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An approach to Enhance the software and services of Health care centre

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Abstract

In this paper we are suggesting software applications based on Internet protocol infrastructure for healthcare center in UK. For suggesting software applications we are considering a case study. And in this case study a company named XYZ is any arbitrary UK healthcare center for which we will suggest software's after studying its environment and operations. Implementing these new software applications will enhance its previous system working processes. Manual work will also be reduced. Our objective is to provide professional commercial software applications based on IP (Internet Protocol) infrastructure. Implementing our approach will provide more effective and efficient services at lower cost.

Keywords: e-business, healthcare centre, ROI (return on investment), Equipment Management System, Content management systems (CMS)

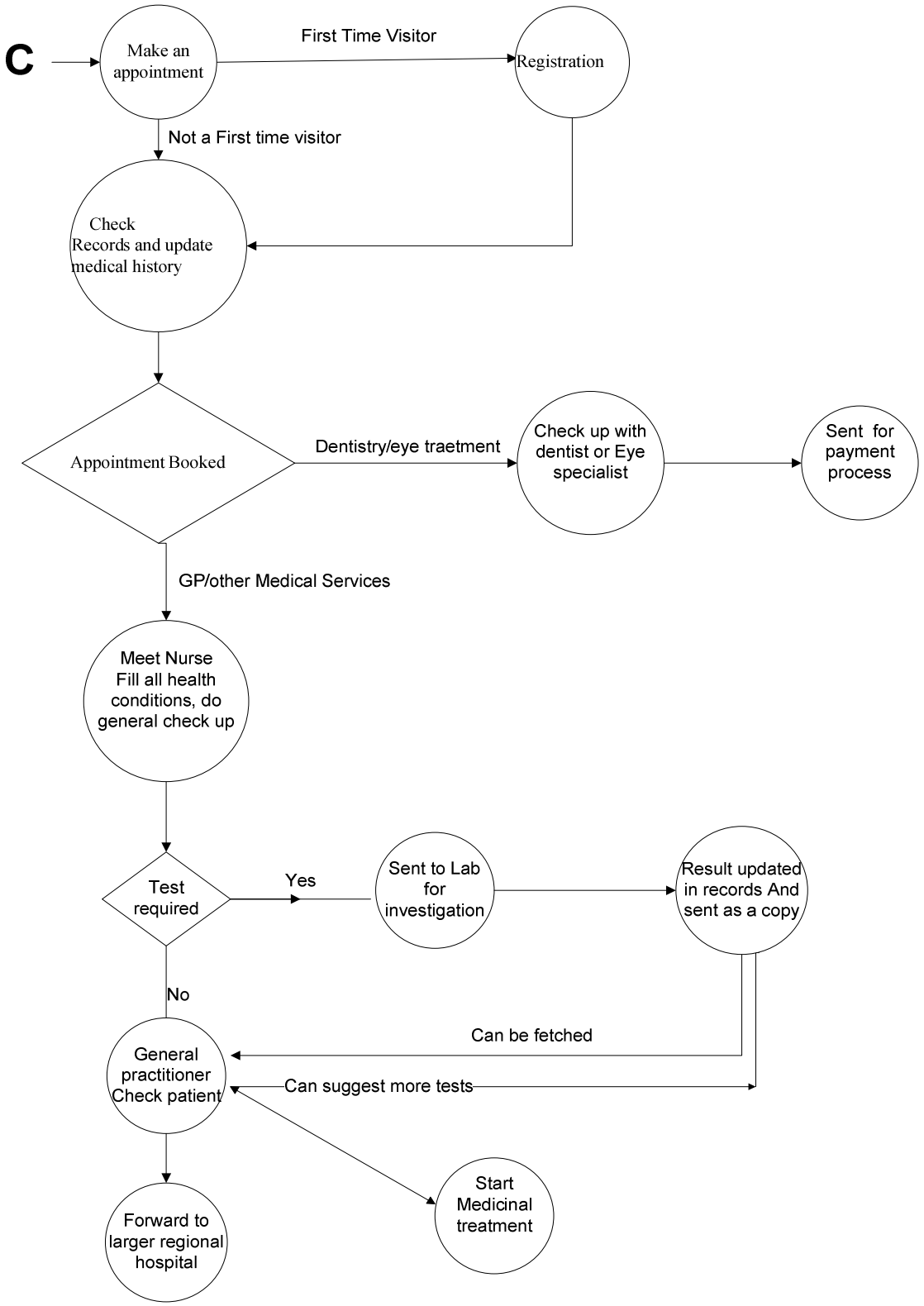
1. Introduction

This is a proposal for improving the computerized services provided by a healthcare center in UK to its customers. So a case study is taken into consideration. In this case study first we have defined the workflow in client company i.e client company operations and its environment. Their flow is represented in the form of a figure and then all the client activities are described in detail. Later on in this section we have shown flow of payment methods and services with the help of a figure. These figures show how Client Company is working currently. In the next section we have proposed all the possible packages to improve the working of Client Company. These packages are described in detail in this section. All the benefits, features, pros, cons etc are mentioned properly, so that the client company can easily decide what they want for their company. And then in next section cost summary with ROI (return on investment) is calculated for all the proposed software's. This ROI will also show whether it is cost effective or not, to implement suggested software's.

2. CASE STUDY: Client Company Operations and its Environment:

