visually, stored in files or records or registers, and communicated in parts or in total to various destinations within the health sector (e.g. CHIMS – see *para 2.4* above) and outside Ghana (e.g. WHO).

In contrast, all the health care institutions have an obligation to "report" on a regular basis, mostly monthly and annually. Reporting flow is also manual even when the "reports" contents are a partly prepared on an office desktop Spreadsheet or Word Processor. These manual practices are widely plagued by delays, losses

and errors which are often noticed much later. There is a broadly expressed need for the introduction of computer-support to replace much of the current manual procedures for data recording, validation, processing and reporting.

Nearly all the users consulted during this study stress, and their actual technical requirements confirm, the need to give priority to the following solutions:

- Ghana HealthNet (chapter 6);
- NHC/MIS (chapter 4);
- NHDD (para 3.10.2);
- the extended of the TeleMedicine Network (para 2.2); and
- the CPD/CME services (para 3.5).

Equally important, the majority of all levels of staff in the National Health Care Services are reasonably aware of the existence and potential benefits of the *"uses of computing, networking and communications"* in general and in the health sector.

Many staff members readily comment on how such improvements could improve the quality, efficiency and economy of their and their institutions' technical services and of the direct benefits to their patients. Also, these staff appear to appreciate the importance of basing such developments on international standards and on the highest extent of Nation-wide Compatibility.

4.2 The recommended Strategy to a Solution

As stated above, the top priority immediately after Ghana HealthNet is the concrete improvement of management information systems in the health care institutions of Ghana. The totality of these MISs make up what is referred to, by the Author, as the National Health Care Management Information System (NHC/MIS).

In its totality, such an NHC/MIS could be a massive, complex and costly system which Ghana needs but for which the available resources and infra-structure are inadequate at present. A sensible strategy is to first acquire, install and start using the affordable essential, and then gradually build onto that.

Hence, the *recommended strategy* for the acquisition and development of the NHC/MIS, is as follows; these strategic steps could be carried out in parallel with the development of Ghana HealthNet (chapter 6 below):

- a) To avoid initially installing "complete" Hospital MISs and, instead, to acquire and install only the core functions (*point (d) below*) of a Hospital MIS;
- b) To avoid being lost in "the business of developing software" instead of "the business using software", and concentrate efforts in a wise selection of a national solution through open, international competitive bidding;

- c) To install the core functions of the selected solution in as many hospitals and health clinics as possible, and in the shortest time possible, so that these institutions day-to-day operations are adapted and brought up in unison.
- d) These six core functions are recommended:
 - Admissions, Discharge & Transfers;
 - Minimum Data Set of Patient Records;
 - Order Entry;
 - Laboratory;
 - Pharmacy; and
 - Patient Billing.

It should be noted that these six recommended core functions (out of a total of 20-25 functions) are chosen such that they support the key chores of Patients' Registration and demographic data; Patients' clinical data; Physicians' orders regarding patients and their follow-up, including orders for Laboratory and Pharmacy services; and Patient Billing.

- e) The "health centre core functions" would be a sub-set of those for hospitals. For example, a health centre would have a Patient Registration function but not a Patient Admission function. That is why the Hospital MIS has to be selected carefully and according to the technical criteria cited below (*point f*).
- f) The selected solution must have, as a minimum, the following basic features:
 - Modular and Scalable, that is it could be reduced to a version suitable and optimised for installation in smaller hospitals and in health centres;
 - Exists and actually operational somewhere, that is Ghana will not be a test-bed for an untested or newly programmed applications;
 - Based on international and de facto Standards;
 - Runs in a wide range of facilities, from a PC to an IP-Network; and
 - Totally independent of any proprietary hardware.
- **g)** To install and start the operation of the common data bases and services of the selected solution on Ghana HealthNet (*chapter 6*) at the same time as the installation of the core functions in the first pilot hospitals and health centres. The "common data bases" include the Electronic Patient Records, and the "common services" include Appointments and Scheduling of patients visits, laboratory tests, etc.

The above recommended strategy is meant to speedily lead to an essential minimum number of health care institutions that are MIS-supported in their essential day-to-day activities. And, from whose MISs, relevant data could be extracted and communicated ("reported") periodically to satisfy other need – notably to the Health Statistics, Epidemiological Surveillance, Public Health and Planning services.

4.3 Technical Specifications

The relevant requirements and related technical specifications for the Hospital MIS (HMIS) are summarised in *Annex IV* of this Report. The Annex starts by citing the major considerations in choosing an HMIS suited for Ghana's purposes and then briefly describes every main functionality and feature required in the specific HMIS. It is important to note that, whilst the recommended approach aims at acquiring and installing initially only six core functions of the HMIS, no compromise should be made in ascertaining that the selected HMIS is functionally complete and exists as such.

5. A NATIONAL TELEMEDICINE NETWORK

5.1 Scope

Individual experts and specialists are quite rare outside the main cities' health care services. This is due to complex issues that range from personal preferences to the absence of facilities and qualified support staff in the remote and under-served areas. As a result, a system of Patients Referrals is in force. The Author's July 2004 Report gave, in chapter (7), a tutorial-like explanation of the "relevance & justification" of a National TeleMedicine Network, and the importance of analysing the workload related to patients referrals in order to quantify the real needs. Apparently, statistics on patients referrals had not been kept with details to enable such an analysis.

Nonetheless, all professionals interviewed stress that, and the Author concurs, that Ghana requires a National TeleMedicine Network to bridge the severe shortages of Experts and Specialists and the lack of specialised diagnostic facilities, by remote support. The remote support would initially be from the two Teaching University Hospitals and on primarily for Diagnosis and proposed Treatment using:

- **TeleRadiology**, whereby radiological images, prepared in a remote hospital or health centre, are sent for expert readings by Specialist Radiologists;
- **TelePathology**, whereby microscopic images of pathological samples, prepared in a remote hospital or health centre, are sent for expert readings by Specialist Pathologists; and
- **TeleUltrasound**, whereby ultrasound images or even films, prepared in a remote hospital or health centre, are sent for expert readings by Specialists, starting first with maternal and foetus images for examination by expert Obstetricians (noting that "maternal and child health" is an integral and priority part of "primary health care").

and,

- **TeleEducation**, whereby lectures and training courses will be provided, over the same TeleMedicine links, by Experts from the two Teaching Hospitals or

abroad. These courses could eventually be part of the Continuous Professional Development for all health care professions, including Continuous Medical Education (CME) for physicians.

5.2 Technical Specifications

The relevant requirements and related technical specifications for the pilot National TeleMedicine Network are summarised in *Annex VI* of this Report. The Annex briefly describes the recommended priority TeleMedicine applications, and how the facilities for such applications could be enhanced to cater for TeleEducation.

6. GHANA HEALTHNET: A GHANA HEALTH INTRANET

6.1 Infra-Structure

The term "Infra-structure" is used here to refer to the computing, networking and telecommunications facilities and services which link geographically spread, numerous and varied organisational units and peripheral and common equipment, into a cohesive whole. With such links, and with pre-set procedures, protocols and standards, the infra-structure could enable the flow of transactions and information and the sharing of common resources between all those linked to such an infrastructure and authorised to use its services. This is viewed as a "private Network", and a private network that uses the same communication protocols as the Internet, is referred to as an "Intranet".

In most countries, the physical cabling backbone that enables such Intranets, is usually owned and run by the Telecom operator. This way, the private network, or Intranet, is essentially a logical network based and run over the physical network of the Telecom operator. This is also the case for the proposed Ghana Health Intranet. The Telecom operator, Ghana Telecom, owns the networking and communications backbone which links all the cities and regions in Ghana and upon which other logical networks may be based.

It is **recommended** that the MoH establishes, upon the Ghana Telecom networking and communications backbone, a national health network linking all the Ghana health institutions and supporting the systems and services recommended in this report. As mentioned in *para (3.2)*, we propose to refer to such a Ghana health sector Intranet as **Ghana HealthNet**.

How to go about developing Ghana HealthNet? To understand the recommendations that follow, we need first to understand the traditional and presentday links of the Ghana health sector, their services and limitations. **Fig. 1** gives a schematic diagram of the main present means of health data and information flow in Ghana. Hospital and health centres periodically "report" to the GHS and MoH, who process and consolidate the data and obtain aggregates and summaries thereof. The special programmes, such as HIV/AIDS, Nutrition, etc... also report in nearly the same way. In addition, the MoH requires and obtains other data from, for example, the National Statistics Bureau and the Ministry of Interior, and use these as the national baseline information. All this information is kept either in files or, as shown in *Fig. 1*, parts are stored in computerised data bases, particularly that of CHIMS (see *para 2.4* above). The contents of these files and data bases are also meant to be selectively retrieved, processed and used by a wide range of users, particularly for Planning, Monitoring and Evaluation.



In practice, the actual uses of such data is much lesser than the potential particularly by health institutions outside Accra and those without computing and networking capabilities.

The main **weakness of the current links** is that they connect a small fraction of the health sector institutions, and that most are essentially point-to-point links (also known as one-to-one connections), that is every line of communication between any two locations is specifically set for that particular service. Whereas this approach works, it is in fact quite limited, more costly and certainly inefficient. It is limited in connectivity, and it is costly and inefficient because a communication line is needed between every two points that need to communicate.

6.2 The Proposed Ghana HealthNet

What is really **required** is a network that links any and all health institutions and authorised individuals together (also known as many-to-many connections). That is, Ghana needs a "national platform" which connects and facilitates communications between all the Ghana Health institutions and can support all forms and types of data/information. Such a platform, or **Ghana HealthNet** as the Author proposes to call it, will be a cost-effective and efficient means of accessing all the **existing** common data bases, references and look-up services, such as:

- The national repository of Health Statistics and Epidemiological data bases;
- The national Standards (those agreed to and under consideration);
- The national directories and registers; and
- The national Health Legislation reference manuals.

And in addition to stimulating the further development and nation-wide uses of the above services, Ghana HealthNet would and support the *required new* common data bases, references and look-up services, and would enable those authorised to access these services, and to have these cost-effectively managed. Examples are:

- A national repository of Electronic Medical Records;
- A national Patients Data Base; and
- The common eHealth tools needed to promote and practically enable Nationwide Compatibility, such as the vital "National Health Data Dictionary".

In addition, with the development of a reliable and secure **Ghana HealthNet**, today's hospitals and health centres, and tomorrow's "autonomous" hospitals and health centres, would be encouraged and tangibly supported to collaborate on, to contribute and to share information, services and facilities, through a *single national platform* that specifies, enforces and maintains *Nation-wide Compatibility*. Authorised users could securely link to such a platform and use it:

- to benefit from its services and resources;
- to use it as the direct means by which to honour their obligations of reporting and contribution to "epidemiological surveillance", and the monitoring and assessment of the national health services;
- to plan the improvements to, and future enhancements of their health care services based on nation-wide standards inherent in Ghana HealthNet;
- to economically avail highly needed service; for example Electronic Medical Records and the start of a National Patient Data Base.

