Requirements Engineering

Recruitment Management System: Assignment 3

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1. Introduction

1.1 Overview

We consider a company that we can automate its recruitment process and this company is currently using a manual system to recruit employees; since recruiting employees manually is a time consuming, possibly erroneous in employing incompetent individuals, thus wasting of the company's money or loosely speaking not a wise strategy in terms of economy. Recruitment system is a process of selecting potential candidates for a vacant position and hiring the candidates who fulfill the requirement of the organization; hence hiring is a strategic function for human resource department. Human resource management includes several responsibilities, mainly selecting potential employees that the company needs so that this system will help the company in selecting the best potential applicant that could help in achieving its goals. Recruitment is the systematic process of generating a pool of qualified applicant for organization job. Selection and recruitment is a vital process for a company. The employment of competent workforce can bring growth and stability.

1.2 Purpose of the System

Recruitment management system is a comprehensive system to manage the entire recruitment processes of an organization. It facilitates the information flow of a company within HR departments. Just like performance management, payroll and other systems, Recruitment management system helps to contour the recruitment processes and effectively managing recruitment. The features, functions and major benefits of the recruitment management system are explained below:

- ➢ Structure and systematically organize the entire recruitment processes.
- ➢ It facilitates faster, unbiased, accurate and reliable processing of applications from various applications.
- ➢ Helps to reduce the time-per-hire and cost-per-hire.
- ➢ It helps to incorporate and integrate the various links like the application system on the official website of the company, the unsolicited applications, outsourcing recruitment, the final decision making to the main recruitment process.
- ➢ It maintains an automated active database of the applicants facilitating the talent management and increasing the efficiency of the recruitment processes.
- ➢ It provides a flexible, automated and interactive interface between the online application system, the recruitment department of the company and the job seeker.
- ➢ It helps to communicate and create healthy relationships with the candidates through the entire recruitment process.

The Recruitment Management System (RMS) is an innovative information system tool which helps to sane the time and costs of the recruiters and improving the recruitment processes.

1.3 Business process of the existing system

The company recruits employees for definite or indefinite period of time. The indefinite period recruitment process includes the following activities:

1. Requirement unit shall receive requisition from any departments of the company through hiring manager.
2. Recruitment unit prepare job description and person specification.
3. Recruitment Unit shall announce vacancies to the public through radio, television, newspapers and etc.
4. Recruitment Unit shall register applicants and receive their educational and other relevant documents after checking against their originals.
5. Recruitment unit will do Short-listing and identifying the prospective employee with required characteristics and conduct interview with the selected candidate.
6. Hiring manager make decision on the selected candidates and shall prepare minutes and recommend for approval.
7. Recruitment Unit ensures that the successful candidate is medically fit and free from any criminals and finally result will be posted on the organization notice board.
8. The selected candidate who are certified and fit for the job shall fill in application forms for employment.
9. Recruitment Unit prepares Personnel Action (PA) after collecting all documents necessary for the personal file of the employees. The PA shall describe Employee name, identification No, position/grade and salary, job code, cost center, location, work Unit/department, division, section, remarks and effective date.
10. A recruited employee shall be assigned to their respective department for 45 days of probation period. The department shall notify to Recruitment Unit on the performance of the employee before the probation period ends.
11. Recruitment Unit shall prepare Personnel Action to terminate unfit probationer or to confirm permanent employment for probationer with acceptable performance

Employment for definite period is a type of employment when a person to be recruited becomes temporary employee of the company. The employment process includes the following activities:

1. Department heads determine whether the vacant positions duties can be handled by the existing regular employees and then initiate temporary employee requisition by specifying need justification, and forward it for approval to hiring manager.
2. Employment of contract workers shall be carried out as per the delegation authority given to Departments.
3. The company follows the same procedure as above (indefinite period recruitment process) starting from number two (2) to six (6).

4. Recruitment Unit shall orient the recruiter the right and obligations stipulated in the contract form. The contract form contains names of employee, duration of contract, job title and place of work, task as per attached job description, salary and allowance, right and obligation of employee, right and obligation of the corporation, termination of contract, renewal of contract, compensation, and modification of contract and date of contract.
5. Recruitment Unit shall prepare official acceptance letter and send it with the contract form to administration office manager.

2. Problems of the existing system
Scope of the problem

To identify the problems of the current system we use PIECES framework which is a checklist for identifying the problems of the existing system. As the current business process is not automated the company needs to cope up with the following set of problems.

Performance:

- ✓ Poor time management: Often paper work is slow, which results delay on client's services and for the personnel processes of the company.
- ✓ Response time: Delay in the preparation and distribution of personnel action. For instance, preparation and distribution of personnel action for permanent employment takes about eight (8) days.

Information:

- ✓ Redundant information: Personnel information about employees stored in many places.
- ✓ Data is captured redundantly: Personnel information has to be captured again and again when activities related to a particular employee is performed.
- ✓ Data is not securely stored as the result; personal information of employees is exposed to unauthorized agents.
- ✓ Due to the large number of manual files, data organization is difficult and is not easy to meet new information needs from stored data.

Economics:

- ✓ Manual handling of data is expensive as compared to automated system. Cost in terms of time is high.

Control (and security): too little security

- ✓ Difficulty in keeping track of hiring cost and activities.
- ✓ Decision making errors due to lack of credibility of reports.

Efficiency

- ✓ Inefficiency due to poor time management.

- ✓ Effort and materials required for tasks is excessive.
- ✓ During the registration process and coordination of services, materials and supplies are often wasted because of redundant input of information or erroneous data. Besides the personnel are not trained to make full use of computer resources.

Services

- ✓ The system produces inaccurate results: Once an error occurs in the input process this error can affect all levels of the division.
- ✓ The system produces inconsistent results: Inconsistency in decision making with regard to employees.
- ✓ Recruitment activities are prolonged for about two months since the existing system is manual.
- ✓ Delay in announcing notice for vacant positions.
- ✓ Poor recording of requisitions.
- ✓ Performance of work units is humped due to lack of programmed recruitment activities.