XYZ is a healthcare centre in the London area. This centre offers General Practitioner, Dentistry, Health Visiting and other medical services - all to a local catchments area. It is one of a number of such centres that are grouped together as a 'trust', which manage front-line medical care, backed by a few large regional hospitals.

2.1 Work flow in client company:


C
Make an appointment
First Time Visitor
Registration
Not a First time visitor
Check Records and update medical history
Appointment Booked
Dentistry/eye traetment
Check up with dentist or Eye specialist
Sent for payment process
GP/other Medical Services
Meet Nurse Fill all health conditions, do general check up
Test required
Yes
Sent to Lab for investigation
Result updated in records And sent as a copy
No
Can be fetched
General practitioner Check patient
Can suggest more tests
Start Medicinal treatment
Forward to larger regional hospital

Above Activities In Detail:

a) Make an appointment: Appointment can be made through a phone call or by personally visiting the healthcare centre.

b) Registration: If the patient is first time visitor in the health care centre then he/she has to register with the centre. Details like Name, Address, Phone number, Date of Birth, Email id, National insurance number, NHS card details etc will be added to the healthcare systems or will be placed safe in the form of paper documents. Patient can be a member of medical schemes where by he/she pays to dental/eye services depending upon on which scheme they fall, like fully exempt or partly exempt.

c) Appointment done: check what the problem with the patient is and make an appropriate appointment depending upon the needs of patient. Example: whether an appointment is with GP (General Practitioner) or with Dentist or for any other medical services.

d) If Dentist appointment: Directly have check up with dentist. Depending upon the needs dentist will take X-Ray and will do all the needful surgeries. And then patient will do the payment depending upon the work done on them and also depending upon on which scheme do they fall. A patient can go for NHS(National Health Services) or private treatment.

