

# ICT penetration in public Greek hospitals

**Aristides Vagelatos**

Computer Engineer, PhD,  
Department of “IT projects for the Public Sector”  
Computer Technology Institute  
*Aristotelous 19, GR-10187 Athens, Greece*

**Dimitrios Sofotassios**

Computer Engineer,  
Department of “IT projects for the Public Sector”  
Computer Technology Institute  
*Kolokotroni 3, GR-26221 Patras, Greece*

**Christos Papanikolaou**

Computer Engineer,  
Department of “IT projects for the Public Sector”  
Computer Technology Institute  
*Aristotelous 19, GR-10187 Athens, Greece*

**Christos Manolopoulos**

Economist,  
Department of “IT projects for the Public Sector”  
Computer Technology Institute  
*Kolokotroni 3, GR-26221 Patras, Greece*

**Abstract** Last year a survey was carried out with the main purpose to measure how ICT has been adopted in the public Greek hospitals. The survey was made possible in a rather short period of time through the utilisation of a questionnaire. H/W existence, application S/W installations, WWW sites and E-mail use as well as IT personnel employed, were among the factors that were studied. The outcomes of this survey present a rather high penetration in the administrative sector of the hospitals, whereas the medical sector faces a low level of computerisation. The absence in most of the hospitals, of a well-organised and appropriately staffed IT department, seems to be one of the reasons for the low overall penetration of ICT in the average public Greek hospital.

## 1. Introduction

Information and Communication Technologies (ICT) are playing an important role in the health care sector. Moreover, Hospital Information Systems (HIS) contribute major benefits in the direct support of patient care, providing great advantages over the paper record in reporting, organising and locating administrative as well as clinical information.

Computer Technology Institute (CTI) is since 1997 the technical consultant of the Greek Ministry of Health and Welfare regarding ICT projects. Last year CTI undertook the task to prepare a master plan for the modernisation of ICT in the healthcare sector for the next 6

years. Within this context and among other preparative actions, a survey was conducted in order to assess the current level of ICT penetration in the public Greek hospitals with the utilisation of a questionnaire.

In Greece there exist 131 public hospitals spread around the national territory. The size of these hospitals varies from 100 beds the smaller to 1200 beds the largest, with an average size of 300 beds (35.851 beds in total). Most of the large hospitals are located in Athens (the capital of Greece) as well as in Thessalonica (the 2<sup>nd</sup> largest city in Greece). Typically there is at least one public general hospital in the capital of every prefecture (there are 52 prefectures in Greece).

In this paper we present the outcomes of the above-mentioned survey. More specifically, first we present the survey details along with the questionnaire. Next we refer to the actual survey outcomes regarding the H/W and S/W infrastructure as well as human resources in the hospitals surveyed. Finally, we discuss these outcomes and give some conclusions.

## **2. The survey**

The main objective of this survey was to assess the ICT penetration in the public Greek hospitals (at this stage only the public hospitals were included - the private sector hospitals will be studied in an next stage). In order to do that in the shortest period of time, a questionnaire was constructed.

The questionnaire was sent in the last week of April 2001 to all the public hospitals in Greece (131 in total). The deadline for filling and returning the questionnaire was due to the end of June 2001. At the end of that period less than 50% of the questionnaires had been filled. Only at the end of July there was a number of 112 filled questionnaires. That was the internal deadline for receiving questionnaires set by CTI. During the whole period between May and July the organization and process of the data was being done gradually using a database that had been developed for that purpose. In the middle of August, the processing of the data had been completed and a corresponding report was sent to the Ministry of Health and Welfare.

In the next section the used questionnaire is described in brief.

### *2.1 Structure of the questionnaire*

The questionnaire was separated in certain discrete parts.

The first part included the Hospital's identification data, such as the number of beds, the size of personnel and number of medical units (clinics, laboratories and supervised Health Centers).

The second part requested the hospital's personnel distribution per category (administrative, medical, nursing, informatics) and degree of education (university, technical education, hi-school degree education).

The third part included data concerning the hospital's data network: the technology of the installed network (Switched Ethernet, Fast-Ethernet, ATM etc.) and the percent of coverage by network outlets for the hospital's departments (administrative and clinical).