Fig. 3 shows an approximate schema of the proposed national health information platform, or "*Ghana HealthNet*", and also hints at the following examples



of the types of systems, services and information flow that will be enabled by and over Ghana HealthNet:

- The National Health Care Management Information System (NHC/MIS), discussed in *chapter (4)* and detailed in *Annex IV* of this report, comprising of and linking hospital and health centres MISs and eventually usable by all the authorised health care institutions in Ghana;
- The potential support to a nation-wide TeleMedicine Network, briefly described in *chapter (5)* and specified in *Annex VI*, to cover the under-served areas in the country;
- The access to courses for Continuous Professional Development (CPD) and Continuous Medical Education (CME), discussed in *para* (3.5) of this report;
- The expansion of the current eMail services to all health care institutions so that it becomes a national formal means of written communications;

- The improved and potentially nation-wide access to the main MoH legacy systems (e.g. Personnel, Finance, Health Statistics, ...); and
- An Operations Centre that manages the day-to-day operations of Ghana HealthNet, its integrity & security; provides help and trouble-shooting support to its users; and manages its gradual geographic and functional development.

Ghana HealthNet will also have this other indirect but critical and vitally important advantage: guaranteeing *Nation-wide Compatibility* (*para 7.3* below).

6.3 Technical Specifications

The relevant requirements and related technical specifications for the proposed Ghana HealthNet are summarised in *Annex III* of this Report. The Annex briefly describes the required computer network infra-structure and the applications and services it is intended to support including the National Health Information and Data Repositories. The Annex also specifies the all-important protection and disaster recovery arrangements needed, as well as the HealthNet Operations Management.

7. STANDARDS

In para (3.10.2) above, a National Health Data Dictionary was discussed and recommended. Furthermore, the importance of such an NHDD was emphasised as the readily-accessible central repository of all the standards and of the standard definitions of all the data items and entities used throughout the health sector. This chapter points out which standards are already in use in Ghana health sector, and stresses which other standards need to be considered and adopted for Nation-wide uses. Finally, it briefly explains the proper meaning of Nation-wide Compatibility.

7.1 What is established and used?

At present, there are national standards for the following:

- Disease Coding
- Clinical Procedures Coding and,
- Network communications, which is the Internet Protocol (IP).

7.2 What is needed at present?

There are no standards for the following categories; against each of these categories, we indicate the de facto international and vendor independent standard that is **recommended** for adoption and nation-wide uses in Ghana:

- Drugs Coding (Anatomic, Therapeutic & Chemical Coding)
- Medical Devices (Global Medical Devices Nomenclature)
- Patient Discharge Summary: content and outline

It is also necessary to stress that, in the absence of clear-cut international standards for the following categories, it is important and *recommended* that Ghana sets national standards for:

- Locations, e.g. Hospitals, health centres, Laboratories, ...
- Professional Groups (physicians, nurses, technicians, ...) and,
- The Latin spelling of popular Ghanaian names and titles.

7.3 The meaning of Nation-wide Compatibility?

It is important to stress that "compatibility" is much more than just "data compatibility". The latter merely ascertains that data from one system or application is recognised by or translatable onto another.

It is *recommended* that Ghana aims at nothing less than full Nation-wide Compatibility which enables:

- · Common procedures that facilitate Efficiency of inter-institutional transactions;
- Economies of effort and scale in the development or acquisition of new or enhanced technical facilities hardware, software and services;
- Transaction in one application or system triggers another transaction in another application or system, thus avoiding uncoordinated services or differing and contradicting values and data in supposedly related services;
- An improvement or enhancement in one location can be readily shared with and used by other locations without the need for adaptation or modifications;

And,

• Trained persons in one location can move to another location and, as they would not require further training, can be immediately productive.

The above understanding of *Nation-wide Compatibility* should be adopted and clearly explained to all concerned so that all are committed to guard and maintain it.

8. DIGITAL SECURITY

8.1 What is Digital Security?

The Author's July 2004 Report gave, in chapter (12), a tutorial-like explanation of the importance of Digital Security.

As pointed out in para (3.7) above, the Author has found that there is little awareness that "Passwords" protection is most inadequate for security of digital facilities, transactions and their information content.

There is a strong need to appreciate the unequivocal importance of "Digital Security" and of having thorough measures for such security. All data, information and transactions that are processed on computer applications and which flow through networks, must be based on secure methodology, protocols and procedures, as well as on physically secure equipment.

"Digital Security" is a critical part of eHealth Support. Solutions to develop a secure computing, networking and communications operations are available.

First, it is **recommended** to review and ensure the *physical security* of the existing even though simple MoH network (e.g. its gateways and routers), and the computing devices attached to it (e.g. the users' personal computers, the network servers, etc...). These should be behind locks when they are not in actual use by their authorised users.

Second, it must be clearly understood that *"Digital Security"* of transactions within applications and services, and over networks such as the proposed Ghana HealthNet, means that these FOUR measures must be strictly ascertained:

- Authenticity: to know and vet the identity of the specific sender of a message or initiator of a transaction, and the identity of its intended receiver. These are done via a unique digital certificate and signature for each user and server. Additionally, and very effectively, Biometric devices can be used to verify the uniqueness of an individual's fingers print, voice print, retina image, iris image, etc...
- **Integrity:** to be totally sure that the contents of the message or transaction have not been changed, either accidentally or maliciously, since it was sent or initiated and, if it had been somehow changed, to initiate the necessary warnings and as necessary re-transmission.
- **Confidentiality:** to ascertain that nobody, other than the sender and the intended recipient, has the ability to view, copy or otherwise know the contents of the message or transaction.

- **Non-repudiation:** to maintain an unequivocal record of a message or a transaction such that neither its initiator nor its recipient is able to later deny the message exchange or the transaction.

Thorough solutions are available for all the above four measures. These solutions are a mix of digital technologies and methodologies including a "Public Key Infra-structure (PKI)" solution. For certain transactions, such as ePayments, a "Trust Structure" is further used whereby a third party vets sender, recipient and type and extent of transaction before it is executed.

The Digital Security measures have to be in place and operational before any systems or services coping with computerised personal medical data, are introduced. It is for these reasons that Digital Security is **recommended** as an integral part of the priorities in the proposed eHealth Strategy.

The Author was informed that there is a "national effort for the establishment of a national Digital Certification Authority". All attempts made by the Author, through his MoH and GHS counterparts, to verify this and to make an appointment with those who are supposedly "in charge" of such an effort led to nothing. It is **recommended** that this situation be seriously verified. If there is indeed such a national effort, then it would be a logical and correct strategy for the health sector to seek to use its eventual outcome, and that is to set up a Health sector Registration Authority under the national Certification Authority. But, if there is no such effort, then the health sector would be obliged to speedily pursue a solution of its own - because whilst the health sector could indeed proceed with the developments recommended in this Report it must ascertain the digital security of the data and transactions involved before declaring these developments fully operational.

Chapter (9), on Budgetary Estimates and Funding, includes the necessary provision for Digital Security.

8.2 Technical Specifications

The relevant requirements and related technical specifications for Digital Security are summarised in *Annex VII* of this Report. The Annex stresses the systems, services, network and physical facilities that should be secured, as well as the security of the "content" thereof.

9. HUMAN RESOURCES & RELATED ISSUES

9.1 Software Development

The Author was asked in the course of this Study to advise if it would be more economic to contract a local software company to develop a Hospital MIS for Ghana, rather than purchase the necessary software and have it customised? Software development of large and complex systems, such as a Hospital MIS, is a major undertaking. Going into the chores of such development risks placing the MoH or GHS or both into the uncertainty and pains of *"the business of software development"*, when the health sector is and should be in *"the business of properly using software"*.

It is *recommended* to avoid the own-development of software of the scale and complexity of the proposed NHC/MIS or its component hospital MIS. Such systems require 100s of person-years to develop, debug, optimise, document and continue to improve and modernise. Moreover, the present market is a buyer's market, full of fine choices and the MoH or GHS stands to, and can, cultivate commercial competition to the utmost.

9.2 Staffing

The National MoH and GHS IT Teams, charged with the eHealth Support, are well-motivated and have a fine theoretical basis, but are not up to the challenges ahead because they are too few and lack practical experience. At present, there are only four professionals (plus a consultant) and their main workload is to support the operation and to trouble-shoot the applications cited in *chapter (2)* of this report.

It is **not recommended** that the MoH and GHS recruit staff to develop the nation-wide health information network and the new nation-wide solutions cited in *chapters (3) to (8) and Annexes III to VII* of this report. These major undertakings are best, and certainly more economically and efficiently left to local and international contractors, selected through competitive commercial bidding.

However, it is **recommended** that the MoH and GHS must have staff with the capacity to monitor the execution of the successful bids and to assess their outcome before formal acceptance, and to manage the guarantees and maintenance and support contracts thereafter.

If the decision is taken to implement the main recommendations of this report, then it is *recommended* to immediately recruit 4 more professionals and re-structure the resulting 8-person Team as follows:

- Overall Manager of eHealth Support (1);
- Network Administrator & a Network Engineer (2);
- Data Base Administrator (1);
- Major Applications Development and Trouble-shooting (2); and
- Training, and Help Desk services (2).

It is *also recommended* that any eventual bidding must include a thorough training to the MoH and GHS IT Teams and, where feasible, this could include technical visits of 1-2 weeks to locations where similar solutions are being developed or operational.

9.3 Partners & Others to be Involved

If the main recommendations of this report are accepted and approved for implementation, then these *three further recommendations* are necessary:

- a) Set up an "eHealth Users Group", whose main role would be both advisory and promotional, and which comprises of representatives of the full spectrum of the health sector eHealth users; and
- b) Give serious consideration to hold the "1st National eHealth Conference" in Ghana, as a one/two-day event for all levels of the staff concerned. The conference should serve two purposes. The first is educational, and thus it provides a general familiarisation with the eHealth Strategy and the scope of the priority "eHealth Support" being developed, why and how it would be integrated into the health care services? The second is managerial, and thus it avails the opportunity to all interested to question or to obtain clarifications on the proposed/approved National eHealth Policy, Strategy and Work Plan.
- c) Regardless of having a national conference or not, establish a 2-3 person team to provide **travelling seminars**, to all the districts and to groups of hospital staff, on the specific solutions being introduced prior to actual implementation in their respective sites. This is apart from the actual training inherent in the contracts for the supply, installation, training and introduction of each of the solutions concerned.