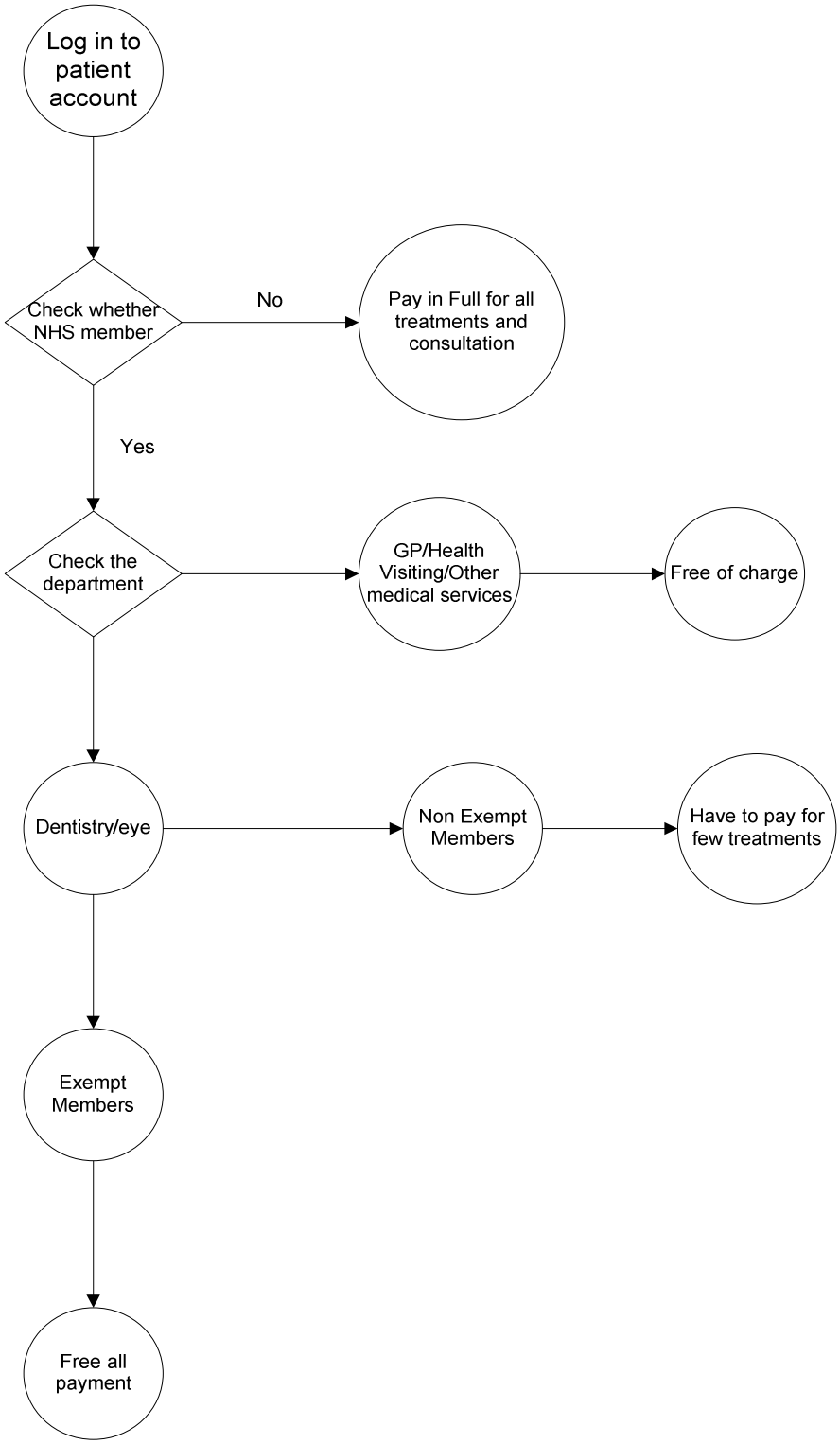
e) If appointment for other medical services or for general medical check ups: Usually nurse will do all these types of check ups and fill the medical information about the patient in the database which can further be viewed. Depending upon the requirement of the health condition of the patient nurse will either forward the patient to GP or will suggest lab test.

f) If appointment with GP: Check the patient, either suggest lab test or will give medicines depending upon the health condition of the patient or will forward the patient to larger regional hospitals. All the details including the medicine course taken will be put on the records of the healthcare center so that if the patient is coming again to the centre then all the details can be viewed. Even if the patient's GP is changed all the details can be read from the records of the patient.

2.2 Payment Methods or Services:

For getting payments from Patient:

Below is the assume payment process of the client organization, in actual it may be little different.


Log in to patient account
Check whether NHS member
No
Pay in Full for all treatments and consultation
Yes
Check the department
GP/Health Visiting/Other medical services
Free of charge
Dentistry/eye
Non Exempt Members
Have to pay for few treatments
Exempt Members
Free all payment

For other healthcare centre work and staff payments:

Healthcare centre's are funded by PCT(primary care trust). These PCT's will ensure whether healthcare centre is maintaining all the standards. PCT will give money to contract holders of the healthcare centre and then contract holders distribute that money as pays or salaries between the staff.