3. The Context

3.1 Domain Properties

Effective and consistent recruitment practices are essential to ensure that all applicants are treated fairly and with diversity and equality of opportunity and that costly recruitment mistakes are avoided. The recruitment process must result in the selection of the most suitable person for the job in respect of skills, experience and qualifications. This Policy defines the principles that the Company considers important in the recruitment process and aims to ensure that consistency and good practice is applied across the Company. The Company policies are listed as follows:

- ➢ **Monitoring equal Opportunities**: Applicants are treated equally regardless of their gender, race, religion, color, ethnic, natural origins, color, age, disability, marital status, family responsibilities and other inappropriate distinctions.
- ➢ **Job Descriptions**: The Company documents an employee's tasks and responsibilities, what his or her authority is and what skills and qualifications are necessary to do the job.
- ➢ **Advertising of Vacancies:** The Company advertises vacancies to all members of staff as well as external means. Internally this will be informed by the company department heads to employees; externally a method which is direct advertising using different communication Medias.
- ➢ **Probation Period:** Recruited employees are assigned to their respective department for 45 days of probation period. The department notifies to Recruitment Unit on the performance of the employee before the probation period ends.
- ➢ **Qualification Certificates**: All applicants provide certificate of qualifications either in the form of original certificates which will be copied and then returned.

➢ **Medical and Criminal Certificate**: The selected candidates are medically fit and free from any criminal activity. Therefore they provide a medical fit and crime free certificates.

3.2 Stakeholders

The stakeholders are anyone who benefits from the system or who have an interest in the system. They may be affected by it either directly or indirectly. Stakeholders who will be involved in this system and their role will be described as follows:

Recruitment Unit: - The primary function of the recruitment unit is to attract highly qualified candidates to meet the organization need while providing equal opportunities for all. They prepare job descriptions and personnel specifications, Post job vacancies, screens applicants, devise and implement selection processes, conduct interviews and routes to hiring managers.

Department Heads: determine whether the vacant positions duties can be handled by the existing regular employees and then initiate temporary employee requisition by specifying need justification, and forward it for approval to hiring manager and notify to Recruitment Unit on the performance of the employee before the probation period ends.

Managers: employees with high authority who make key decisions and run the company.

Hiring Managers: are employees who are responsible for making wise decisions on selecting potential candidate by working together with recruitment unit.

Job Applicants: job seekers who are applying for a certain vacant position.

3.3 Goal Model Analysis

Goals of Stakeholders and possible alternative solutions for the respective problems