10. BUDGETARY ESTIMATES & FUNDING

10.1 Budgetary Estimates

Here, the Author gives only the budgetary estimates for the acquisition and installation of what is referred to in this Report as the "pillars" or the main building blocks of the eHealth Support, and budgetary estimates for the start of operation and post-Guarantee annual support and maintenance.

It is **stressed** that what follows are <u>not</u> cost estimates for "testing" anything, but **estimates for the start of the actual installation and operation** of:

- the design of the proposed National Health Information Platform, that is Ghana HealthNet, and the facilities required to link the 12 proposed pilot installations, that is the 2 teaching hospitals, 5 district or general hospitals and 5 health centres; the installation and start of operations of a HealthNet Operations Centre; and all other professional services including the necessary training. Reference *chapter (6) and Annex III* of this Report.

- the acquisition and installation of the NHC/MIS six core functions (as proposed in *point (d) of para 4.2* above) in the 12 pilot sites mentioned above, together with the design, establishment and start of operation of the proposed National Health Data Dictionary, the Minimum Data Set of the Electronic Medical Records and National Patient Data Base, together with all the necessary training. Reference *chapter (4) and Annex IV* of this Report.
- the establishment of a National TeleMedicine Network, supported over HealthNet and covering the same 12 pilot sites, each with a workstation for each of TeleRadiology, TelePathology, TeleUltrasound and TeleEducation together with all the necessary training. Reference *chapter (5) and Annex VI* of this Report.
- the acquisition and installation of the hardware and software of the Public Key Infra-structure solution needed for Digital Security, including 10'000 digital certificates and 2'500 devices (tokens) for the physical storage of 2'500 digital certificate, together with all the necessary training. Reference *chapter (8) and Annex VII* of this Report.

Priority Substantive Component	Main Cost Items	Estimate in US\$
HealthNet: National Health Platform <i>(ref: chapter</i> 6 & <i>Annex III)</i>	 LAN partial cabling in 12 sites "Last Mile" cabling for 12 sites GT installation services Operations Centre H & Software 	900'000
Hospital & H Centre MIS, Electronic Patient Records & National Patient Data Base (ref: chapter 4 & Annex IV)	 Licence for core functions Users stations & Servers Installation & Customisation Other professional services 	1'250'000
National TeleMedicine Network for 12 sites <i>(ref:</i> <i>chapter 5 & Annex VI)</i>	 Acquisition 3 stations (Rad, Path, U/Sound) for each of the 12 sites Acquisition 12 supplementary Video stations for TeleEducation Professional services 	830'000
National Health Data Dictionary (<i>ref: para 3.10.2</i> & <i>Annex V</i>)	- Licence - Server - Professional services	250'000
Digital Security (ref: chapter 8 & Annex VII)	 Licence & 10'000 certificates Server & tokens Professional services 	450'000
	Total	3'680'000
Post-guarantee Support and Maintenance services	10% of licensed acquisitions	230'000

It **should be noted** that the estimates above are based on the limitations cited in this Report and on the cost and rates in today's eHealth market, and

- a) do not include any duties, taxes, VATs, etc...;
- **b)** do not include any provision for local or foreign Consultancy services to guide the preparation of the Request for Proposals, or invitations to tender, which can be readily carried out by the appropriate national Procurement service;
- c) assumes that MoH and GHS staff time and expenses will be locally absorbed.

10.2 Funding

In Ghana, as in many industrially developing countries, some major critical development work may depend or await "external funding".

Whereas seed funding, from sources such as UNDP, WHO and the World Bank, are often a great catalyst for improvements and change, it is **recommended** that Ghana should invest its own resources for the proposed pilot implementation and launching of eHealth Support, and thus establish the evidence that eHealth support could directly positively impact the objective of equitable access to quality health care services. The "external funding" would then be more forthcoming and could be directed towards nation-wide expansion of these essential support services.

11. PROPOSED STRATEGY & WORK PLAN

The overall Health Care Policy and Strategy for Ghana is clear and very welldocumented as stressed in the Author's July 2004 Report. In contrast, the Strategy for the relevant eHealth support to the Health Policy is almost non-existent. This Report proposes an eHealth Strategy that is based on users requirements and related technical specifications. The need for the eHealth Strategy proposed in this report has been strongly expressed, and enthusiastically contributed to, by all staff interviewed at all levels. However, it has to be frankly stated that there are strong signs of turf conflicts which threaten to delay that further.

It is **recommended** that the responsibility for leading, and acting as a national Secretariat for, the effort to develop and introduce nation-wide eHealth Support should be clearly designated to one Directorate guided by an eHealth Users Group (see *point (a) in para 9.3* above).

It should be noted that the approach followed so far is essentially a *top-down* approach whereby we started with an analysis of current problems and explored

potential, alternative solutions, checked these with the anticipated users, and followed some key strategic steps that eventually led to the Strategy proposed in this report: the development of a network, specific systems and services, which we refer to as the "pillars" or building blocks for a gradual nation-wide provision of eHealth support and infra-structure.

In contrast, the approach for the actual implementation is <u>the reverse</u>. That is, a **bottom-up** approach is followed whereby the technological support and related procedures are developed and put in place first, before the new or "reformed" health care systems and services are introduced and eventually gradually extended nationwide. Specifically, the bottom-up implementation approach delivers on the following main steps:

- a) develop and initiate the proposed Ghana HealthNet network;
- **b)** decide on the prerequisites, e.g. a Patient Numbering scheme, codes for locations and professions;
- c) competitively select the most suitable Hospital MIS as technically argued and specified in chapter (4) and Annex IV.
- d) Contract, and ascertain with GT and the contractor that all the 12 pilot sites (2 Teaching hospitals, 5 district/general hospitals and 5 health centres) connect to Ghana HealthNet;
- e) competitively select the TeleMedicine peripheral facilities and ascertain their 12 installations and inter-connections via Ghana HealthNet;
- f) acquire and introduce the necessary Digital Security measures;
- g) install and test the core functions of NHC/MIS in the 12 pilot sites;
- **h)** adapt the methods of work of the various levels of the health care services, and related reporting requirements, to the new eHealth support;
- i) evaluate above and extend these geographically and functionally.

Thus, the table below brings together the <u>main</u> recommendations made throughout this Report, and organises them in Work Plan such that these could be efficiently executed and managed. It is **not implied** here that the steps included in the Work Plan below are all the steps necessary; indeed, many other likely steps and provisions are not included and would have to be ascertained locally. By way of a "legend", in the table below,

• the "work" involved is expressed in main steps numbered I, II, III, etc... and sub-steps numbered 1, 2, 3, etc....;

- a distinction is made between "Management" and "Senior Management".
 "Senior Management" is meant to refer to the Minister of Health, Minister of Communications, the Under Secretaries and the Deputy Under Secretaries of both ministries, and the Director General of Ghana Health Services. And "Management" are the Directors and Heads of Departments, Medical Care or support services, including those managing hospitals and health centres; and
- cross-reference to other parts of this report is given within <---> brackets.

	Action by	I – Preparatory Decisions and Actions	
1.	Management	Share copies of this report, and the July 2004 report, with all key MoH, MoC and GHS staff, and the management staff of all hospitals and health centres, and all who contributed to this study <i><annex i=""></annex></i> , for information and review.	
2.	Senior Management	Announce which recommendations in this Report are to be fully implemented as priority and within the next 2-5 years.	
3.	Senior Management	Designate the "pilot" hospitals and health centres for the initial networking and introduction of the new systems and services.	
4.	Senior Management of MoH & MoF	Ascertain the necessary Budgetary provision <para 10.1="">.</para>	
5.	Senior Management	 Start the recruitment of four senior additional IT professionals, and designate a Responsible Officer for of each of: Ghana HealthNet and LANs in hospitals & centres; Pilot Hospital & Centres MIS's including the NHDD; Establishing the National TeleMedicine Network; Digital Security. 	
6.	Senior Management	 Request the responsible National Standards for specific codes for the following <i><para 7.2=""></para></i>: Locations, e.g. Hospitals, health centres, Laboratories, ; Professional Groups (physicians, nurses, technicians,); The Latin spelling of popular Ghanaian names and titles. 	
7.	Senior Management	 Designate relevant tasks and ascertain the following is done: National consensus for a Patient Numbering Scheme List of all current and approved Data Standards in Ghana List of current or new Legislation needed to cover eHealth 	
8.	Senior Management	Issue the relevant Request for Proposals (invitations to bid).	
9.	Technical Task Forces and Senior Management	 Evaluate offers, choose successful bidder for each of these work areas, noting that a bidder may win more than one area: Ghana HealthNet and LANs in hospitals & centres; Pilot Hospital & Centres MIS's including the NHDD; Establishing the National TeleMedicine Network; Digital Security. 	
10.	Senior Management	Negotiate Contracts with successful bidder(s), including the eventual post-Guarantee Maintenance contracts. Sign an installation contract that clearly cites the key Milestones, schedules and relevant penalty clauses (e.g. for delays).	