Usually GP (general practitioner) and all other staff members are salaried employees. And will get their salary from the healthcare centre.

Dentists will get their pay depending upon the UDA (units of dental activity) i.e. according to the amount of work they have done. Similarly for eye specialists.

3. Proposed Software Systems:

We have done some research and found few enhancements that will improve the performance of client organization in a cost effective way. Few of the software application packages are:

Package 1: We can provide a user interface application with centralized database (an intranet application)—

If you don't have a user interface to directly insert or update information about the patient in database, i.e. if all the work is manually done in the healthcare centre or if the work is done manually and then at last the data is updated by some computer literate then we can make a software application with proper user interface for managing patient details and their visits. This user interface will have all the necessary links that are required in the healthcare centre. This will be an intranet application with proper secure access keeping data protection laws in mind.

Some of the major problems that client organization may be facing in the current system if you don't have web based user interface application are:

- Heavy paper work is involved which in turn requires heavy maintenance and these records are cumbersome and bulky.
- Written records for every information takes a long time leading to wastage of time and delay of services.
- May be there is Manual file management due to which there is a possibility of files being destroyed or spoiled by fire, moisture or by wear and tear.
- Most part of the work done is of repetitive nature due to which there is a heavy loss of time and energy because the same work has to be done almost from scratch every time.
- The system is not user friendly.
- In case, we need some information, we have to go through all the records which is a time consuming process and even then the information gathered may not be accurate.
- Written records are easier to tamper with.

So, it becomes important to automate the system in such a way that all the works are performed by the proposed system. Various facilities provided by the proposed system are discussed next.

All the general practitioners, dentist, nurse, receptionists and all other staff members will have their account in the database and they can access information related to their department. Any staff member can see the patient details if they have privilege of viewing patient information, when they login with their account details. This will be a system for inserting patient data in the database and later on which can be viewed in proper way or can be printed out if necessary or required by the patient. But there won't be any content management system attached to it. This application will reduce client paper work and improve the quality of work. Client Company's work flow process will be more effective and efficient.

Benefits of this user interface are:

- Timely updating of patient details.

- Data can be fetched as and when required within in little time.
- Patient history and other details can be viewed by more then one person at a time from the same database, this wont be a case if work is done manually in the hard coded form (paper copy form).
- Records fetched would be more accurate.

Software requirements for this are:

Technologies used are:: HTML/XHTML/JAVA/JSP/PHP

Database can be:: Oracle 10g/MySQL/or any other as per your wants.

Package 2: Content management system for patients and other staff

If you already have user interface to enter data in the database then we can provide content management system (CMS) application to enhance user interface work.

Content management systems (CMS) allow the delivery of business-critical information to consumers by extracting data from different sources. The digital content may include business records, customer service information, marketing messages (email), images, video or other types of digital information to store x-rays, ultrasound reports, CT Scan, MRI and other visual scans..

This content management system will help client organization to manage client data in more productive and efficient way.

This CMS application can do following things:

- We can provide an additional activity window to the previous software so that the nurse, doctors, receptionist etc can see what all things they have done on particular patient and what all are the left out things they have to do. Activities that are still left to be done will be highlighted. In this way no one will miss out any of the important activities.
- Mails of appointment data and timely reminders can also be sent as and when required to patients as well as to concerned doctor or nurse.
- A time management window can be added to the application for patient slot booking. For example: Receptionist can book the patient time slot with General practitioner or with dentist or with nurse depending upon patient needs. This window will add a managed booking system in client organization.
- A reporting tool can be provided which can generate reports of financial data or about the activities done by particular staff member during particular time period. Or any other report as per the specifications.
- Bluetooth Token Display :

Bluetooth token display is an application that will display token numbers of the patient on their cell phones.

Requirement for this are:

- Patient should have Bluetooth enabled phones.
- Patient has to switch on their Bluetooth's to receive messages about token numbers.