1. Recruitment unit

The main goal of this unit is to hire potential candidate and perform different procedures which is effective related to hiring and can be shown diagrammatically as follows:
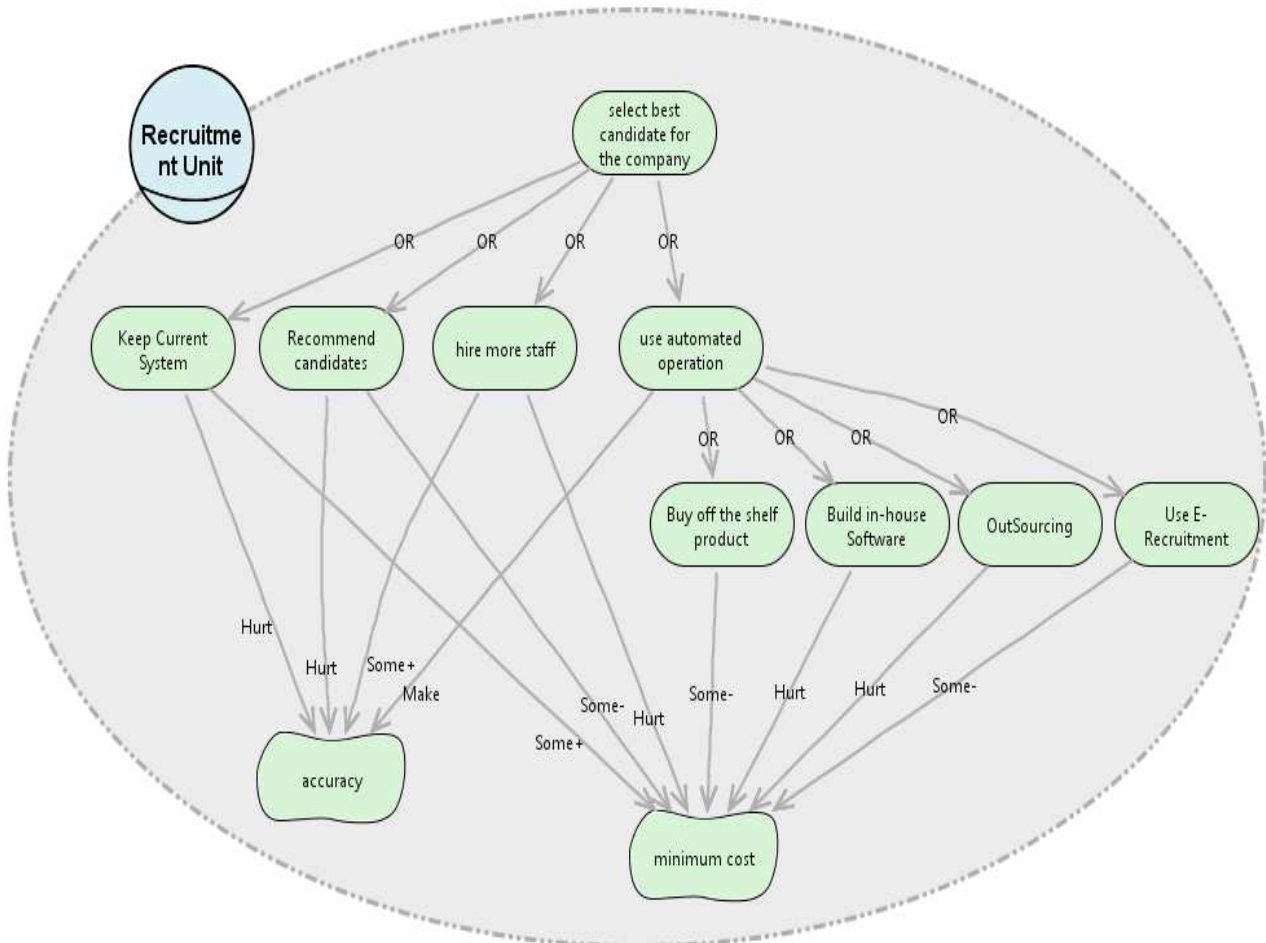
Figure 1 Goal Model for Recruitment Unit
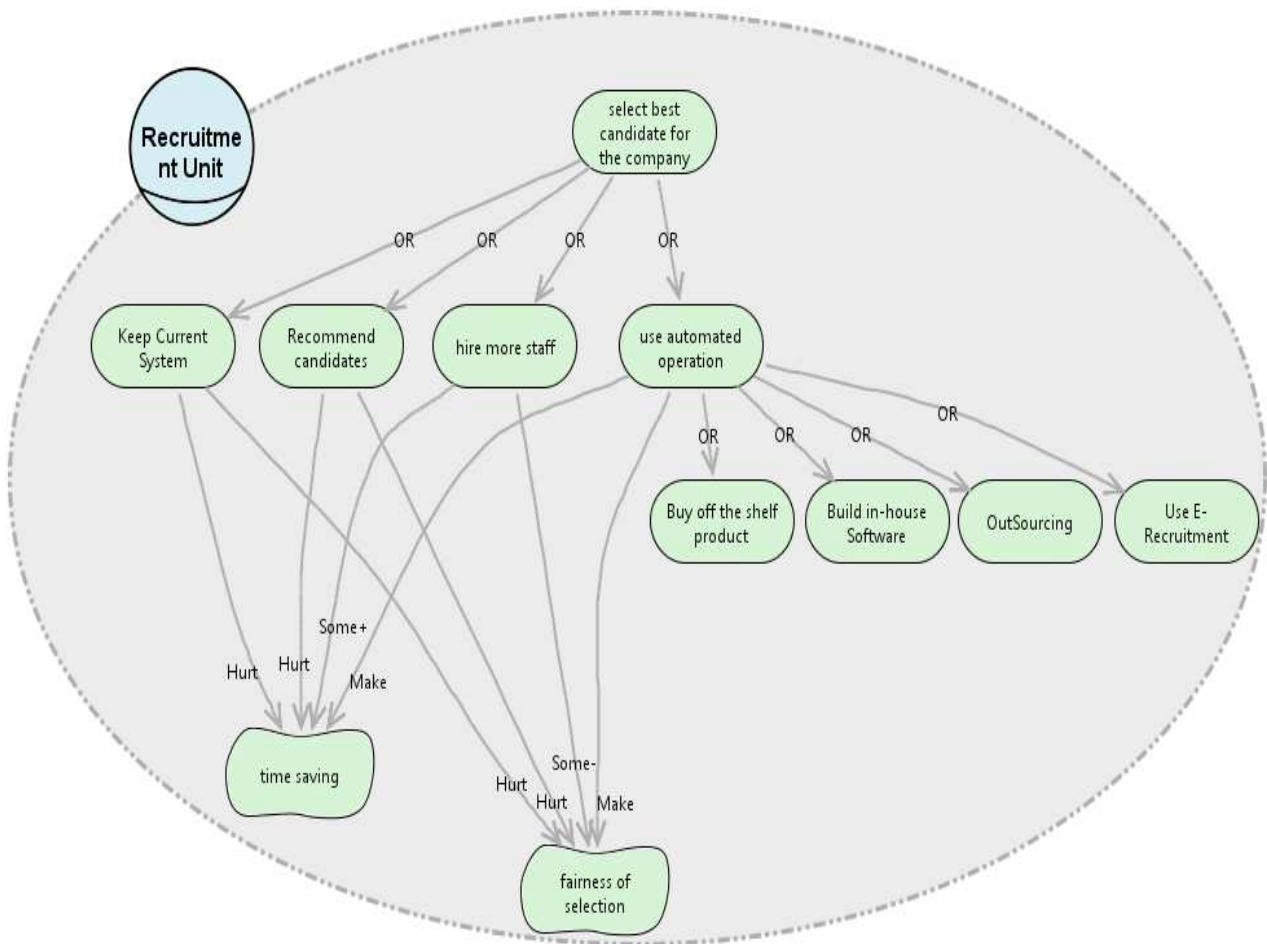
Figure 2 Goal Model for Recruitment Unit