11.	Contractor and Management	After elapse of Guarantee period(s), sign the Maintenance contract.	
12.	Management	Announce a future date for, and start the Organisation of, the 1 st Ghana National Conference on eHealth <i><para 9.3<="" i="">></para></i>	
	Action by	II – Ghana HealthNet	
	,	<pre><chapter 6="" and="" annex="" iii=""></chapter></pre>	
1.	Management	Set up a "Ghana HealthNet Task Force" with the designated Responsible Officer of MoH/GHS IT Team as Secretary.	
2.	Contractor and Task Force	Ascertain that all the users PCs are installed and tested in the 12 pilot hospitals and health centres.	
3.	Contractor	Install a Local Area Network (LAN) covering the priority locations in each of the 12 pilot hospitals and health centres.	
4.	Contractor	Ascertain that Ghana HealthNet links reach the target end users in the 12 pilot hospitals and health centres.	
5.	Contractor	Connect the Look-Up information services, e.g. Epidemiology and Health Statistics; policy documents; reports; etc, and ascertain they readily and routinely accessed.	
6.	Contractor	Users Training, "Users Manuals" and the recommended set-up and operation of "Users Help & Support" desk.	
7.	Contractor, Task Force and Management	Acceptance Testing, together with system documentation.	
8.	Contractor and Senior	Launch the operation of Ghana HealthNet.	
	Management		
	Management		
	Management Action by	III – National Health Care MIS and a National Health Data Dictionary <chapters 3.10.2="" 4,="" and="" annexes="" iv="" para="" v=""></chapters>	
1.	Management Action by Management	III – National Health Care MIS and a National Health Data Dictionary <chapters 3.10.2="" 4,="" and="" annexes="" iv="" para="" v=""> Establish a "NHC/MIS Steering Committee" to coordinate the implementation, and designate a specific member of the MoH or GHS IT Team as the Responsible Officer.</chapters>	
1 . 2 .	Management Action by Management Contractor and Task Force	III– National Health Care MIS and a National Health Data Dictionary <chapters 3.10.2="" 4,="" and="" annexes="" iv="" para="" v="">Establish a "NHC/MIS Steering Committee" to coordinate the implementation, and designate a specific member of the MoH or GHS IT Team as the Responsible Officer.Ascertain that all sites are ready for the start of installation of Hospital Management Information System (HMIS) software, and related Health Centre MIS (HCMIS) software, in the 12 pilot sites <chapter 4="" and="" annex="" iv=""></chapter></chapters>	
1. 2. 3.	Management Action by Management Contractor and Task Force Contractor	III– National Health Care MIS and a National Health Data Dictionary <chapters 3.10.2="" 4,="" and="" annexes="" iv="" para="" v="">Establish a "NHC/MIS Steering Committee" to coordinate the implementation, and designate a specific member of the MoH or GHS IT Team as the Responsible Officer.Ascertain that all sites are ready for the start of installation of Hospital Management Information System (HMIS) software, and related Health Centre MIS (HCMIS) software, in the 12 pilot sites <chapter 4="" and="" annex="" iv="">Install and test the six core functions of the chosen HMIS in the pilot 2 Teaching Hospitals and 5 general/district hospitals, and the Health Centre functions in the pilot 5 centres <para 4.2="">.</para></chapter></chapters>	
1. 2. 3.	Management Action by Management Contractor and Task Force Contractor Contractor	III– National Health Care MIS and a National Health Data Dictionary <chapters 3.10.2="" 4,="" and="" annexes="" iv="" para="" v="">Establish a "NHC/MIS Steering Committee" to coordinate the implementation, and designate a specific member of the MoH or GHS IT Team as the Responsible Officer.Ascertain that all sites are ready for the start of installation of Hospital Management Information System (HMIS) software, and related Health Centre MIS (HCMIS) software, in the 12 pilot sites <chapter 4="" and="" annex="" iv="">Install and test the six core functions of the chosen HMIS in the pilot 2 Teaching Hospitals and 5 general/district hospitals, and the Health Centre functions in the pilot 5 centres <pre>para 4.2>Gradually build up the National Health Data Dictionary, as used by the NHC/MIS and augmented by and for other collections of data, codes and coding schemes <pre>para 3.10.2 and Annex V></pre></pre></chapter></chapters>	
1. 2. 3. 4.	Management Action by Management Management Contractor and Task Force Contractor Contractor Contractor Contractor Contractor	III– National Health Care MIS and a National Health Data Dictionary <chapters 3.10.2="" 4,="" and="" annexes="" iv="" para="" v="">Establish a "NHC/MIS Steering Committee" to coordinate the implementation, and designate a specific member of the MoH or GHS IT Team as the Responsible Officer.Ascertain that all sites are ready for the start of installation of Hospital Management Information System (HMIS) software, and related Health Centre MIS (HCMIS) software, in the 12 pilot sites <chapter 4="" and="" annex="" iv="">Install and test the six core functions of the chosen HMIS in the pilot 2 Teaching Hospitals and 5 general/district hospitals, and the Health Centre functions in the pilot 5 centres <para 4.2="">.Gradually build up the National Health Data Dictionary, as used by the NHC/MIS and augmented by and for other collections of data, codes and coding schemes <para 3.10.2="" and="" annex="" v="">.Document, in user-friendly content and format, the necessary changes in the procedures related to all the newly installed tools, e.g. Patient Registration; daily/monthly reporting; accounting; etc</para></para></chapter></chapters>	
1. 2. 3. 4. 5. 6.	Management Action by Management Management Contractor and Task Force Contractor Contractor Contractor Contractor and Management	III – National Health Care MIS and a National Health Data Dictionary <chapters 3.10.2="" 4,="" and="" annexes="" iv="" para="" v="">Establish a "NHC/MIS Steering Committee" to coordinate the implementation, and designate a specific member of the MoH or GHS IT Team as the Responsible Officer.Ascertain that all sites are ready for the start of installation of Hospital Management Information System (HMIS) software, and related Health Centre MIS (HCMIS) software, in the 12 pilot sites <chapter 4="" and="" annex="" iv="">Install and test the six core functions of the chosen HMIS in the pilot 2 Teaching Hospitals and 5 general/district hospitals, and the Health Centre functions in the pilot 5 centres <para 4.2="">.Gradually build up the National Health Data Dictionary, as used by the NHC/MIS and augmented by and for other collections of data, codes and coding schemes <para 3.10.2="" and="" annex="" v="">.Document, in user-friendly content and format, the necessary changes in the procedures related to all the newly installed tools, e.g. Patient Registration; daily/monthly reporting; accounting; etcAcceptance Testing for both, the NHC/MIS and NHDD.</para></para></br></br></chapter></chapters>	

8.	Contractor and Senior Management	Launch the operation of the NHC/MIS.	
	Action by	IV – Digital Security <chapter 8="" and="" annex="" vii=""></chapter>	
1.	Management	Establish a "Digital Security Task Force" to coordinate the implementation and designate a specific member of the MoH or GHS IT Team as the Responsible Officer.	
2.	Contractor	Install the Certification Authority, in the physically secure site agreed for this purpose, for the issuance of Digital Certificates	
3.	Task Force and Management	Prepare a full list of the authorised users, and their access levels, of Ghana HealthNet and all its systems and services	
4.	Task Force and Contractor	Authenticate each user; then issue relevant Digital Certificate on the physical medium (token) included in the successful bid.	
5.	Contractor	Users Training, "Users Manuals" and the recommended set-up and procedures for "Users Help & Support" desk.	
6.	Contractor and Management	Acceptance Testing of facilities installed	
7.	Contractor and Management	Launch the start of the operation of Digital Security.	
8.	Task Force and Contractor	Monitor, and ascertain that "logs" are automatically and properly kept by the system	
	Action by	V – Establish the National TeleMedicine Network <chapter 5="" and="" annex="" vi=""></chapter>	
1.	Senior Management	Establish a "TeleMedicine Task Force" to coordinate the implementation, and designate a specific member of the MoH or GHS IT Team as the Responsible Officer.	
2.	Task Force	Ascertain that the equipment installation sites are ready to received the TeleMedicine workstations and that the links to Ghana HealthNet are properly functional, in all the selected 12 sites.	
3.	Contractor	Install the TeleMedicine workstations	
4.	Contractor, Task Force and Management	Ascertain that all the necessary TeleMedicine protocols are fully documented, understood & accepted by the pilot users concerned.	
5.		Acceptance Testing	
6.	Contractor	Users Training, "Users Manuals" and the recommended set-up and procedures for "Users Help & Support" desk.	
7.	Contractor and Senior Management	Launch the operation of the expanded TeleMedicine Network	

Annex I - Terms of Reference of the Expert Consultant

- 1) To meet with representatives of a cross-section of health care users in the Health Care Institutions (hospitals, health centres, laboratories, medical schools, Ministry, District offices etc.);
- 2) To assist these institutions in articulating their requirements for the proposed ICT services;
- 3) To prepare a Summary Report of the stated Users Requirements and to vet it with the MOH and Ministry of Communication (MOC) authorities;
- 4) Based on the "Agreed/Approved" Users Requirements articulated, propose at lease two possible solutions and prepare a related
 - Workplan;
 - Bill of Qualities; and
 - Budgetary Estimate for:
 - Human Resources;
 - Financing; and
 - Facilities.
- 5) To develop/convert the "Agreed/Approved" Users Requirements into "Technical Specifications" that could be used to invite competitive bidding for the supply, installation, testing, training and commissioning of the ICT network and services;
- 6) To prepare and submit to the ITU a draft report in electronic format;
- 7) Prepare a mission report and submit to the ITU.

Annex II - People Met & Institutions Visited

	Name	Position	Institution
1.	Hon. Major Courage Quarshiga (Rtd.)	Minister	МоН
2.	Dr S. A. Akor	Executive Secretary	NHIC
3.	Patrick Nomo	Financial Controller	МоН
4.	Dr Eddie Addai	Ag Director	PPME, MoH
5.	Dr Kofi Ahmed	СМО	MoH
6.	Isaac Adams	Ag Director	RSIMD, MoH
7.	Sam Bosomprah	Statistician	PPME,MoH
8.	Kinna Likimani	ICT Consultant	MoH
9.	Sam Quashie	Systems Administrator	МоН
10.	Gray-Ramond Gapko	BPEMS - Support	МоН
11.	Dr C Ntim– Amponsah	Lecturer/Ophthalmologist	KBTH
12.	Emmanuel Kotey	STO (information)	KBTH
13.	Benjamin Abrakwah	NHIS Coordinator	KBTH
14.	P. E. Karikari	Medical Director	KATH
15.	Carl Wemegah	Computer Technologist	KATH
16.	Mensah Abrampah	Accountant	KATH
17.	Dr Ken Sagoe	Director	HRD, GHS
18.	Dr Frank Nyanator	Director	PPME, GHS
19.	Dr Cynthia	Deputy Director	ICD, GHS
	Barnerman		
20.	Dan Osei	Head, Planning & Budget	PPME, GHS
21.	Daniel Darko	Head	CHIM/PPME, GHS
22.	Prince Boni	Systems Analyst	HRD, GHS
23.	Kofi Benning	Assistant Director (ICT)	Min. of Communications
24.	Kwaku Nsiah	Technical Advisor	Min. of Communications
25.	D. B. Addo	Librarian	College of Physicians and
			Surgeons
26.	Mr Jarle Rekve	Chief Technical Officer	Ghana Telecom
27.	Mr Truis Andresen	Chief Officer, Fixed	Ghana Telecom
		Network Services	
28.	Mr Emmanuel Dziko	General Manager, Strategy & Business Dev.	Ghana Telecom

Annex III - Requirements & Specifications: Ghana HealthNet

(reference chapter 6 of this report)

The supplier is required to develop, install and initiate operations of:

- a Ghana HealthNet that links the varied and geographically spread organisational units of the health sector, and their peripheral and common equipment, into a cohesive whole;
- a central Ghana HealthNet Operations Centre; and
- all the necessary procedures, protocols and standards that enable the secure flow of information and transactions and the sharing of common resources and services between all those linked and authorised to use Ghana HealthNet.

1) Computer Networks Infra-Structure

- 1.1 The Ghana HealthNet infra-structure is initially required to connect 12 selected pilot sites (the 2 teaching hospitals, 5 district/general hospitals and 5 health centres). However, the supplier must provide a full description of the architecture of a nation-wide Ghana HealthNet that is scalable, secure and centrally manageable.
- 1.2 The supplier must provide a listing of the proposed technological components of the proposed Ghana HealthNet, such as end-users equipment, routers, load balancers, cloned front-end Web servers, multilayer switches, firewalls, infrastructure servers, communication tools and back-end database and management systems and their hosts.
- 1.3 Ghana HealthNet should enable a remote user to rapidly restore a connection with a recovery aid.