This system will have benefits like:

- Patient will be free of tension of sitting and waiting for their number to come. If waiting time is more, then Patient will be free to go to cafeteria, washrooms or toilets without missing their token. They can go freely to cafeteria and can have some coffee or food. They just have to manage their time according to the token displayed.
- As soon as a person is in Bluetooth range they will start receiving information like structure of healthcare centre i.e. which department is where. They don't have to search for centre map for finding any department or room.

- Patient can also receive messages about health awareness or about new services started by healthcare centre. Ex. You can send messages about any seasonal disease like cold, flu etc or about swine flu symptoms and what to do when they are caught with any type of such flu's. You can send any health related news that you feel important. By this healthcare centre will be more publicized and it's a nice way for advertising new services.

This CMS application will provide better control and monitoring of the healthcare centre.

Package 3: Website for healthcare center

We can make a website for client healthcare center. Usually websites are just made for the sake of having one website but in actually websites play an important role in business. It's a flow of information to understand the business value and offerings one is providing. A website is an online resume of your organization for the outer world. If the website is good then it will inspire customers to visit client center. A good website has following features:

- It should be elegant with proper vision.
- Should have easy and smooth navigations.
- Intuitive layout
- Color scheme and Graphics should be chosen correctly.
- Should not have more of distracting information like noises, animations etc that make customers irritated and can make them leave the site.

We can assure you that we can provide almost all these features to the site.

Features and benefits of the website are:

- Your website will be a window to show what all services you are providing to customers.
- It will show structure of client organization, what each department is doing and what facilities each department is providing to their patients.
- It will show what action to take under certain circumstances. Like under emergency situations or when suffering from flu etc.
- It will show all the contact details of client organization. Ex. Department wise contact details, emergency time contact details, contact details for booking appointment etc.
- You can use the website for advertising new services that you are providing.
- You can advertise different ads in the site and can earn money.
- Website can be used for selling online medicines. Like if a customer is already getting treatment from the healthcare centre then he/she can order for medicines online and as healthcare centre is treating almost all the local people so it's easy to provide medicines within 1 day. Medicines will be couriered to customers if and only if they are prescribed by their doctor and are updated in the database by their doctor. This will increase sale of your medicines and you will attract more customers by providing better services.
- You can also get all the emails personalized with the company domain.
- Customers can enter their details by filling the form in the site and these details can be used for marketing purposes like for email marketing etc.

Package 4: Equipment Management System

We can provide an equipment management system for the client organization. This system will have the following functions::

- Login: for authorized access of the system.
- Can book or order for new equipments that are not there in healthcare center. This can be taken as a suggestion when buying new equipments, so that you don't have to call for meetings when buying new equipments. Staff can

order their order online what they want and what all things are good.

- Any staff member can order or book any sort of equipments required by them for their work.
- This system will also show how many equipments each staff member is ordering or using. Whenever anyone book/order equipments then date number of quantity and other details will be updated in the system.
- There will be an option to show how many equipments are returned after full utilization and how many are in use. For use and throw materials, equipments returning option won't be there. This will give rough figure of the utilization of equipments in the organization.
- For new equipment buying there will be a way of conforming from the department and then from other superiors. When necessary confirmation can be made and then final mail can be sent for buying of equipments to the concerned person. No one has to search for people for conforming about the order of buying.

4. **Cost Summary: ROI(return on investment)**

There are a number of ways of comparing investment projects one with another in terms of their net benefit to the organization. Usually commercial organisations consider only two parameters:

- Net return in money terms on a time-weighted basis.
- Risk.

Net return is commonly interpreted (and most easily understood) as the projected Internal Rate of Return (IRR) of the project. Risk is commonly assessed as the standard deviation of the probability distribution of expected outcomes, which is used as a proxy for the 'uncertainty' that the return will be as projected and in particular of the average amount by which is could turn out to be less than anticipated.

Individual cash flows:

$$PV = amount/((1 + i)^{**}n)$$

Where $i is the chosen discount rate expressed as a proportion and $n is the number of time periods (including fractions of a period) until the particular cash flow occurs. $amount is negative for outflows and positive for inflows. If you do that 'foreach ($amount)' and sum, then the IRR is that chosen rate that will make the sum ($PV - the 'present value') zero.