2. Department head

Requisition for the new candidate is one of the main goal of this position; pictorial representation of this goal will be shown below.
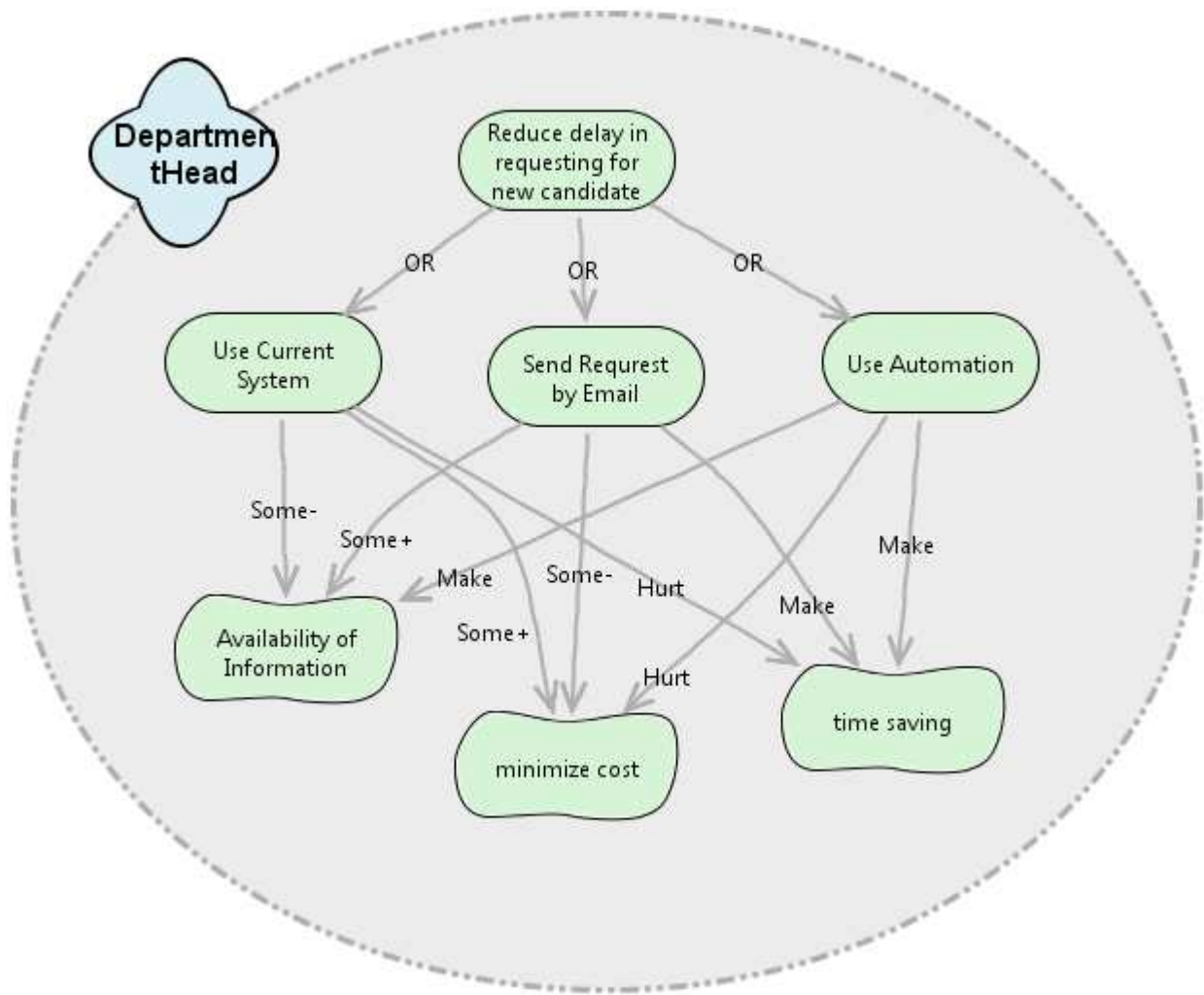
Figure 3 Goal Model for Department Head

3. Hiring manager

The main goal of hiring manager is decision making and approval of the newly selected candidate with certainty. Pictorial representation of this goal will be shown below.
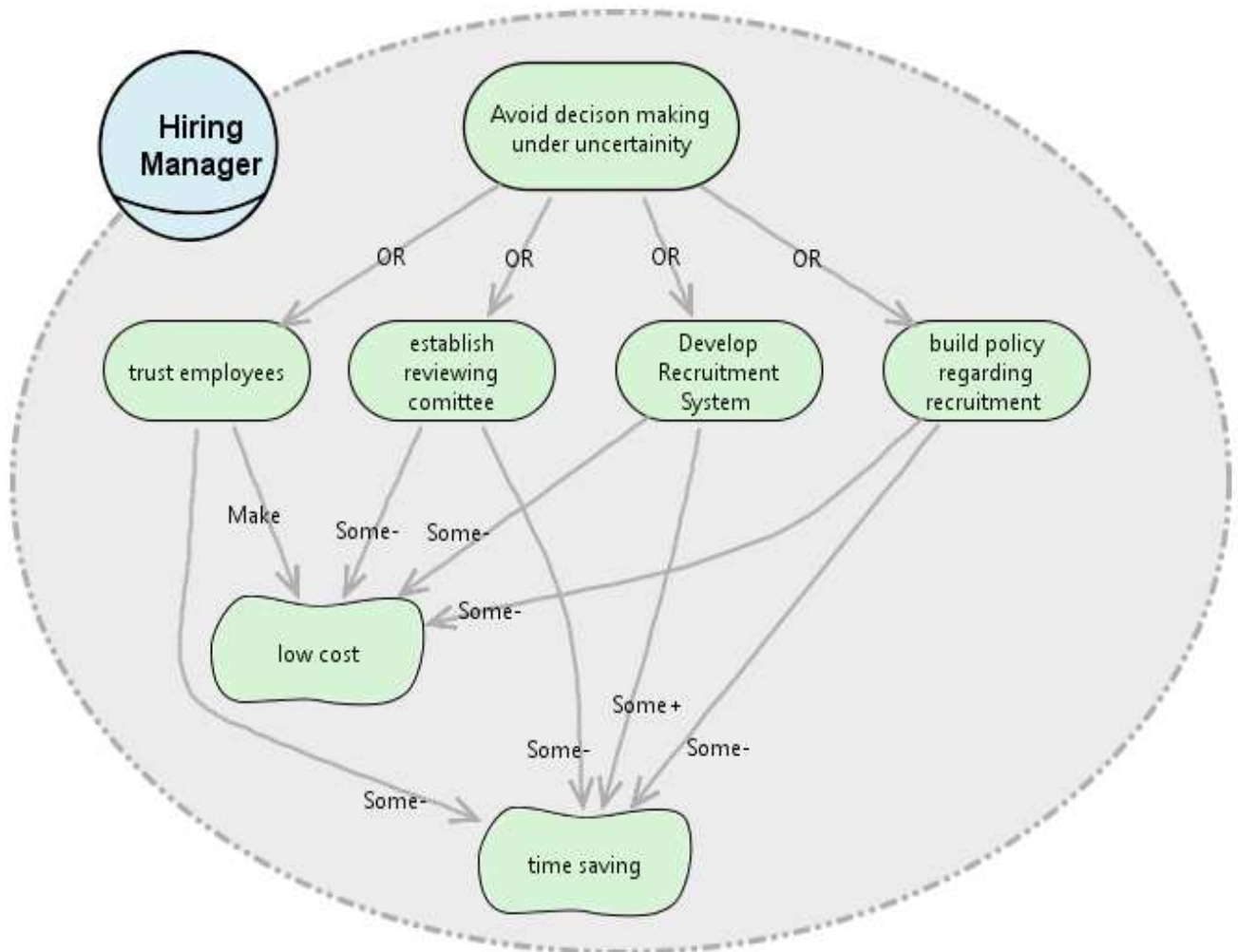
Figure 4 Goal Model for Hiring Manager

4. Top managers

The main goal of top managers is to manage reports and decisions which incorporate:

> ➢ Less time to calculate and generate reports.
> ➢ Manage recruitment process and approve the result.