2) Application/Database Servers

The supplier must fully specify the recommended central processing units for each of the 12 pilot sites and for a central Ghana HealthNet Operations Centre.

- 2.1 It is the responsibility of the supplier to ensure that the equipment has sufficient capacity and processing power to support the workload at the listed hospitals and health centres as evidenced by the utilisation statistics. The supplier must provide the parameters on which the responses were based.
- 2.2 The supplier must agree to their equipment being connected to other manufacturers' equipment and to provide the technical specification for such interfaces and any other information which may be required to allow such connection and to ensure its efficiency.
- 2.3 The hardware must be designed and configured as a fault tolerant system with no single point of failure.
- 2.4 All hard disk units must be hot swappable and use RAID technology.

- 2.5 The supplier must provide a detailed description of the proposed system's operating system, including user facilities to control the system.
- 2.6 The supplier must describe the central processor or processors offered, including: its internal technology, its performance ratings; available and proposed maximum memory size; input/output bandwidth; details of the proposed and maximum terminal and other peripherals connectivity; the minimum number of concurrent users and the capability for future expansion; the limits to the disk capacity and/or number of disk drives that can be attached.
- 2.7 The supplier must describe how the system in general would be upgraded, and provide cost schedules to accommodate more peripherals.
- 2.8 The proposed solution must provide an automated backup facility without any downtime impact on the availability of the applications or the database.

3) Data Repository Systems

- 3.1 It is required to facilitate, host and support national health data repository systems. An example a such a repository is that which hosts Electronic Health Records. A description of how such repositories are supported over Ghana HealthNet must be provided.
- 3.2 These repositories are to be partly fed from (the MIS's in) the 12 pilot sites. However, The supplier is required to confirm that these are scalable upwards to gradually cover all Ghana health care institutions. The supplier must cite the tools, and related protocols, for downloading and uploading data onto repositories.
- 3.3 The supplier must state the rules that may be selectively applied to validate the data before it is definitively added to the repository(ies), including the security measures.

4) Business Continuity and Disaster Recovery System

A *Disaster Recovery System* is essential to ensure the continuity of the service in the event of a major disaster. *Disaster Avoidance* is the means to anticipate events that can adversely effect system operation, and to act if these occur. Events that can disrupt services range from an Internet connection problem to minor failures in components that cannot be readily replaced, or more complex software problems. A *Disaster Recovery Plan* are the pre-set steps, and related preparedness, to recover from unavoidable disasters and outages.

- 4.1 The supplier must propose a Disaster Recovery System(s) and fully describe it/these.
- 4.2 A Disaster Avoidance Plan must be proposed and based on the performance and availability requirements for the NHC/MIS and applications such the National Patient Data Base and Electronic Health Records.
- 4.3 The Disaster Avoidance Plan should include a proposal for geographical redundancy and remote storage of backup facilities.
- 4.4 The Operations Centre architecture should provide resilience with no single point of

failure. It is still essential, however, to plan for adequate backup so that data and systems configuration can be restored in the event of a catastrophic failure.

4.5 Disaster Recovery should cover all systems including: hard disk subsystem failure; power failure; operating system failure; systems and application software failure; accidental or malicious deletion or modification; a destructive virus; natural disasters; loss, theft or sabotage; and cover the data warehouse & database; servers; network devices; cabling infra-structure; security devices; transmission lines; etc...

5) Cabling of Hospitals and Health Centres

- 5.1 The supplier should investigate the current infra-structure of the 12 pilot hospitals and health centres, and include in their bids these **two options**. First option, the supply and installation throughout each of the entire 12 site; and Second option, the supply and installation of the network infra-structure in each of the 12 sites necessary, initially, for the target users only (that is those involved in the six core functions that will be given initial priority, as specified in para 4.2, and Annex IV of this Report), including:
 - Structured Cabling,
 - Electric Power Supply.

6) Ghana HealthNet Management

A scalable, reliable, secure, and manageable Ghana HealthNet Operations Centre is required to be equipped and charged with the duties of the day-to-day management of Ghana HealthNet and its related services.

- 6.1 The supplier is required to propose the management system, procedures and other tools they would equip and enable such an Operations Centre.
- 6.2 The Management System facilities should include the means to carry out the necessary performance measurements, monitoring and alerts, scale of operations, availability and security. The supplier should provide a full description of the proposed system.
- 6.3 The services over Ghana HealthNet need to be provided without interruption, in a secure and controlled manner. These services must be consistently available and have the capacity <u>inter alia</u> to grow as the requirements increase. These services would also allow Ghana HealthNet to quickly, efficiently monitor applications and extract necessary information for long-term business needs. The supplier must fully describe its solution.

Annex IV - Requirements & Specifications: NHC/MIS

(reference chapter 4 of this report)

The supplier is invited to bid for a Hospital Management Information System (HMIS) software: its supply, installation, customisation, testing, users training and start of operation. The system sought is such that it can be scaled down to run in small district and general hospitals and in health centres and clinics.

Initially, a **Pilot** comprising of the 2 Teaching Hospitals, 5 general or district hospitals and 5 health centres, will be designated by the MoH and GHS from amongst those that are covered by and within the reach of the services of the Ghana Telecom Network backbone. Moreover, initially only these <u>six</u> core functions of the successful HMIS will be installed; the rest of the functions/modules will be covered in a near future phase of implementation:

- Admissions, Discharges and Transfers; that is patient registration with the related Master Patient Index;
- Electronic Patient Records (Minimum Data Set for ...)
- Order Entry;
- Laboratory;
- Pharmacy; and
- Patient Billing.

Section (1) of this Annex covers the HMIS software and sets out essential general requirements thereon. Section (2) covers the likely hardware procurement requirement, that is the Servers and users PCs and Printers. Sections (3) and (4) set the main considerations and technical features that a proposed HMIS must minimally satisfy. Finally, section (5) summarises the principle functionalities that the required HMIS must provide which goes beyond the six core functions covered in this initial phase.

1) The Hospital MIS (HMIS) Software

The supplier for the software to satisfy the hospital and health centre Management Information System requirements must:

- (a) present the overall design of the proposed solution mapped over the planned nation-wide health Intranet (or Ghana HealthNet), descrived in Annex III of this Report, and show the placement of Servers and examples of users' peripherals;
- (b) give the full technical specifications of the proposed software including the computing and networking hardware and system software required to support the HMIS software at both the users and the servers levels;
- (c) show how their product(s) meets the requirements outlined in sections (3), (4) and (5) of this Annex;
- (d) highlight any features that are more than or short of the requirements outlined in this annex;
- (e) give a clear cost quotation for every item required for the one-time installation and initiation of operations, and for the ongoing costs thereafter;

- (f) spell out clearly the users training included in their offer and confirming that it is what is required for the HMIS operation;
- (g) give a workplan, with minimum and maximum duration, for the major steps in the supply, installation, customisation, testing, training & initiation of operations; and
- (h) list out any other conditions upon which their offer(s) stand; and
- (i) offers are required to include quotation(s) for differing options, including that of a "national licence for an unrestricted number of sites,workstations and users" within the Ghana health sector.

2) Bidding for the related Hardware & System Software

Bids may also be made for the hardware, system software (e.g. operating system) and Data Base Management System (DBMS) to run and support the proposed HMIS.

2.1 The initial phase of the implementation of the HMIS is *estimated* to require, apart from the needs at the central/servers level, the following:

160 PC units (2 x 30, plus 5 x 15, plus 5 x 5);
80 Printer (2 x 15, plus 5 x 8, plus 5 x 2); and
19 Servers (2 x 2, plus 5 x 2, plus 5 x 1).

2.2 The supplier is required to asses and confirm or modify the above numbers for all the 12 pilot sites, as well as rationalise and stipulate the necessary minimum configuration for the users workstations and servers and make its offers accordingly.

3) Major Considerations

A key requirement is that the HMIS should be modular, scalable and completely developed. The introduction of the HMIS will not be the conventional installation and testing in one hospital, evaluate it and then a gradually implement in other hospitals.

The strategy adopted calls for the *six core HMIS functions* to be installed in ALL the pilot sites (the 2 Teaching hospitals, 5 general or district hospitals and 5 health centres) within a period of a maximum of 2-months from the start of implementation, including the users training to the staff concerned.

Simultaneously with the installation of the six core functions cited above, a pilot National Patient Data Base is to be created and linked, via Ghana HealthNet, to all the 12 pilot hospitals and health centres to both contribute to and use the Data Base.

The HMIS must have the main characteristics briefly discussed in the following paragraphs (3.1) to (3.5).

3.1 Modularity and Scalability: The features and functionalities required in the HMIS

system vary from hospital to hospital (e.g. general and specialist hospitals), and certainly vary from one Health Centre to another, depending on its size and scope of service. Hence, the HMIS should be modular, scalable and flexible so that only relevant functions are implemented in a hospital or health centre.

- 3.2 **Hardware Independence:** The HMIS Software must be totally independent of the hardware it is run on.
- 3.3 **Centralised Data Bases:** The HMIS must efficiently support centralised data bases of a wide variety of data including multi-media. This should enable data to be stored where necessary but made accessible to any other authorised user regardless of location.
- 3.4 **Security and Confidentiality:** The data and transactions of the HMIS, and the HMIS itself, must be thoroughly digitally secure. This requirement is so important and vital that it is covered separately in Annex VII of this document.
- 3.5 **End User Interface:** The HMIS should provide a high level of user-friendliness. In particular, it should have automated & flexible data entry interfaces, a facility for adhoc queries and easy-to-use pre-set reports and the ability to create new reports without having to refer back to the system vendor.

4) GENERAL SOFTWARE REQUIREMENTS

The HMIS should be characterised by the features cited below.

- 4.1 **Comprehensive:** The HMIS should be proven to be comprehensive, offering the full range of Clinical, Financial and Administrative functions and applications.
- 4.2 **Modular Design:** The HMIS should be modular with the modules corresponding to specific functional requirements.
- 4.3 **Ad-hoc Queries:** The HMIS should have extensive facilities to manipulate data in an easy and efficient manner and the means to setup and run user definable queries.
- 4.4 **Phased Implementation:** The HMIS must permit phased implementation, both in one health care institution or across several institutions.
- 4.5 **Centralised Databases:** The HMIS should enable any of its features to be organized around central databases, e.g. a proposed National Patient Data Base. The HMIS must support different levels of access enabling restricted views of the centralised databases(s).
- 4.6 **Help Features:** The HMIS should have a "contextual on-line help" facility. By clicking an icon or a special function, the system should provide brief descriptions of the function or entry being performed and tips on how to proceed. The system must also have an escape-like function.
- 4.7 **Look-up Facility:** The HMIS must have the means to facilitate data entry by the optional display of the list of codes and descriptions and selection from the list.