Depending upon the above equation we have calculated IRR below for different packages:

We have assumed below values and hope they are closet to real values for client organization.

WACC (Weighted Average Cost of Capital) is assumed 8%.

Package 3:

We are using maximum 5 years time frame when assessing benefits from investments.

Fully integrated website with domain for 5 years will cost £500,000 and will take a year to implement.

Staff retraining and training cost is assumed to be £20,000.

Contingency funds £300,000 that would be set aside to fund major upgrade if technology or requirements change, these funds are kept at 5% interest.

Maintenance cost is assumed to be £30,000 per annum.

Proposed sales improvements of healthcare centre unit is £100,000 p.a. and proposed sales increment for Medicines unit (Pharmacy unit) is £60,000 p.a.

Estimated Funds by advertising different ads of other company's product will cost £40,000 p.a.

So dividing all the figures by 1000:

All cash flows

Positive Cash Flows

£100p.a – Services Sales Improvement

£60p.a – Sales Improvements of medicines dept

£15p.a – Interest from the Bank (5/100*300=15)

£300 - Contingency Funds

Negative Cash Flows

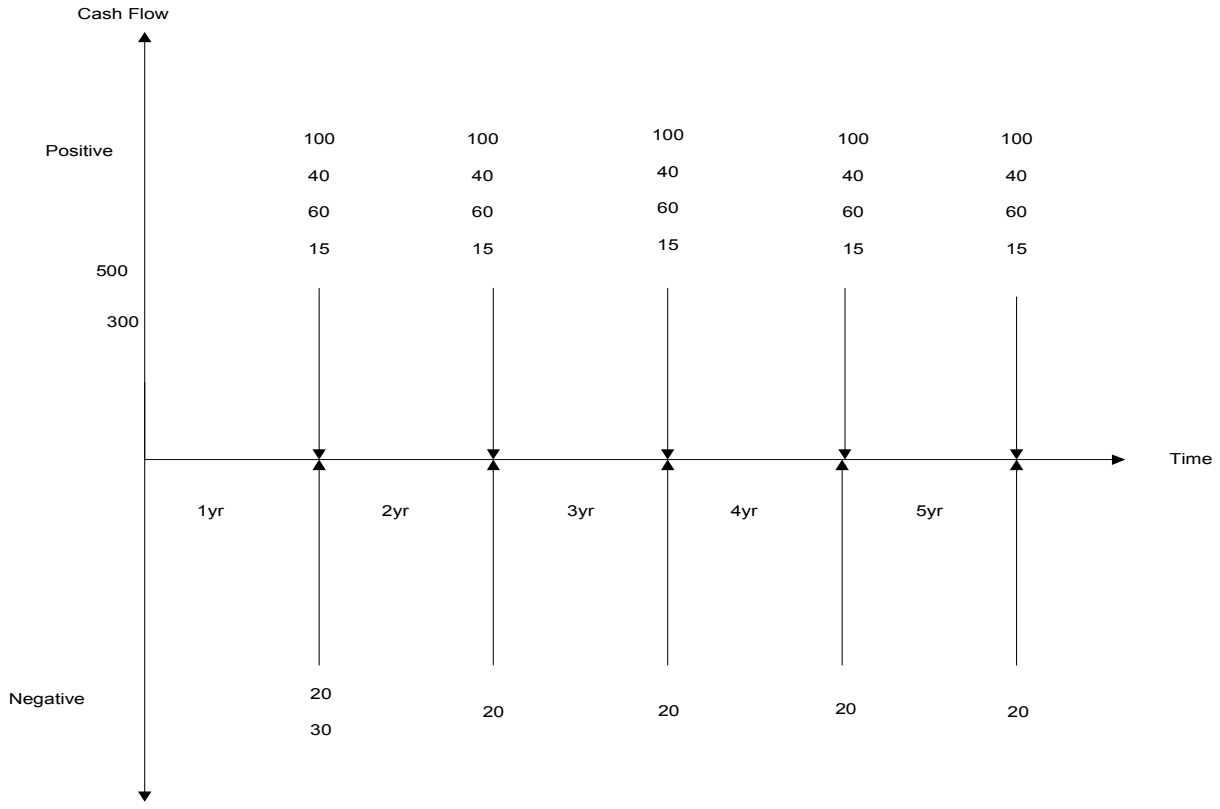
£500 - Software Installation

£300 - Contingency Funds

£20 - staff training

£30p.a – Maintenance Cost

Time frame: 5 years.