Pictorial representation of this goal will be shown below.
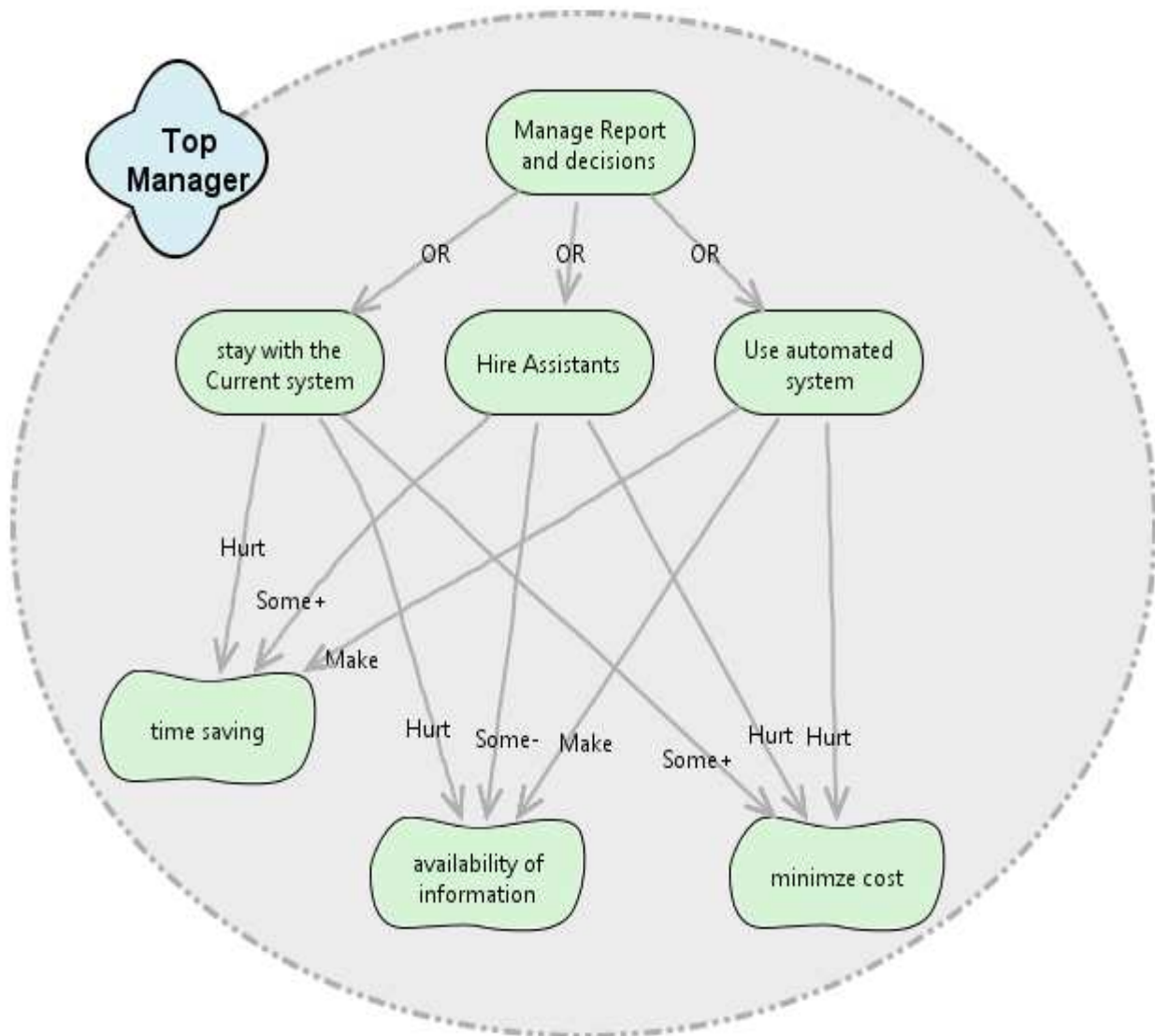
Figure 5 Goal Model for Top Manager

5. Job Applicants

The main goal of applicants is getting vacancy information easily and the goal modeling for this problem will be shown as follows.
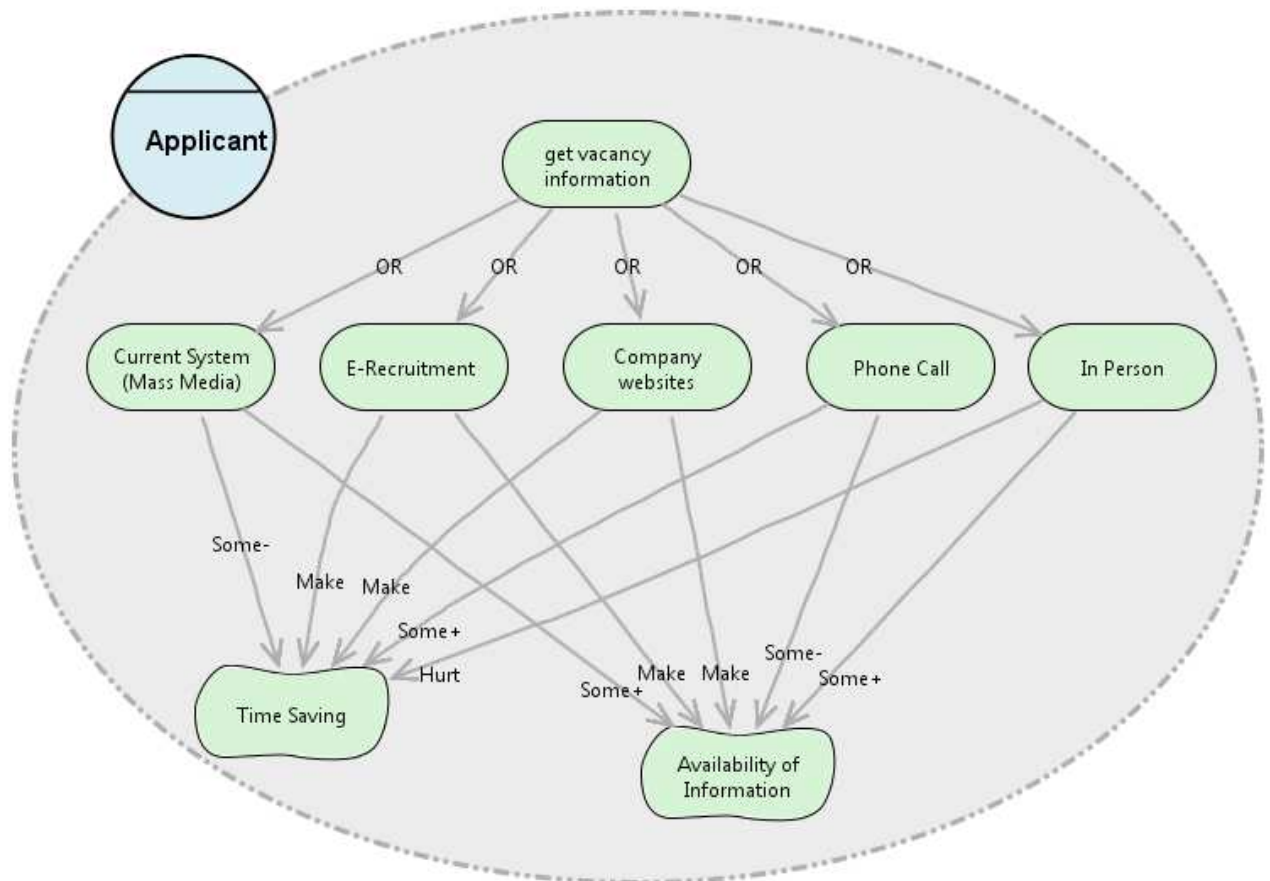
Figure 6 Goal Model for Job Applicant