- 4.8 **Training Package:** The HMIS must include a package which exactly mimics the operational system. Such a training package should include a training database which can be (optionally) used in training users without any effect on the operational system. Both the training and operational databases could be in operation at the same time.
- 4.9 **Test Database:** The HMIS should include a test database to test new applications or changes to the system. Both the test and live databases could be in operation at the same time.
- 4.10 **Multi-User Support:** The HMIS should provide simultaneous record retrieval access to any number of users over the health sector Intranet, that is Ghana HealthNet.
- 4.11 **Data Recovery:** The HMIS must be able to set up a duplicate data base and update it throughout the normal operations of the system. In case of a failure of any of the two databases, the system must be able to continue to operate uninterrupted. Data apart, the HMIS should also recognise duplicates of any of its applications specified by the user as critical. The HMIS should enable recovery of the failed data files to their current status.
- 4.12 **Transaction Logging and Recovery:** The HMIS should have the facility to tag all or selected transactions with (as a minimum) user flags, workstation number and date and time, and to maintain transaction logs. In case of a disaster rendering the operational and duplicate databases unusable, the HMIS should be able to restore a database to its original status by using the last backup and applying the contents of the transaction log files.
- 4.13 **Users Logging:** The HMIS usage log should contain the time, date, workstation number, user identification with the application(s) accessed & operations performed.
- 4.14 **Standards:** The HMIS should be fully compliant with the "open systems" standards, and should
 - fully operate on an IP network;
 - have been developed using modern-day applications software development tools, a relational database management system and a Data Dictionary;
 - have interfaces to popular programming languages; and
 - supports multi-media interface.
- 4.15 **Data Capture:** The HMIS should support automated data capture, wherever feasible, including interfaces to bar-code readers, on-line analyzers, optical character readers and image digitizers/scanners, audio-video and biometric devices, ...
- 4.16 **Interfaces to Other Software Products:** The HMIS should interface with the usual office software packages such as eMail, Word Processing, Spreadsheet and Statistical analysis. This feature should include easy-to-use interfaces to files maintained by the HMIS applications, as well as the ease to down-load the required data from the central database to the relevant packages.
- 4.17 **Menu Driven:** The HMIS should be menu driven and has flexible, easy to use menu and icon generator.

- 4.18 **Error and Warning Messages:** The HMIS should provide the System Administrator with the tools to customize error and warning messages. Error and warning messages, where feasible, must be reported interactively to enable the user to complete the services effectively and efficiently.
- 4.19 **Documentation:** The HMIS should include an eVersion and a hard copy of the system and user documentation for each functionality and for the HMIS as a whole.

5) FUNCTIONAL REQUIREMENTS

As pointed out in the introductory paras of this Annex, initially only six core functions of the successful HMIS will be acquired and installed. But, the successful HMIS must be proven to exist and to be complete. "Complete" means that the HMIS supports all the functions listed in the following paragraphs. "Proven" means that the system, in its entirety, is demonstrably operational in a real health care institution preferrably in an industrially developing country. That is, a supplier's offer must <u>not</u> include any 'applications development' or 'modifications' costs - other than the inevitable "customisation".

5.1 Patient Registration & Master Patient Index

5.1.1 Patient Identification:

"Patient registration" and a related "Master Patient Index (MPI)" are the main repositories of core information on patients. All patient related systems draw on the MPI information.

The HMIS should be able to identify a new patient based on the Ghana Civil Identification Number, and one or more other identifies. The HMIS should issue a unique patient identification number to each patient and permit the use of the same number in all hospitals and health centres in Ghana. The HMIS must permit registration of new born babies by defaulting the information from the mother's record.

The HMIS should issue an identification card with alternative automatic identification facilities (e.g. magnetic strip, bar-code cards, etc...). It should also be capable of printing patient labels with bar code identification for use in the wards and other clinical support areas.

The system should enable the distinction between and non- Ghanaian patients and cater for differing requisites such as "Patient Billing".

5.1.2 Patient Search:

The HMIS should provide, in addition to the normal search facilities, a phonetic search on names. The phonetic algorithm should cater for problems due to non-standard English spellings of Ghanaian names.

5.1.3 Multiple Patient Identification Numbers:

The HMIS must facilitate detection of multiple identification numbers for any patient by providing query facilities to the Master Patient Index on various user definable criteria. For any cases when a patient is found to have more than one Identification Number, the HMIS must enable the merging of the visit histories of such identification numbers to the one chosen.

5.2 Inpatient (includes: Admissions, Discharges and Transfers)

The HMIS must fully support the processing of Admissions, Discharges and Transfers of inpatients. The HMIS should report on the current and expected open beds, and facilitate the management of waiting lists for elective and urgent patients.

The HMIS should permit admissions from several locations including the admission of emergency patients. Emergency admissions, with incomplete data, should be permitted. However, all such admissions should be highlighted to facilitate the eventual updating of incomplete records.

The HMIS should generate, as required, patients' admission documents including labels and wrist bands, and should provide the tools to specify the relevant preferred format and contents.

The HMIS should record newborns and assist in maintaining the *Birth Register*.

The HMIS should record inter or intra ward patient transfer requests. The actual transfers should also be appropriately recorded.

The HMIS should enable Patient Discharges to be entered either at the nursing stations or at the Medical Records office. Deaths is to be processed as discharges but should be recorded separately to facilitate maintenance of *Death Register*. The Death Register should also include cases in outpatient clinics and those brought in dead to the hospital or health centre.

The HMIS system should produce daily bed census statements along with other statistical reports like occupancy rates, average length of stay, etc. The format and content of these reports should be user-definable.

For all paying and to-be-billed patients (e.g. covered by a Health Insurance scheme), the HMIS should permit maintenance of the payment and deposit status at the time of admission. The HMIS administrative and clinical functions should interface with the Patient Billing function to transfer 'Inpatient Stay' details to enable accurate billing.

5.3 Outpatients

The HMIS should record the outpatient visits to various specialist and general clinics with recognition of first visits and re-visits, and the production of visit sheets. The HMIS should permit recording of actual/scheduled information along with no-shows to ensure production of accurate monthly utilization reports.

5.4 Appointment Scheduling

The HMIS must permit booking of appointments to specified consultant clinics and other services (e.g. vaccination, periodic maternal check-ups, ...). Different services within the hospital have different master schedules and the HMIS should be able to keep track of the different scheduling characteristics of each service. The appointments may be given either for a specified time or for a time-bracket and should enable a conscious overbooking and the handling of emergencies. The HMIS should detect conflicting appointments and to track no shows, and to enable appointments rescheduling and cancellation.

The HMIS should allow requests for appointments to be initiated at remote sites, particularly at the Health Centre level, and should issue the corresponding confirmation notification or otherwise.

5.5 Medical Records

5.5.1 The record:

The HMIS should provide the full facilities to maintain Patients Records, for all inpatients and outpatients, and to enable the following main data categories to be maintained in the appropriate format, including Multi-Media:

- Demographic data
- General Medical Information
- Treatment History (by episode and/or visit reference)
- Diagnosis
- Discharge Summary.

When the patient is admitted or when he/she is being treated in outpatient specialist clinics, a detailed current record should be maintained. Upon completion of treatment or discharge a summary record should be generated automatically by the HMIS, for verification by authorized medical record staff and for adding any missing information, to be recorded in consultation with the treating doctor. At the same time, the result of investigation of the various services should be consolidated.

The HMIS should, on completion of the summary or abstract of treatment details, have the tools to render the record non-modifiable. From then on, the HMIS should maintain that as part of the individual's medical history, that can be accessed only by authorized users.

The HMIS must enable the initial definition of a **core medical record**, according to the following **Minimum Data Set**:

- unique identifier;
- date and time of contact;
- where? (health centre, hospital, inpatient care, emergency, home visit);
- health problem (maximum of three per contact);
- type of care provided (medical intervention);
- medication provided (by class or specific type); and
- disposition.

5.5.2 Diagnostics & Procedure Codes:

The HMIS must provide easy to use data entry routines using standard codes for diagnosis and procedures. The HMIS should provide the flexibility to use more than one coding scheme if necessary.

5.5.3 Reporting

The HMIS must enable the generation of various disease-related and service-related statistical reports to support planning, budgeting and other managerial decisions.

5.5.4 Archiving:

The HMIS should enable the patients history to be archived according to set guidelines. And, the system should enable the easy restoration of such data, by those authorised to do so, and to process queries thereon.

5.6 Special Disease Registers

The HMIS should enable the creation and maintenance of special disease *registers* (e.g. Cancer, Diabetes, Tuberculosis, HIV, ...), with differing levels of access authorization.

5.7 Order Entry

The HMIS should enable the entry of all patient and non-patient related orders from any workstation in any location. The HMIS must cater for different types of orders such as:

- appointment requests for out-patient clinics,
- laboratory test requests,
- radiology orders,
- medication orders,
- request for patient notes,
- special diets,
- etc.

The system must have the means to validate each order for completeness and consistency, and to ensure its integrity and, as necessary, to generate a periodic audit trail of all orders generated including the source and destination department. The HMIS should include the means, for those authorized, to review the contents of an order and to authorize these. On authorization the HMIS should have an option to electronically pass the order to its intended recipient, or to print the order at the area and/or at the destination service area.

5.8 Results Reporting

A wide variety of tests are performed in hospitals and the HMIS should process the results of all different types of tests and examinations. The processed and verified results should be signalled to, or printed at, the service area or at the destination area. When "signalled" the destinee is able to access the result concerned. If a patient has been

transferred to a different unit since the test was ordered, the test results must be automatically signalled or printed at the current location of the patient. Test results of outpatients should be signalled to, or printed at, a location decided by the hospital.

The HMIS must allow printing of results in, or eSending these to more than one location. The HMIS must be able to flag results upon which immediate action must be taken. Cumulative reports containing test results over a set period of time must also be supported. Authorized users should be able to check the status of all orders & results for a given patient.

5.9 Laboratory

The HMIS should provide automation support for laboratory functions such as:

- Pathology,
- Cytology,
- Clinical Chemistry,
- Haematology, and
- Microbiology, including bacteriology, parasitology, virology and serology.

The supplier is required to indicate the data/information measured and maintained for each of the above functions.

5.9.1 Entry of Test Requests

The HMIS should provide for entry of test requests either at ward, outpatients, casualties or in the laboratory and should integrate with the Master Patient Index to retrieve other relevant data. Labels should be produced to assist with specimen procurement and identification and the system should flag hazardous specimens as "High Risk". The system should enable tests to be entered as codes for both individual tests or panels, and enable requests for multiple item tests or test groups for a patient.