Adding all for 5 years together:

-800+{(100+60+40+15-20-30)/(1+i)**1}+
{(100+60+40+15-30)/(1+i)**2}+{(100+60+40+15-30)/(1+i)**3}+{ (100+60+40+15-30)/(1+i)**4}+
{(100+60+40+15-30+300)/(1+i)**5}=0

Or we can write above equation as:

0= - 800 + (100+40+60+15-20)/i{1-1/(1+i)**5} – 30/(1+i) + 300/(1+i)**5

By putting i=0.139 gives ROI value nearest to zero.

So the IRR is 13.9%

Seeing the internal rate of interest we can only say that its worthwhile investing on the project as internal rate of return (IRR) is greater then WACC value for the company(13.9>8).

Package 1:

We are using maximum 5 years time frame when assessing benefits from investments.

Fully integrating, installation, developing of the application with Database installations cost: £600,000

Maintenance Cost estimated: £40,000 p.a.

Staff Training cost is: £100,000

Contingency funds £300,000 that would be set aside to fund major upgrade if technology or requirements change these funds are kept at 5% interest.

Staff cutting cost: £150,000

Because of automation efficiency of doctor and other staff members increases as a result more patients are looked in a day and thus increases annual turnover by 200,000 p.a.

Doing calculations in similar way as for above application we get the equation:

0= -300-600+[(200-40+15)/i{1-1/(1+i)**5}]+(150-100)/(1+i)+300/(1+i)**5

Hence calculating i=0.09 gives ROI value nearest to zero.

So IRR is 9% which is greater then company WACC value.

So finally we can say that it is worth investing in this project.

Package 2:

We are using maximum 5 years time frame when assessing benefits from investments.

Fully integrating, installation, developing of the application with Bluetooth systems cost: £1,000,000

Maintenance Cost estimated: £60,000 p.a.

Staff Training cost is: £50,000

Contingency funds £300,000 that would be set aside to fund major upgrade if technology or requirements change these funds are kept at 5% interest.

Better performance and time management improves sales £50,000 p.a.

£300,000 p.a. is saved by generating reports automatically and using them electronically so that paper usage is less.

Doing calculations in similar way as for above application we get the equation:

0= -300-1000+ [(300+50+15-60)/i{1-1/(1+i)**5}]-50/(1+i)+300/(1+i)**5

Hence calculating i=0.09 gives ROI value nearest to zero.

So IRR is 9% which is greater then company WACC value.

So finally we can say that it is worth investing in this project.

Package 4:

We are using maximum 5 years time frame when assessing benefits from investments.

Development and Installation of the software will cost: £250,000

Staff retraining and training is estimated: £25,000

Contingency funds £200,000 that would be set aside to fund major upgrade if technology or requirements change these funds are kept at 5% interest.

Maintenance of the application is estimated to: £20,000 annually

Staff reduction cost and funds saved by less miss handling of equipments are: £90,000 p.a.

Doing calculations in similar way as for above application we get the equation:

0=-200-250+[(90+10+-20)/i]{1-1/(1+i)^5}-25/(1+i)+200/(1+i)^5

Hence calculating i=0.065 gives ROI value nearest to zero.

So IRR is 6.5%.

For this package IRR<WACC, but still its greater then the bank rates (usually 5%). So this package can also be considered.

5. Conclusion and future work

So while concluding this paper we can say that before starting the paper we tried our best to find out how present system of healthcare centre is working and then we tried our best to suggest the computerized packages to the healthcare centre in UK, so that it can improve its services for their patients and the staff. So for this we have suggested packages like user interface application, content management system, website and equipment management system. There can be many more improvements that we can probe later on in future.

Many open issues are not discussed in this paper which we will cover and will try to find out solution in our next paper.

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