

System Analysis Of Non-Patient Related Modules Of Hospital Information Systems Used In All State And University Hospitals In Turkey:

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Abstract . *Hospitals are in the business of caring for patients, therefore, patient-centered, operations optimization-based, integrated information systems are the core of hospital management information systems. Successfully implementing patient care information systems (PCIS) in health care organizations is a difficult task. Hospital information system (HIS) developed for one country may not work in another country because the rules and regulations that these institutes are to follow are different from those of the United Kingdom or the United States of America where most of the HISs have been developed. Especially, the implementation of a PCIS which has been developed elsewhere is more likely to end up with 'failure' than 'success' in another country since "programs and jokes do not travel". These HIS programs almost have to be rewritten from the scratch, therefore, costs to tailor packages to fit the needs of the local market and integrate them are often outrages or unknown. There are several failures of implementation of foreign hospital information systems in Turkey due to the software companies' lack of knowledge about how the state and university hospitals function in the country. Fortunately, six hundred and eighty state hospitals and forty nine university hospitals in Turkey have to follow and comply with the same rules and procedures that are set by the ministry of health. They all conduct or have to conduct their business more or less in a very similar fashion and they do make a huge market for software companies in the business of developing and selling hospital information system. There has been no previous study of **System analysis of non-patient related modules of Hospital Information Systems used in all state and university hospitals in Turkey.** In this paper, it is the first time, system analysis and modules of the state and university hospitals management information system are given in detail so that they can be used as reference by the people who need to know how the state and university hospitals conduct their business in Turkey.*

Keywords: *Hospital Information System, Medical Records, Management Information System, System Analysis of Hospitals, Patient Care Systems, Hospital Information System Analysis in Turkey, Clinical Information System*

1. Introduction

Hospitals are in the business of caring for patients, therefore, patient-centered, operations optimization-based, integrated information systems demonstrably enhance such care [1-48].

Successfully implementing patient care information systems (PCIS) in health care organizations is a difficult task. Especially the implementation of a PCIS which is

developed elsewhere in a country is more likely to end up with 'failure' than 'success'. Moreover costs to tailor packages to fit the needs and integrate them in another 'foreign' environment are often outrages or unknown. These programs almost have to be rewritten from the scratch. The software developers are to learn and concentrate on understanding the specific sub-domains together with the

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corresponding local and cultural requirements. There are several failures of implementation of hospital information systems of foreign origin due to the software companies' lack of knowledge about how the state and university hospitals work in Turkey. These failures can not be reported by the author for ethical reasons even though we know all of them. They had to rewrite the entire hospital information system costing them millions of dollars way overdue their budget. Hospital information system developed for one country may not work in another country. Six hundred and eighty state hospitals and forty nine university hospitals in Turkey have to follow similar rules and procedures that are set by the ministry of health. They all conduct their business more or less in a very similar fashion. In this paper, system analysis and modules of the state and university hospitals management information systems are given in detail so that it can be used as reference by the people who need to know how the state and university hospitals conduct their business in Turkey.

2. Methods

A system analysis has been conducted in the 3000 bed Istanbul University Istanbul Faculty of Medicine Teaching Hospital, 300 bed Marmara University Teaching Hospital, 400 bed Kocaeli University Teaching Hospital, 400 bed Aydin State District Hospital, and a 1300 bed Sisli Etfal State District Hospital as part of the development of a computerized hospital information system. During this analysis, the functions, rules and procedures that have been followed by the hospital administration have been studied and the modules are described in detail.

3. Results

Circulating Capital
DEPOT MANAGEMENT
PROCUREMENT
LIBRARY SERVICES
PERSONNEL INFORMATION
SYSTEM

Hospital administration is mainly comprised of circulating capital, depot management, procurement, personnel information systems and library services.

Circulating capital consists of general ledger, cash management, general reporting, financial planning, patient billing, and circulating capital purchasing.

Depot management consists of material ordering, material receipts, commodity control, commodity control yearly, stock issue, kitchen depot, fuel oil, vehicle gasoline, medical depot, and inventory control.

Procurement consists of purchasing, tendering, and government health insurance.