4. Description of alternatives

In this section as we have seen above we will see three main possible alternative solutions and their sub solutions to solve company's current problem regarding employee recruitment process are described as follows.

1. **Stay with the current system**
    This alternative state that the company can stay operating on the current manual system to manage reports , decisions, requests for the new candidate , selecting best candidate, provide vacancy information and generally to manage applicant's information and recruitment procedures.

2. **Hire more staff members**
    The company can consider the option of hiring more recruitment staff members as supporting staff for running recruitment process and managing reports, decisions and selecting best candidate. This alternative will reduce the time spent on analyzing the data, registering cluster of applicants and all tasks that should be done by this unit by dividing the task among the assistants.

3. **Automate and manage the existing system**
    The main goal is to automate and manage recruitment operations in order to increase efficiency on managing reports, avoiding decision making under uncertainty, reducing delay in requesting for the new candidate, selecting best candidate, on current working procedures and facilitating applicants on getting vacancy information.

Automation is required because time is very essential for stakeholders. Especially recruitment staff wants to automate all tedious jobs like Preparing the job description and person specification, Locating and developing the sources of required number and type of employees (Advertising etc.), Short-listing and identifying the prospective employee with required characteristics, arranging the interviews with the selected candidates, Conducting the interview and decision making and etc. Automation also helps to reduce manual errors and increase accuracy. Basically automation of short listing candidates and selecting the best potential applicant that could help in achieving its goals are required. Management involves speeding up recruitment procedures and improves overall management of applicant's records. Automating the system can be achieved by the following sub-alternatives:

4.1 Buy software
Buy already developed recruitment management software from the market. Buying the software can be achieved by using **customizable software** or **buy off –the-shelf** products.
4.2 Build in house product
Hire software developers and system analysts to do the requirement analysis and implement the system.
4.3 Outsourcing to a third party vendor
Have a contract with software developing firm to do the requirement analysis and implement the system.

4.4 E-recruitment

It is the process of personnel recruitment using electronic resources, in particular the internet. Companies and recruitment agents have moved much of their recruitment process online so as to improve the speed by which candidates can be matched with live vacancies. Using database technologies, and online job advertising boards and search engines, employers can now fill posts in a fraction of the time previously possible. Using an online e-Recruitment system will save the employer time as usually they can rate the eCandidate and several persons in HR can independently review eCandidates.

4.1 Goal Analysis Criteria

The criterion used for analyzing the alternatives depicted as follows:

➢ **Low cost :**

The decrease in cost of the recruitment is extremely valuable for the company since it allows spending the savings from the recruitment process to other activities.

➢ **Accuracy :**

Accurate calculation is very much needed by the company to avoid unfair short listing and final evaluation of employment process.

➢ **Availability of information :**

Company wants to avoid delay of information regarding recruitment management when requested.

➢ **Time saving :**

Company wants to avoid wastage of time in hiring employees and processing of data. Thus this criterion is essential to analyze the proposed alternative solutions.

➢ **Fairness of Selection:**

An ineffective or biased working environment cannot only affect the managerial decision of the company but could also hinder the output and progress of the business by taking wrong decision; therefore it is very important for the company to make decisions based on facts.

Table 1 Goal Analysis Criteria

Select best candidate for the company	Save Time	Minimize Cost	Availability of Information	Accuracy	Fairness of selection
Keep Current System	**(- -)** since it is manual system, hiring a new candidate takes longer time and difficult to finish the evaluation with in short period of time.	**(+)** The current system engages several hiring teams, though it has some cost.		**(--)**Calculating marks is made by hand manually ,there might be miscalculations while short listing candidates	**(--)** As it is based on paper work probably there could be unfair (biased) selection of candidates. And it affects the decisions making.
Recommended Candidates	**(++)** Since candidates came to the company with a recommendation through a respected colleague or hiring manager from different company, it is not a time taking process.	**(++)** As of the company's understanding the recommended candidate is already a qualified candidate so that it has no cost of hiring process.		**(--)**The current system engages several hiring teams, though it is still manual work so that there could be miscalculations.	**(--)**Still it is based on paper work so that probably there could be unfair (biased) selection of candidates. And it affects the decisions making.
Automation	**(++)** As data is processed electronically using software it minimizes time.	**(--)**Using software have ongoing maintenance cost besides the cost of the software.		**(++)** This alternative can calculate the data accurately; there will be no error on calculating cumulative results of the applicants.	**(++)** As data is processed electronically using software it minimizes being biased or increases fairness of selection.
Hire More employees	**(+)** Hiring additional employees reduce time on analyzing data by dividing the tasks among the assistants.	**(--)** Hiring more staff member could have ongoing salary expense and paying a qualified person every month is expensive.		**(+)** By this alternative the company can reduce errors but still as it is performed by human there could be error.	**(-)** when the number of staff members increase unfairness might decrease somehow.