The fourth part requested information about the main servers that the hospital possesses (server type, year of purchase, estimated performance etc.).

The fifth part records the installed software application per sector. The recording is based on the departments of every sector. For example, for the laboratory sector, the software is being recorded per laboratory (biochemistry, microbiology, etc.), for the medical sector the software is being recorded per clinical department, etc.

The sixth part asked for the degree of Internet utilization (existence of web site, number

of E-mail accounts per personnel category, etc.).

### 3. ICT penetration

For the study of the ICT penetration in the health care sector and especially in hospitals, the hospital's activities must be classified in order to be able to process the data and produce valuable outcomes. The following were the most interesting results of this survey.

#### 3.1 H/W Infrastructure

H/W infrastructure can be divided in two main areas: local area networks and computer equipment.

Local Area Networks is a basic IT infrastructure that is a necessary requirement for whatever application implementation is intended to be deployed in a hospital. Nevertheless the results of our survey proved that LANs are not always present, especially in the older hospitals. Table 1 shows the results of the survey regarding the existence or absence of LANs<sup>1</sup> in the two main parts of a hospital: the administrative departments (AD) and the clinical departments (CD - including the laboratories) in the 112 hospitals surveyed.

Table 1. LAN coverage in the hospital's departments.

LAN coverage	0%	20%	40%	60%	80%	100%
Administrative Departments (number of Hospitals)	8	7	13	28	44	12
Clinical Departments (number of Hospitals)	52	18	9	15	14	4

On the other hand, an important consequence of the introduction of S/W applications in today's hospitals is the need for the appropriate hardware equipment that can cope with the performance needs of the healthcare environment.

The survey shows that in the 112 public Greek hospitals of the survey, which have a number of 32.608 beds in total, there exist:

- 206 mainframe computers and
- 3.110 PC-workstations.

It must be pointed that in order to have some reliable figures regarding the computer equipment, we asked only for mainframe computers purchased after 1997 (which means that they are still in order today). As far as the PC-workstations are concerned, the presented figures give only the number of personal computers that are used for the hospital's information system applications (personal computers that are used solely e.g. for word processing are not included here).

#### 3.2 Application Software

The various S/W applications that may exist in a hospital (and constitute the Hospital

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<sup>1</sup> The technology of the LANs that were encountered are most of the time Ethernet based, with a speed of 10Mbps for the AD areas up to a speed of 100Mbps or more, for the CDs.

Information System – HIS) were classified in the following discrete system modules:

- **Administration System (AS).** Includes: patient admission – discharge – transfer, invoicing; reimbursement; pharmacy; external patient’s appointment;
- **Clinical Information System (CIS).** Includes: medical record registration and archiving; registration of clinical data; order entry; electronic prescription; discharge and referral letters;
- **Laboratory Information System (LIS).** Includes: test requisition system; biochemistry, microbiology and haematology system;
- **Radiology Information System (RIS).** Includes medical imaging and PACS.

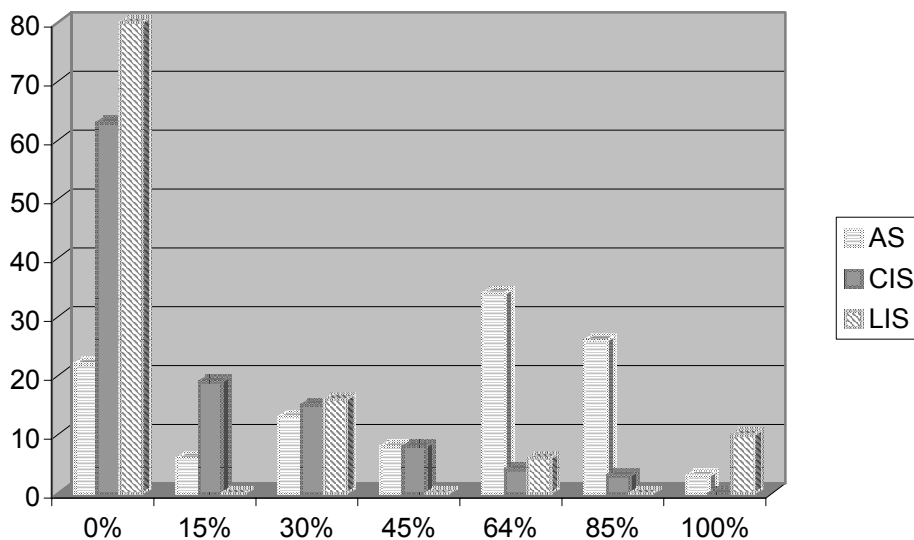
Table 2 shows the number of hospitals that have already implemented any application of the above modules. This table does not present the level of implementation (coverage) of each of these modules in every hospital (which is presented in table 3). Thus it is important to note, for example, that 49 hospitals (44%) seems to have a CIS system which is truth only to the extent that most of these hospitals uses only some kind of CIS applications and not an integrated and fully functioning CIS system.