CIRCULATING CAPITAL

General Ledger

Cash management

General Reporting

Financial Planning

Patient Billing

Circulating Capital Purchasing

General Ledger

1. Cash on Hand, is the amount of cash held in the Circulating Capital Cashier's case for daily business operations.

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2. Cash in Bank, is the amount of cash deposited by the main cashier of the hospital or the payments made by the third party payers for the bills of the no-pay patients in a state bank for business operations.

3. General Revenue, is comprised of

a- inpatient bed and nursing revenues charges,

b- fees for the outpatient clinical examination and consultation and for the Health Council Reports and minor procedures performed at the outpatient clinics,

c- inpatient baby delivery and surgical revenues,

d- central laboratory, special laboratories, radiology, EEG, ECG, pathology, endoscopy etc. and special departments revenues,

e- pharmacy and medical supplies revenue,

f- donations and other revenues.

4. Management and Administrative Expenses; this account is broken down into types as follows;

a- accounting staff salaries,

b- family compensation,

c- birth, death and funeral compensation,

d- treatment, clothing, food and fuel compensation,

e- retirement fund payments,

f- travel expenses,

g- stationary and office equipment expenses,

h- staff transportation expenses,

i- medical supplies and drug expenses,

j- food and fuel oil expenses,

k- furniture and inventory expenses,

l- medical equipment expenses,

m- maintenance and repair expenses,

n- contingency expenses.

5. Warehouse account, is a temporary holding account for goods newly received to depots. This account is cleared immediately after payment of an invoice and the amount is then transferred to management and administrative expense accounts.

6. Accounts receivable, is the revenues owed to the university hospital.

7. Accounts payable, is the unpaid expenses of the university hospital.

8. Fixed Assets and Furniture, this is an account for recording capital assets.

9. Depreciation, this account is for accumulating depreciation of Fixed Assets.

10. Circulating capital, the amount of revenues provided to the hospital as described in General Revenue and by the government at the time of establishment of the hospital and by the rector of the university whenever operating funds are insufficient.

11. Unpaid capital, the amount of funds repaid from the hospital to the government through the rectorship.

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12. Profit and Loss, this account is periodically used to close the Revenue and Expenses account.

13. Advance account; this is a small cash account used for small purchases. It is closed and balanced every 30 days.

14. 5% Headquarters share; records amount paid annually to the Headquarters of Circulating Capital Administration (5% on gross revenues).

Cash management

This section receives patient and other hospital revenues and disburses cash to cover expenses.

The cash receiving section receives cash from patients or other sources, writes and prints out a receipt through the computer and records the data in the computer. There are eight cash receiving points within the hospital.

a. The patient comes to one of the eight cash receiving points, Outpatient Admissions, Archive, Central Laboratories, Radiology, Special Departments such as pathology, endoscopy etc. and Inpatient Admission/Discharge and pays his fee or makes a deposit and receives a receipt generated by the computer.

b. The cash amount is entered in to the computer. On a daily bases cashiers process approximately 100 inpatients and 800 outpatients.

c. Patient discharge/billing makes the final bill, prints it out of the computer and the Cash Receiving who is the same person that is making the discharge receives the cash if the patient owes a balance.

d. At the end of each day cashiers' cashbook list are printed from the computer and copies of the Receipts are given to the Main

Cashier for general reporting function to record in official cashbook of the hospital using a pen with ink as required by law.

Cash Disbursing is responsible for disbursing cash to cover hospital operating expenses paid out of Circulating Capital.

a. Patient discharge/billing sends a disbursement voucher printed from the computer to Cash Disbursing if the patient is due a refund. Accordingly, Cash Disbursing issues cash to the patient and the patient signs the voucher acknowledging the refund.

b. Head of Circulating Capital sends a disbursement voucher to Cash Disbursing (an accountant appointed by the Finance Ministry) as required as authorization for vendor payments. Accordingly, Cash Disbursing issues a check or cash to the vendor and the vendor signs the voucher acknowledging the receipt of cash against his invoice.

c. These vouchers are held in a file and turned over to General Reporting at the end of each day.

General Reporting

This function is responsible for auditing daily cash receipts and disbursement, recording transactions and reporting to the director of the hospital.

Cash Balancing (main cashier) reviews the cash receipts and disbursements, verifies balances and prepares the daily cash voucher entry.

a. receives the cashier's cashbook list from the computer and voucher files from Cash Receiving and Disbursing on a daily basis.

b. balances and totals the cash drawers and verifies the cash balances.

c. prepares a final disbursement voucher for transmission of cash to the bank account.