Request for the new Candidate					
Automation	(++)It is time saving because information is processed digitally.	(--)Using software might have ongoing maintenance cost in addition to the cost of the software.	(++)Data's are stored in digital form and it's always available when it is needed.		
Use E-mail	(++) Electronic mail is a time saving technology which supports instant communication or message transfer.	(-) Email use is a hidden cost for many companies.	(+) Company can decide to use such technology which provides data availability 24/7.		
Current System	(--)The current system consumes much of time due to bureaucratic paper work.	(++)The current system was deployed long days before therefore it has no deployment cost this time but there is some a running cost.	(-)Candidates dossier may be misplaced or some of the file may be missing due to negligence therefore availability of information is not granted.		
Avoid decision making under uncertainty					
Establish reviewing committee	(-)To avoid uncertain decision, forming reviewing committee may take several time.	(-) Establishing committee might have a small amount of cost.			
Develop recruitment system	(+) This alternative saves time of managers as the reports are done by the software and helps them to make certain decisions since it is possible to cross check information easily.	(--) It is expensive because the maintenance and licensing is costly.			

Trust employees	**(-)** It is a bit time consuming alternative as it is based on the current system which is performed manually.	**(++)** As it is staying with the current system and it is already in operation so that this system has no cost.			
Build policy regarding recruitment	**(-)**It is still time consuming somehow as it is based on the current system which is performed manually.	**(-)**This alternative has cost because while building policy the company might need consultants who has expenses in the beginning and may be ongoing.			
Manage Reports and decisions					
Stay with the current system	**(--)**It is a time consuming alternative as it is based on the current system which is performed manually and tiresome.	**(+)** As it is staying with the current system and it is already in operation so that this system has no cost.	**(--)** As it is paper work this alternative does not assure that reports will be always available at hand when required.		
Hire Assistants	**(+)** This alternative might take little time because the task will be done with more work forces.	**(--)** This alternative has a high cost because the salary and other allowances are ongoing.	**(-)** somehow doesn't not assure that reports will be always available at hand.		
Use Automated system	**(++)** This alternative saves time for the managers as the reports are done by the software system.	**(--)**Using software might have ongoing maintenance cost in addition to the cost of the software	**(++)** Availability of information is ensured and the data is presented in a way the company required it to be.		

Get vacancy Information					
Stay with the current System	**(-)** since vacancy is announced using different communication medias getting vacancy make take some time based on the media which is used.		**(++)** In this alternative there is availability of information for instance we can use newspaper.		
E-recruitment	**(++)** E-recruitment is a time saving technology with which we can see the vacancy any time where there is internet connection.		**(++)** An applicant can use such system which provides data availability 24/7 if the company uses this system.		
Use Company's website	**(++)** website is a time saving technology with which we can see the vacancy any time where there is internet connection.		**(++)**Availability of information is ensured by the company.		
Phone call	**(+)** This alternative is a bit time consuming since applicants can make call any time on the working hours of the company.		**(-)** in this alternative a person might not get full information.		
In person	**(--)** It is a time taking process to go to information desk to get vacancy information.		**(+)** to some extent the availability of information is good.		

Under Automation alternative we have sub alternatives; hereafter tabular goal analysis criteria will be shown.

	Build In house software	Out Sourcing	Buy off-the-shelf	E-recruitment
Minimum cost	Building in house product will also cost high if the developers/analysts could not complete the project implementation on time. The maintenance of the software is low but the wages/salary costs will be high.	Delegating other company to build the product will also does not cost high initially but the maintenance will cost high.	Buying off-the-shelf product might not fulfill all the company needs and also it is expensive because the maintenance/ customization and licensing per year might cost too high	Using E-recruitment might not solve all the needed procedures of the hiring process hence the company has to hire recruitment staffs in addition to use this technology, therefore it is costly.
Time saving	This alternative also saves time as any analysis of data is done by the software.	Time-saving, as any kind of analysis which could be analyzed with the system are done by the software.	This alternative saves time of recruiting process because analyses are done by the software.	Time saving alternative as it is internet based it process under good internet connection condition.
Accuracy	As this alternative is a computerized system, there is no error in calculating candidate's evaluation.	As this alternative is also a computerized system, there is no error in calculating candidate's evaluation.	As this alternative is a computerized system, there is no error in calculating candidate's evaluation.	E-recruitment may generate many unqualified candidates and may not increase the diversity and mix of employees.
Availability of Information	As it is an automated system, it will also provide availability of the information	Availability of information is ensured and the data is presented in a way the company required it to be.	Company can decide to buy such software system which provides data availability 24/7.	As it is an automated system, it will also provide availability of the information but not all of the company information.

Fairness of selection	An ineffective or biased working environment cannot only affect the managerial decision of the company but could also hinder the output and progress of the business by taking wrong decision; therefore it is important for the company to make decisions based on facts and this alternative provides this service to the company.	This alternative ensures fairness of selection.	This alternative ensures fairness of selection.	This alternative ensures fairness of selection.

4.2 Feasibility Study

Feasibility study is a study that determines whether a proposed system is technically, financially, and operationally viable. The need of this study is to identify and demonstrate the best alternative. Cost benefit analysis and other feasibility studies such as technical, operational and schedule feasibility are applied for the identified alternatives. Based on that a score from 0 to 100 is given for all the alternatives and the one that gets the higher score is recommended as a solution.

1. Economic Feasibility:

Economic feasibility   or cost benefit analysis helps the company to determine the benefit and savings that are expected from the proposed system and compare it with the cost the company incurs.

Alternative 1 - Staying with current System

Costs: This alternative uses different resources; mainly manual process requires more staff members and the operation is totally based on paper work. The company could go through different steps to perform the recruitment and selection process since the tasks are done manually, therefore it costs a lot.

Benefit: The Company does not gain any benefit from the current system instead it loses a lot of money due to inaccurate information; hire unqualified staff, loss of data, lack of ease of accessibility of data.