5.9.2 Parameters

The HMIS should provide for extensive parameterisation of laboratory tests. The supplier must provide details of such parameterisation.

5.9.3 Work lists

The HMIS should provide for flexible work list formats for a single test or related tests. The HMIS should enable user-definable work lists (size, format and sequence), and must detect and enter all incomplete tests into the work list. Urgent requests must be highlighted. It should be possible to electronically transmit the work list data directly into the on-line analyzers.

5.9.4 Result Entry and Validation

The HMIS should enable the entry of results either directly from automated analyzers or manually by patient identifier, test code or work list. In the manual mode it should be possible to input results as numbers, coded comments or free text. At the time of result entry, access should be provided to view previous results. The system should validate results against reference and abnormal ranges and previous tests. The validation criteria for test results should be flexible and user definable.

5.9.5 Reporting

The HMIS should optionally generate reports as and when the tests are completed or in a batch mode. The HMIS should allow printing on pre-printed as well as blank sheets. Cumulative reporting facility on completion of treatment or at user defined intervals should be provided for. It should be organized by date/time in reverse chronological order. The availability of urgent results should be brought to the notice of the requesting location.

5.9.6 Quality Control

The HMIS must provide for quality control which should include calculation of means, standard deviation and coefficient of variation for each quality control sample. The quality control analysis data must be stored for user definable periods for display and analyzers. The system must support quality control by userdefinable techniques.

5.9.7 Archiving

The HMIS should archive completed requests according to set criteria. The length of time for which the finished reports are allowed to remain on the system are to be decided by the hospital or health centre, and could be based on multiple criteria. It should be easy to access the archived results.

5.10 Blood Transfusion Services

The HMIS should allow the various codes to be user definable, covering at least the blood group, genotypes, antibodies, anticoagulants, additives, blood products, fat codes and transfusion reaction codes. The HMIS should maintain donor information and history with a facility for screening for quality and quantity.

Blood stock operations should cover maintaining information at product/unit level and monitoring the status including expiry date. Other functions to be provided by the HMIS should include request for blood group, cross-matching and allocation and recording of blood transfusion or return to stock.

The HMIS should have the means to interface with other related services, notably the Blood Bank.

5.11 Radiology (and Nuclear Medicine)

The HMIS should support automation of the radiological and nuclear-medical services, including the scheduling of examinations for inpatients, casualties and outpatients, recording of requests, printing of labels for identification of X-ray films and result recording.

The HMIS should enable result entry to be either in the form of free text or modification to standard text blocks maintained by radiologists. Authorized and signed off results could, optionally, be displayed and printed in single or multiple copies either in the Radiology or Medical Imaging department or in the designated printer of the requesting units or in the Central Medical records section. Reprinting of results should be possible.

The system must keep track of all films produced at requisition/examination level and monitor borrowed films.

5.12 Operating Theatre

The HMIS should maintain a waiting list of operations for both inpatients and outpatients. The confirmed list of operations should be used for scheduling of operations taking into account the scheduled availability of surgeons, special equipment, anaesthetists and other staff.

The HMIS should provide user-modifiable pre-operation(s) checklist(s) which could also be used to enter orders for various services and automatically check the completion of patient preparation procedure taking into account results of all related investigations. The operation list produced for each operation should identify all facilities required including surgeon's preferences. Surgical reports should be entered in free text format.

The HMIS should have the facilities to enter operating theatre records (anaesthesia, procedure and recovery timings, attending surgeons, actual procedure done, diagnosis etc..) to generate a variety of statistical reports on the utilization of operating theatres.

5.13 Pharmacy

The HMIS must support the pharmacy functions in these ways: formulary, drug dispensing for inpatients and outpatients and interface to medical stock within the hospital and the Central Medical Stores. The HMIS should maintain a formulary (non-proprietary names) of drugs with supplier information. Selected formulary details should be available to authorised personnel, if necessary complimented by commercially available drug information.

The HMIS should provide for entry of prescriptions and medication orders at outpatient clinics or wards. Alternatively, the prescription can be entered by pharmacists in the pharmacy. On entry of a prescription for a particular patient the system should display other drugs currently taken by the patient if any, and should also check for allergies and sensitivities, possible drug interaction, contra-indications, over dosages, special instructions, etc.

Taking into account the route, dosage, forms and times of administration, drug labels should be printed for each patient's prescription. The system should have a controlled procedure for the authorization of all issued drugs and should maintain a separate *register* for controlled drugs and narcotics.

For inpatients, the HMIS should maintain patient medication profiles and prepare medication administration schedules with days, times and dosages. The system should support both the imprest and unit dose system of drug dispensation.

5.14 Accident & Emergency

The HMIS should allow the registration of accident and emergency patients even with minimum demographic data. Other information gathered should include accident type and location. Other features required are facilities to record the nature, duration and type of complaint, interventions made, outcome of the visit and statistical reports.

5.15 Clinical Services

The HMIS should also facilitate the maintenance of clinical sub-systems which should also integrate with the Master Patient Index to access patient demographic data. A complete patient record in a clinical sub-system should include the following:

- Basic demographic data
- Department treating the patient
- Referral Information
- Important dates (referral, assessments, treatments and follow up)
- Therapist and other staff assigned
- Type of treatment received
- Outcome.

The HMIS should enable the review of case histories either by patient or for a given type of service.

5.16 Nursing Care Planning

The HMIS should include procedures to guide a responsible nurse through the steps of patient assessment, to assign the patient classification from the adopted classification system. The system should convert the patient classification index into required nursery houses (by nurse type) and indicate the cumulative nursing care required. The system should compare the required and actual levels to generate differential reports.

5.17 Patient Billing

The HMIS should have an integrated billing function. It should provide flexibility in billing by relating charge items to billing actions.

Billing actions, rates for billing and billing groups must be user definable, and could be at service, visit or episode level. There should be a provision to bill at fixed intervals also.

The system should integrate with the inpatient function to transfer the room charges to the patient folio. It should integrate with all other functions so that service information can be passed on for billing purposes. Manual entry of charge items should also be enabled. The system should enable authorised individuals to modify a system generated invoice, and should also permit billing other institutions, e.g. a Health Insurance Scheme or employer.

5.18 Medical Stores

The HMIS should provide comprehensive facilities for managing each hospital's and health centre's inventory of drugs, medical, surgical and laboratory items, and for the appropriate interface (including transactional interface when needed) to a Management Information System of the Central Medical Stores.

The system must support user defined classification of items with provision for storing an item in multiple locations. There should be provision to record receipts, requisitions, issues, returns, transfers and adjustments. Multiple items in a voucher should be permitted. The system must be on-line to update the stock balance on confirmation of transaction. Such transactions must be costed on average cost basis.

The HMIS should control and monitor expiry dates and automatically select the earliest expiring batches and warning on soon-to-expire items and, on confirmation, to automatically adjust stock quantity for expired items. The system must generate physical stock verification lists with a facility for the generation of variance reports and automatic adjustments. The system should generate various consumption, movement costing and analysis reports.

5.19 General Stores

Here, the HMIS should provide all the facilities mentioned in para "5.18 Medical Stores" above, except for expiry date monitoring. The system must maintain stock movement history and purchase history for a user-specified duration. Using a predetermined re-order level, the system must generate requisitions with prioritized options.

5.20 Sterile Stores

The HMIS should maintain a master file containing all sterile items including, where appropriate, instruments, metalware, consumables and linen. Items are grouped into sets. The HMIS must maintain set information as well as monitor the issue/return, at the set and instrument levels, and record lost instruments.

5.21 Purchase Order Control

The HMIS should maintain contract information containing supplier, items, quantity, unit price, delivery period etc. Purchase requisitions are raised from the hospital or health centre stores. All authorized purchase requisitions should be automatically converted into requests for offers/tenders and/or local purchase orders. Alternatively, the local purchase orders can be manually prepared and then entered into the system. The HMIS should enable Purchase Orders to be monitored against delivery schedules.

The HMIS should allow entry of supplier invoices against purchase orders to monitor the status of the order. The system should also support direct purchases and purchases against quotations, and to monitor vendor performance and to compare price quotations. The system should be fully integrated with its "Stores" functions (paras 5.18 to 5.20 above).

5.22 Engineering Maintenance

The engineering maintenance comprises the following:

- Breakdown maintenance
- Preventive maintenance
- Inventory Control and Management
- Energy Management
- Vehicle Management.

The HMIS should maintain a list of all equipment in the hospital including electrical, mechanical, air-conditioning etc. The system should support the entry of all breakdown reports, either directly by users from their workstations or centrally at a designated location in the Engineering Department. Such input includes equipment code and/or description, type and details of fault, urgency, requesting department and person. The system should be capable of printing a work order request slip.

For allocation and assignment of work, the HMIS should maintain a table of employees with type of expertise. The system should print work sheets, the contents of which should be user definable. Completed work orders could be entered into the system to monitor the outstanding work.

The HMIS should generate preventive maintenance schedules at fixed intervals with a checklist of all work to be carried out and the type of expertise needed. The system should monitor all spares for equipment maintenance with the associated cost details. Other facilities required are to maintain supplier maintenance contracts and internal communication directory.

5.23 Dietary Services

The HMIS must provide the means to maintain a dietary profile for a patient containing all diet-related information required for the proper treatment of the patient. The information maintained in the dietary profile should include diet orders, temporary meal requirements, nourishments, food preferences and food allergies. The HMIS must also provide for stock control of kitchen items and for costing of meals.

5.24 Financial Accounting

The HMIS must permit flexible accounting including the interactive entry of the General Ledger transactions. It should be possible to define standard journal entries for recurring and allocation entries. It should be possible to define a journal voucher as reversing type so that a reversal entry is automatically passed in the following accounting period.

The system should permit unit accounting in addition to value accounting. The general ledger system should provide for full integration with other HMIS applications. The system should also provide flexible means for access to and extraction of information for financial auditing.

5.25 Personnel & Payroll

The HMIS should readily interface with the computerised systems of other government departments for both, down-loading personnel information and passing on payroll related data.

The HMIS should have the means to maintain profiles of all (e.g. medical and paramedical, support, administrative, ...) staff including their qualification, expertise and experience details. The payroll calculation process should use a table driven approach, whereby different types of fixed and variable allowances and deductions can be stored against each employee and grade. The system should be fully integrated with the General Ledger system.

The HMIS should also generate staffing rosters (e.g. for nurses) with indication of under-staffing and over-staffing, taking into account absences or inavailability. It should display and list rosters by department and/or ward.

5.26 Clinical Costing and Management Information

The HMIS should facilitate the *performance evaluation* of hospitals and health centres, so as to ensure the efficiency of health care services and the optimal use of resources. Such performance evaluation could be based on WHO or Ministry of Health "indicators" and a management accounting system to highlight, in tangible terms, the strong and weak points in different aspects of the health care services.