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d. the cash receipts and disbursement data is turned over to the Recording office at the end of the day.

Recording reviews the cash voucher, prepares disbursement vouchers and records transactions to the general ledger.

a. Recording receives cash receipts data of different cashiers in the hospital and prepares a daily summary sheet which details the revenues of the different cashiers.

b. Recording uses the revenues summary and the individual disbursement vouchers to record accounting information to the General Ledger.

c. Receives the Purchasing and Goods request form from the Circulating Capital Purchasing function, reviews the data, prepares a cash disbursement voucher and sends the disbursement voucher to the Cash Disbursing function.

d. On a monthly bases, Recording summarizes the General Ledger and submits an operating report to the director of the hospital.

Financial Planning

This function is responsible for developing the annual budget of receipts and expenditures for the Circulating Capital funds. The budget for the coming year is prepared and submitted to the Dean of the Faculty of Medicine.

a. Using the itemized revenue data and the expenditure data from the General Ledger, Financial Planning prepares a preliminary budget and submits it to the Dean of the Faculty of Medicine.

b. Dean's office reviews the preliminary budget, makes revisions as it sees fit, and returns a final operating budget to the Financial Planning.

c. The final budget is transmitted to the head of the Circulating Capital to be submitted to the university rector.

Patient Billing

This module is responsible for the billing of the patients' charges entered into the computer during their stay in the hospital if they are inpatient or their treatment period if they are outpatient.

a. Inpatients discharge is made from the Inpatient Clinic secretaries.

b. From the data in the computer a final bill is prepared simply by entering the patient protocol number into the computer.

c. At this time the patient's account in the computer is checked if he/she deposited any amount of money at the time of admission.

d. If the patient owes some additional amount of money he/she pays to cashier at the discharge office. If the patient is due a refund, a special document is prepared from the computer by the person who discharges the patient and the patient is sent to Cash Disbursing.

e. If the patient is a no-pay patient (i.e., a patient whose employer will pay his medical expenses), the bill is retained in the Discharge Office and on a monthly basis the invoice is sent to the patient's employer. If the patient does not have enough money and cannot pay his bill immediately he is sent to the hospital director to clarify his situation. Either a discount is made to the patient or the patient signs a note to pay his bill in monthly installments.

Circulating Capital Purchasing

This module is responsible for purchasing supplies and materials which are not provided from the operating budget of the University Rectorship.

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1. The Chief Administrator receives requested materials from the various clinics entered into the computer.
2. The Chief Administrator sends this request to Circulating Capital Purchasing for a check of the Hospital budget and cash balance available.
3. The Circulating Capital Purchasing committee oversees the proposed purchase.
4. If the committee accepts the request, the required forms using the same data are printed out to be signed, then the vendors are contacted and bids from at least 3 companies are requested.
5. The Circulating Capital Purchasing committee reviews the bids from the vendors and determines the most appropriate bid.
6. The winning vendor is notified and they deliver the goods to the depot.
7. An inspection committee in the depot inspects the quality and quantity of the goods and enters the inspection report in to the computer and the report is printed out to be submitted to the Chief Administrator for payment approval.
8. The approved inspection report, the purchased material receiving form (which is prepared by the depot using the same data entered previously), and the invoice are printed and sent to the Circulating Capital Purchasing for a price check and payment.
9. The vendor dossier, including all the forms mentioned above, is handed over to Cash Management for preparation of a disbursement voucher.

DEPOT MANAGEMENT

Material Ordering

Material Receipts

Commodity Control

Commodity Control Yearly

Stock Issue

Kitchen Depot

Fuel Oil

Vehicle Gasoline

Medical Depot

Inventory Control

Material Ordering

This module describes the method by which the hospital orders material which is in stock and for material that has to be special ordered.

1. Each clinic or hospital organization orders items with a common Inventory Request form using the hospital computer system. This form describes the requested material and quantity.
2. This form requires the approval of the Chief Doctor, Property Accounting, Deputy Administrator and the Chief Administrator.
3. The form has 2 copies, a copy is maintained by the requester and the second copy is used to complete the order by the depot.
4. Upon receipt of this request, Depot personnel complete the form and checks the items ordered in the stock data base in the system. This provides the exact description of the item in the stock and provides the latest on hand inventory balance of the stock.
5. Office supplies are ordered from the Government Supply Depot. In the event the Government stores cannot fill the order, the order is completed on the local market.
6. The material is received through the normal receiving procedure.