Table 2: HIS Modules in Greek Hospitals.

HIS Modules	Number of Hospitals	% of Total
AS	92	82%
CIS	49	44%
LIS	32	29%
RIS	2	2%

Table 3 gives the level of implementation (coverage) of each module in the hospitals. It can be seen that most of the hospitals have a high level of AS coverage, whereas the level of implementation of CIS is rather low: although (given in the previous table) 49 hospitals have introduced some application of CIS modules, only 4 of them have deployed the system to cover more than 64% of the clinical procedures.

Table 3. Level of implementation of HIS modules in Greek hospitals.



### 3.3 IT personnel

The human resources is one of the most important factors that affects the penetration of

ICT in the healthcare and more specifically the IT personnel employed in the IT departments of the hospitals.

Our survey gave the following figures regarding IT personnel: In 112 hospitals that participate in the survey there are only 48 IT employees with a higher academic degree, 37 employees with technical degree and 141 with a technical diploma.

### 3.4 *WWW sites, E-mail*

Living in the Information Era (or “information society” as our epoch has been called), the Internet should provide the means for accessing various information regarding hospitals (from telephone numbers and addresses to booking services). Also the use of E-mail gives a magnitude of the ICT penetration in Healthcare establishments.

Our survey gave the following figures regarding WWW sites and E-mail existence:

- 89 hospitals do not have their own web site whereas
- 23 hospital have some kind of web site but only
- 6 of them (which happens to be university hospitals) have officially maintained site.

Concerning the E-mail accounts, there are:

- 43 hospitals with no E-mail accounts at all,
- 64 hospitals with a number of E-mail accounts between 1 to 20 and
- just 4 (university) hospitals which have their own mailing systems.

## 4. **Discussion – Conclusion**

A study was carried out regarding the ICT penetration in the Greek hospitals. The main results were presented in brief in this article driving us to the following conclusions.

The majority of public Greek hospitals have deployed local area networks that cover mostly their administrative departments, whereas there are very few which have covered clinical departments as well. As far as the PC-workstations are concerned, the survey’s outcome shows an existing proportion of 1 PC per 10 beds.

The S/W application penetration in the public Greek hospitals presents the following trends:

- Most of the hospitals have implemented an AS module which acceptably covers the functions of the administrative departments.
- Almost half of the hospitals have implemented applications of CIS modules. Nevertheless in most of the cases these applications are autonomous and not integrated with the AS and LIS modules and the level of implementation (coverage) is rather low.
- Less than one third of the hospitals have implemented LIS modules and the level of implementation is rather high (covers in most of the cases the three main labs: biochemistry, microbiology and haematology labs).

Finally, the IT department is in most of the cases understaffed whereas the existence of WWW sites as well as E-mail facilities is quite low.

Judging by the time to fill and submit the questionnaires as well as by the data that were reported from the various hospitals, a general conclusion was confirmed: Greek hospitals present strong unevenness regarding informatics, which is in absolute proportion to the existence of a structured and well-organized IT department. The hospitals that have the appropriate IT personnel were clearly more effective in their collaboration with the Ministry of Health and Welfare and presented an overall better degree of informatisation.

## **5. References**

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- [2] Deloitte & Touche. The emerging European Health Telematics Industry. Market Analysis, on assignment of European Commission – Directorate General Information Society, Feb. 2000.