Thus, the HMIS relevant patient care and administrative functions should be integrated with the General Ledger system which should hold the budgetary details and an analysis of actual expenditure against budgetary figures.

The HMIS should also be capable of building a patient's "Episode Cost Profile" by accumulating cost transactions for the duration of treatment from various HMIS service functions. These transactions should contain details regarding the patient and the episode, the hospital department or Health Centre and the treating doctor and the nature of service. Using this information the system should arrive at the cumulative cost of a patient's episode and also determine the breakdown of total treatment cost by functional departments, by type of service and by treating doctors.

The HMIS should support user-definable diagnosis related grouping (such as but not necessarily DRG) to permit costing of resource usage. It should provide facilities for assignment of DRGs to episodes and to compare actual costs with established standard costs. The system should generate various management reports to help assess the performance of the hospital, a hospital unit or a Health Centre. Some examples of the reports envisaged are:

- Actual vs. Budget variance reports,
- Actual vs. Standard DRG costs,
- Cost reports by DRG, Doctor, Functional Department and Service, and
- Patient exception reports e.g. when the cost/length of stay is in variance with DRG units.

5.27 Medical Modules

The medical modules of the HMIS should assist in quality control of the specialized disciplines and in gathering data for case-mix management.

The HMIS should ensure that data is captured only once and at the originating point of care. The data once captured should be shared by all applications linked via Ghana HealthNet. The general features of the medical modules should be:

- Ease of use noting that data is to be entered mostly by health care staff.
- Data collection is a part of, or a direct by-product of, normal work.
- The system should facilitate incorporation of any appropriate coding schemes so that different medical modules may use different coding schemes; and all the coding schemes are then linked to the coding scheme used by the HMIS.

<u>Annex V - Requirements & Specifications: A National Health</u> <u>Data Dictionary</u> (reference para 3.10.2 of this report)

It is understood that some of the solutions to be offered response to meet other requirements cited in this report will include a Data Dictionary system to hold and maintain the definitions of data items and entities used within those solutions. For example, the data dictionary of the Data Base Management System (DBMS) of a proposed Hospital MIS specified in chapter 4 and Annex IV of this report. The interests of the Ghana health sector are served by the MoH and GHS aiming to have <u>one</u> National Health Data Dictionary (NHDD) for all the data items, entities, coding schemes and codes, etc... used in the health sector – both those used in computerised and non-computerised applications . In other words, the National eHealth Strategy should include an explicit requirement of a National Health Data Dictionary 'system' which would both, serve the conventional data dictionary purposes and be posted as a National look-up Information Service.

- 1) A The supplier is required to provide a clear description its conception of such a National Health Data Dictionary system, and how it proposes to have it developed and run.
- 2) General: The NHDD shall be kept on a server at the Operations Centre, and accessed via Ghana HealthNet. A brief description of this procedure is required.
- 3) Authorisations: Applications and users need to be authenticated for authorisation to access the NHDD: read only; read and edit.
- 4) Version Control: All coding schemes contained in the NHDD shall be version controlled. The NHDD should be easily updated in case of a new version of coding schemes released such as ICD-10. A description of a relevant "update wizard" is required.
- 5) "Terminology" Contents of the NHDD: This is the traditional content of a Data Dictionary and contains the 'definitions' of all data items and entities used in all the computer-based applications, as well as entries that could be of future importance but are currently manually used. Such definitions would include the literal name of an item/entity, its explanation, its abbreviation, the applications or modules using it, its value range, its validation rules, who is authorised to view it, who is authorised to update it, etc....
- 6) "Codes" Contents of the NHDD: The NHDD is also required to maintain a proper and usable description of all the Coding Schemes and corresponding Codes used throughout the health sector in Ghana whether in computerised applications or not.
- 7) Other Contents of the NHDD: The MoH intends to adopt the HL-7 Standard for expressing its message schema as a part of its Health Information Reference Model. Thus, the NHDD could usefully also contain such standard and shareable information and/or "metadata". If such the description of this standard may not fit into the proposed NHDD. The supplier is requested to propose how could such an eventually adopted HL-7 Reference Information Model may be stored and accessed over Ghana HealthNet.
- 8) The supplier is also required to provide the applications needed to manage the NHDD. Please indicate these and list their respective features.

Annex VI - Requirements & Specifications: National TeleMedicine Network (reference chapter 5 of this report)

The proposed TeleMedicine Network is to bridge the shortages of Experts and Specialists, and the lack of specialised diagnostic facilities in general and especially district hospitals, with support from the two University Teaching Hospitals / particularly for support with Diagnosis and proposed Treatment using these services:

- **TeleRadiology**, whereby radiological images prepared in any of the above cited four sites, are sent for expert readings by Specialist Radiologists;
- **TelePathology**, whereby microscopic images of pathological samples, prepared in any of the above cited four sites, are sent for expert readings by Pathologists; and
- **TeleUltrasound**, whereby ultrasound images or even films, prepared in any of the above cited four sites, are sent for expert readings by Specialists, starting first with maternal and foetus images examined by expert Obstetricians.
- **TeleEducation**, whereby lectures and training courses will be provided over the same communication links by Experts from either Teaching University Hospitals or abroad, and eventually for Continuous Professional Development for all health care professions, including Continuous Medical Education (CME) for physicians.

The TeleMedicine links will be initiated with a pilot in the same health care institutions that will pilot the NHC/MIS (see Annex IV of this Report), that is between the two Teaching University Hospitals and 10 other sites. Thus, the suppliers are requested to bid for the following:

- 1) the supply and installation of 12 TeleMedicine facilities, users training & start of operations.
- 2) Each facility will include one workstation for each of the following applications:
 - a) TeleRadiology (scanning & transmitting medical Images);
 - b) **TelePathology** (scanning & transmitting medical Images); and
 - c) **TeleUltrasound** (for Maternal and Foetus care).
- 3) The supplier is required to separate, where possible, the (PC) computer and its system software from the rest of the hardware and software that comprise the relevant TeleMedicine workstation. Where the PC is separable, the Bidder must quote for it separately and give its minimum hardware and software specifications.
- 4) The supplier must separately indicate the cost of installation and testing.
- 5) The supplier must indicate the cost of users training & trouble-shooting of the facilities.
- 6) The MoH also wishes to use the installed TeleMedicine facilities for TeleEducation and TeleTraining by expanding the one-to-one links onto one-to-many by the uses of Video Conferencing monitors and related interfaces. The supplier is therefore also requested to include in their Bids the relevant necessary additional facilities, their technical specifications and cost - assuming classes of between 15-20 participants.

Annex VII - Requirements & Specifications: Digital Security

(reference chapter 8 of this report)

The term 'Digital Security' is used to refer to all the methodological and technological measures and procedures employed to ensure the security, confidentiality and integrity of all data and transactions flowing or being processed in computer applications and networks. This includes authenticating the identity of the users at all levels, ascertaining the integrity of all transactions, and maintaining logs of and all operations at the individual, workstation and servers levels.

An effort is ongoing to establish a national Digital Certification Authority (CA), based on PKI (public key infrastructure) technology. This authority would then authorise other institutions to provide Registration Authority (RA) Services. For example, the MoH or GHS could then be merely required to authenticate and send lists of their authorised users, and the CA will issue each with their unique Digital Certificate. The Digital Certificates may be issued on media such as Smartcards and USB tokens.

The supplier is therefore required to ascertain that the 'security' aspects of their offers take into full consideration, and as necessary be based on, the above anticipated services.

1) GENERAL REQUIREMENTS

- 1.1 All the security needs should be implemented in all the selected pilot sites.
- 1.2 The Security measures should be readily expandable to all health care institutions.
- 1.3 All the transmission should be based on Virtual Private Network (VPN) and Public Key Infrastructure (PKI) technologies.
- 1.4 The software included in any Bidder's offer must be fully operable with the 'Digital Security' technologies as cited above.

2) SECURITY WITHIN GHANA HEALTHNET

Any and all Data and Transactions over Ghana HealthNet must be protected on several levels.

2.1 Security at the End-User level

- All individuals referred to within Ghana HealthNet, including applications such as NHC/MIS, will bear a unique reference number based on the national Numbering Scheme.
- Since the medical record belongs to the patient concerned, the latter's consent is required before availing access to any health care professionals, including the patient's doctor.
- Patients are entitled to access their medical records over the from internet, subject to the appropriate Digital Security measures.
- Should a patient decide that a health care professional should not access his/her medical record, then such a professional could communicate the results

of, for example, an examination into the Patient Record using a blank form.

2.2 Security of Data Centres

- Servers will be based in a secure environment and continuously guarded.
- Access to these servers must only be allowed to authorised personnel, who are normally the accredited Ghana HealthNet Operations Centre staff.
- Data on the servers must be encrypted.
- Only the Data Base Administrators are authorized access to the data bases and, even then, the level of authority is pre-determined. The supplier is requested to indicate how this is to be catered for.
- Operations Centre management tools should enable the authorised staff to, for example, check server operations, monitor status, analyze access, designate authorisation levels, etc... The supplier is required to list out all the relevant management tools built into their offers.

3) OTHER SECURITY MEASURES FOR SITES WITH LANS

- 3.1 Unauthorised access must be prevented to or from Ghana HealthNet by firewalls. It should provide load balancing, redundancy features and adherence to the Digital Security measures cited above. They also must monitor attempts to breach the system. It can be noted that a document entitled 'Information Security Policy of the MoH' is under preparation.
- 3.2 Applications should be protected from hackers and other malicious attacks.
- 3.3 Network security should be provided by applying network based intrusion detection and prevention systems. It should continuously monitor and take necessary responsive activities to prevent attacks on the segment it applied
- 3.4 Servers security should be provided by applying host based intrusion detection and prevention systems. It should continuously monitor and take necessary responsive activities to prevent attacks on the segment it applied
- 3.5 Servers should be protected against Viruses. All traffics (SMTP, POP3, SNMP, FTP, SSL) must be scanned against viruses.
- 3.6 Anti-virus, firewall and intrusion detection and preventing systems should be centrally managed with Security Management System. It should monitor and report the systems, and get information from the data so that weak points and attack sources should be located so some preventive actions will be taken against them. It will also consolidate with Security Policy Control System. Therefore, Security Management System should manage and control security policies centrally.
- 3.7 Servers should be protected continuously against security gaps (i.e. code, paths etc.) and it will be integrated with Security Management System.
- 3.8 Security vulnerabilities for systems and applications at risk should be continuously discovered. It should allow administrators to take proactive measures to effectively repair vulnerabilities most at risk.
- 3.9 Identity Management system should be used to automatically manage who has access to which resources and services; logging and reporting what they have done; and enforce organizational, privacy and security policies.