Material Receipts

This operation describes the method in which the Depots receive and inspect material.

1. The selected vendor delivers the specific parts and the Depot Personnel prepare a receiving document in the computer, which describes the material received. In the presence of the vendor, the material is counted and the quality inspection check is performed. Any difference in the count or quality is adjusted on site.
2. After completion of this step, three copies of the final receiving report are prepared and printed out to be signed by the Depot Chief, Requester and the Deputy Chief Administrator.
3. The Quality Inspection form is forwarded to purchasing for future utilization.
4. The vendor, with a copy of the up-to-date receiving report prepares his final invoice and submits his invoice and final receiving document to Purchasing for payment.
5. Purchasing matches the vendor invoice and the receiving document with the Quality Inspection form. If the package is complete, purchasing submits it to the Depot Management for the final match.
6. Depot Management matches his receiving file against the submitted vendor invoice. If all records match, data is entered to the computer for the final payment form to be prepared. Upon completion of this form in the computer, it is submitted to Purchasing for final payment and 2 copies of the document are sent to Inventory Control. At this time the inventory records data base is updated.
7. Purchasing approves the document and gives the vendor his formal package for payment.

Commodity Control

This module describes the commodity control function within the Depot. This is the basic in and out control of parts and materials.

1. When Commodity Control receives the authorization from purchasing that the vendors invoice has been approved, Commodity Control updates the inventory records to show the latest inventory balances.
2. A copy of the final authorization package is sent to the Inventory Control Section.
3. The Commodity Control function maintains the data base for all materials within the hospital. This data, if all records processing is complete and accurate, provides the information about the material within the Inventory Control area.

Commodity Control Yearly

This module describes the data base structure of the yearly activity of the physical inventory.

1. A yearly physical inventory is taken of all inventory within Depots and is recorded onto a form. This is a yearly inventory results form.
2. All detailed transactions of the hospital inventory and the entire year's history of that material or part are printed out at the end of the year.
3. If the final inventory results are greater than the list provided from the computer, it is recorded to the stock data base as new inventory receipts.
4. The final inventory results are printed out to a special form. This form provides all the details required to trace the inventory accounts from last year's carry over to this year's receipts issues.

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5. The final form is completed by Inventory Control and submitted to the Dean's Office and Government Audit.

Stock Issue

This function describes the parts and material issue procedure used to issue stock and material from depots.

1. First, the requests are entered to the computer by the clinics' secretaries or the other personnel. Upon receipt of a request form from the computer and proper authorization, a picking list is prepared.
2. If the material or parts are totally available the material order is filled. If the material is partial or out of stock the requester is notified. If parts have to be ordered a new request form has to be generated.
3. Upon completion of the Parts Issue cycle, the Inventory Control and Commodity Control sections are notified and they update their set of Inventory data base. This is achieved with the results of the actual picking list.
4. At this point of the procedure, both data bases have been updated for the Depot Parts Control and the Inventory Control section.

Kitchen Depot

The meal order form I simple providing selection between menus and allowing selection of meals in accordance with doctor's special orders. The daily meal orders are entered or updated for each diet patient in the morning and in the afternoon. A list is printed out every day at 10 Am. and 3 p.m. showing the day total, service total and the room total of the meals ordered, and also the bed number, patient identification number, name and last name of the patient and the meal ordered for each patient.

This procedure describes the function by which the kitchen receives and issues inventory.

1. Every week the dietician prepares a new menu for the hospital. This will include only normal diets.
2. From the computer every day the total number of people that are employed by the hospital and the total number of patients in the hospital are printed on a special form to be submitted to the kitchen.
3. The clinics' secretaries provide a list of the kinds of meals ordered by physician for the patients on a special form. This is the 'Daily Meal Requirement' form and it is summarized in another special form by the computer using the same data base. The Clinic Summarization Form is printed out and submitted to the kitchen depot. The kitchen depot prepares a Meal Distribution Form.
4. With the total number of people to feed and the total number of types of meals, the kitchen depot computer program computes the total food requirements for the following days' meals on a special form.
5. The vendors are then notified and the food, vegetables and fruits ordered are delivered and inspected for the next days' meal preparation.
6. Normal receiving and payment procedures are used and food items are tested for quality and freshness.
7. On food items that cannot be counted, they are weighed and the results are recorded on the form.
8. Every day from 10:30 to 11:00 a.m. and 15:00 to 15:30 p.m. the kitchen staff obtains the inventory for the next day's meal preparation.

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Fuel Oil

This procedure describes the function by which the hospital receives fuel oil.

1. The same vendor is used for fuel oil and gasoline for the hospital vehicles.
2. The vendor submits his invoice on a monthly basis.
3. All remaining depot management procedures are utilized.

Vehicle Gasoline

This procedure describes the function by which the hospital receives gasoline for its motor vehicles.

1. The same vendor is selected for both the fuel oil and vehicle gasoline.
2. The hospital driver prepares a credit slip showing the amount of gasoline required. This form is approved by Deputy Chief Administrator. The driver submits the approved credit slip to the service station. The service station attendant maintains the slips for the entire month and at end of each month prepares his invoice with the credit slips for final payment.

Medical Depot

This procedure describes the functions involved in the ordering and issuing of medical supplies and drugs.

1. The inventory is received on a required basis from vendor.
2. The standard receiving, inspection, and payment procedures are utilized in this function.
3. The computer generated medical history form is the history of the drug usage and is utilized to generate next years requirements.
4. The computer generated drug ledger form is the history of the medical supplies equipment and the total drug usage for the hospital.

5. To release drugs, supplies or medical equipment from the pharmacy for a patient, a completed medical request must be entered into the computer. For normal operating supplies, the standard computerized request form is used for the medical depot.

6. On a daily basis the clinic secretaries enter the orders into the computer for the drug and medical requirements from the patient tables.

7. On a daily basis the pharmacy prints out the medical needs using the data entered by the clinic secretaries. Upon receipt of the drug and medical requirements the pharmacy divides the request into four types of inventory.

8. The medical request items are filled and the request information updates the medical consumption data base. The medical and drugs are packaged and the computer generated forms are used to identify the clinic location and the patients name.

9. All completed transactions are updated to a special summary files in the data base.

10. The remaining procedures are the same as the normal depot management procedures.

Inventory Control

This module describes the duties and responsibilities of the inventory control section. This section has the overall responsibility for all materials and the accountability of such.

1. Employees can obtain supplies and equipment from inventory control for their own job related use or for the clinic they are assigned to.

2. When the employee terminates from the hospital they are required to clear these inventory items and return all inventory goods.

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3. These items are accounted for during the normal yearly inventory cycle.
4. When an inventory item is damaged, a Damaged Inventory Form must be completed and the data is entered into the computer. Inventory Control will determine if the item can be repaired or replaced.
5. The damaged inventory items data are summarized in the Yearly Summarized Damaged Inventory data summary file which becomes part of the normal yearly inventory records.
6. The normal hospital inventory is taken every two years and all items are accounted for. The inventory information is submitted on the detailed inventory record.
7. The total hospital inventory including food, medical supplies, drugs and all other inventory items are submitted on the Inventory Description Book form. This is the next higher level of inventory records.
8. The general summary information is posted to the total Inventory History Form. This is a posting of both medical and general inventory status for both medical and general inventory.
9. The above information is summarized and posted to the Total Detailed Inventory Form. This is the total detailed inventory and current year purchased items for all depots.
10. All inventory items are summarized in a different form which represents the inventory with values expressed in Turkish Currency amounts. This final report is submitted to the Chief Doctor and the Rectorship.
11. Inventory Control is notified of all issues and receipts of inventory for all depots within the hospital.

PROCUREMENT

This procedure describes the overall function of the Purchasing Department as well as the hospital insurance payment program.

Purchasing Tendering Government Health Insurance

Purchasing

This procedure describes the normal purchasing function of the Purchasing Department.

1. The Purchasing Department buys from two types of vendors - Government and Commercial.
2. The invoice approval on incoming inventory is a major function of the Purchasing Department.
3. The Purchasing Department is responsible for the financial reporting of the current budget expenses.
4. Discounts are given on volume purchases and the lowest bid with the best quality product wins the bid.
5. There is no competitive bidding on purchases of less than 7 thousand Turkish Lira.
6. Technical specifications are provided to the vendor.

Tendering

This procedure describes the tendering function of the Purchasing Department.

1. Tenders are for purchases over 7 thousand Turkish Lira (\$3000).
2. General specifications are sent to the rectorship for new estimates.
3. A minimum of three bidders are required for tendering and purchase estimating.
4. Upon receipt of the estimated prices from the rectorship, the technical and administrative specifications are prepared.

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5. Newspaper ads are placed in the local and government newspapers with the required bidding information. The technical and administrative information is submitted to the vendors.
6. Purchasing maintains copies of the newspaper ads.
7. Purchasing prepares for the bidders conference.
8. Vendors submit their closed bids.
9. Purchasing announces the winner. The winner posts a performance and reference book and enters into final contract negotiations.
10. A final report, outlining the results of the tender, is submitted to the Chief Doctor of the hospital with the announcement of the winner and the award price.
11. The purchasing council which is comprised of a Chief Doctor, Head of the Circulating Capital, Hospital Administrator and Chief Cashier and a member of Purchasing Department meet weekly for the purchase of the materials requested and payment to companies. Purchasing is responsible in describing the actual expense against the general ledger budget.

Government Health Insurance

1. The employees of the hospital are covered by a form of medical insurance provided by the government.
2. All employees are required to submit all invoices and other medical bills and related vouchers to the purchasing department in the rectorship.
3. The families of the employees are also covered by this government insurance plan.
4. Medical treatment inside the hospital is paid from the same special budget that is allocated for the medical expenses in the rectorship.

5. The medical services that are performed outside the hospital are paid with the normal invoicing procedures from the same budget.

6. The following is the types of medical services offered:

Medical Treatment, Dental Services, Eyeglass Services, Medical Operations, Prescribed Drugs and Medical Supplies.

7. The bills for the treatment of the civil servant employees in the hospital are also sent to the rectorship for reimbursement.

LIBRARY SERVICES

Documentation, scientific evaluation, scientific publication, information about subjects, periodicals and textbooks in the library, and PubMed and Web of Science search are available in the hospital library computer system.

PERSONNEL INFORMATION SYSTEM

Payroll and Personnel administration are carried out by using the computer system. Payments to the faculty members are made according to their performances derived from the data in the patient care system.

4. Discussion

The patient's care systems in the country continuously integrate nursing, physician, and departmental activities as well as the other administrative activities. Any item purchased through the purchasing department should be used for patients or services in the hospital. For example, if a laboratory kit is purchased for one test and a certain number of that test should be run with that kit in the laboratory, a comparison of the laboratory performance data with the purchasing department data gives information about the laboratory activities. All information about a patient relevant to

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any administrator, chief director of the hospital, should be available at any time, provided that the administrator is authorized to use such information. For instance, should a pathologist want information regarding a charge was made to a patient for a slide examined, this should be available instantaneously at the pathologist's desk. Similarly, should a physician want to see if the surgery performed on his patient is charged to the patient's account, the information should be available instantly.

I have personally seen many world famous companies which entered the hospital information systems market in Turkey had to rewrite their entire programs from the scratch costing them hundreds of thousands of dollars due to the lack of knowledge about how the state and university hospitals function. In one case 1.6 million dollar HIS program had to be rewritten from the scratch costing the software company hundreds of thousands of dollars and paying for compensation for the delay of the implementation of the program. This company was later banned from the other HIS projects in state hospitals because of its failure in its first project in a big state hospital. It is true that 'programs and jokes do not travel'. The work flow chart of the state and university hospitals and the data types and length of each field of records of the tables about the information kept in each department and module have already been studied and are readily available. This information will be published in a separate paper and can be obtained from the author upon request.

5. Summary and Conclusion

Foreign software companies should study and learn the way the hospitals conduct

their business and the culture of the local people working in these hospitals before they think of winning the international bids as part of a big turn key hospital projects. They have to work with the local people who know the system very well and see if their programs are suitable to meet the needs of the local people. They should not try to impose their program on to the local people because they all have to follow certain rules and regulations set by the ministry of health of that country.

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