Cost-benefit Analysis: The amount of money they lose in 6 years is € 332,575.86 assuming that a company hires one employee per year which is not feasible economically.

Alternative 2- Hiring more Recruitment Staff

Cost: Choosing this alternative is better than the first one but it is still expensive for the company since the salary of the newly recruited Staff is an additional cost for the company.

Benefit: this alternative can improve some of the processes in recruitment and selection process such as attracting candidates, screening, interviewing but still does not alleviate the problem of accuracy since it is still handled by human.

Cost Benefit Analysis: The amount of money they loses in 6 years is € 290,697.92 which are still not economically feasible for the company.

Alternative 3 Automation: under this alternative there are four sub alternatives.

Alternative 3.1 Buying Employee Recruitment Management System

Cost: The main rationale for buying software is lower initial costs and a reduced time to deployment. Ongoing per user licensing and maintenance costs until retirement may make COTS (commercial off the shelf) a very expensive option over the long term.

Benefit: this alternative saves management time and increase accuracy of selection of candidates and it assures the fairness of the selection.

Cost Benefit Analysis: The Return on Investment (ROI) for 6 years will be 40% and the payback period for this alternative is approximately 5.5 years.

Alternative 3.2 Develop In House Customizable Employee Recruitment Management System.

Cost: The cost for this alternative includes labor, administrative and maintenance costs and which is less than the cost of alternative 3.1.

Benefit: using this alternative will give more benefit than the above alternative.

Cost Benefit Analysis: The Return on Investment for 6 years will be 70% and the payback period is 2.9 years.

Alternative 3.3 Outsourcing

Cost: The costs involved in this alternative are the same with alternative 3.2 except the contract cost and maintenance cost.

Benefit: Benefit of this alternative is slightly less than from alternative 3.2.

Cost-Benefit Analysis: The Return on Investment for 6 years will be 48% and the payback period is approximately 6 month which is shortest of all but it does not satisfy all the requirements of the company.

Alternative 3.4 E-Recruitment

Cost: It is one form of automation using internet technology but it is not the same as other automation alternatives basically both applicants and the company communicate through internet for receiving candidate documents, interviewing candidate, giving exam, screening and this all are done by the criteria which is set manually first or by paying for other jobsites for posting the vacancy.

Benefit: The benefit for this alternative is higher than alternative 1 and 2 but less than other alternatives.

Cost Benefit Analysis: The return on investment for 6 years will be 64% and the payback period is approximately 2.5 years.

2. Technical Feasibility

Technical feasibility detects the technology and the resource required by the system is available or not. We check whether our alternatives are feasible in terms of the current technology and manpower needed for the company.

The first two alternatives are not technically feasible because it is a manual recruitment management system in which there is no application of technology and recruitment staff needs not to be a technical expert because of this reasons the two alternatives are given a score of 35%.

The other four alternatives use the current latest technologies which is matured enough and highly available. Company does not need in-house expertise if it buys off the shelf product. So for this reason score 90% is assigned for this alternative. The company allocates enough expertise for alternative 3.2 so we give 95% score and for Alternative 3.3 we give 90% score since the company will outsourced all or parts of the recruitment tasks to an outside service body. And lastly for alternative 3.4 it is assigned a score of 85% since the company can use for example his own website for advertising the vacancy or other job sites.

3. Operational Feasibility

Operational Feasibility emphasize on the issues like whether the current system or the system to be developed will be used by the company staff members.

Alternative 1

The current system used by the company is time consuming and error prone and not effective as stated in the problem of the existing system. So it makes it Operationally Infeasible and assigned a score of 35%.

Alternative 2

Hiring more recruitment staff reduces the workload for staff members but still problems like accuracy and error still persists. So it makes it operationally infeasible and assigned a score of 40%.

Alternative 3

Automating the system comes with the benefit from operation perspective in which it reduce cost of hiring, saves management time, gives accurate and fair selection of high qualified candidates. Alternative 3.1, 3.2, 3.3 and 3.4 assigned a rank of 80%, 90%, 75%, and 70% respectively.

4. Schedule Feasibility

Schedule Feasibility shows the estimated time to complete the project.

Alternative 1: Staying with the current system does not require any time so it is assigned a score of 100%.

Alternative 2: Hiring more recruitment staff can take up to 1 month duration. Based on this fact this alternative is assigned a score of 80%.

Alternative 3: Alternative 3.1 takes no time since it is a readymade software system so it is assigned a score of 100% and Alternative 3.2 has a phase of requirement gathering, analysis and Design and implementation of the system so it takes up to 6 months to develop the system so it is assigned a score of 70%. The other alternatives are assigned a core of 75% and 70% respectively.

4.3 Evaluation of Alternatives

Description	Wt	Stay with the current system	Hire More Recruitment Staff	Buy off the shelf product	Build in house customizable software	Use Recruitment Process Outsourcing	Use E-Recruitment
Economic Feasibility Detailed calculations	30%	Score: 30 See Appendix A	Score: 40 See Appendix A	Score: 70 See Appendix A	Score: 80 See Appendix A	Score: 70 See Appendix A	Score: 75 See Appendix A
Cost Incurred		€ 98,365.43	€ 136,816.20	€ 191,138.11	€ 188,761.80	€ 197,839.43	€ 97,096.00
Payback Period		NA	NA	5.5 year	2.9 year	6 month	2.5 year
ROI:		-	-	40%	70%	48%	64%
Technical Feasibility	30%	35	35	90	95	90	85
Operational Feasibility	30%	35	40	80	90	75	70
Schedule feasibility	10%	100	80	100	70	75	70
Total Ranking:	100%	40	42.5	82	86.5	78	76

Table 2 Feasibility Analysis Matrix

4.4 Recommendation

All possible alternatives for solving the problem of the company were analyzed to choose the better one. We conduct feasibility study for choosing the best alternative. Among the alternatives at hand, automating the current recruitment and selection process brought significant benefits while the others failed to do so. Some of the benefits are better time management, reduce cost of hiring, selecting the best qualified candidate and fast report generation etc. Thus we recommend the company to choose Alternative 3 i.e. automating the system. And considering the score of each alternative, the best possible automated solution will be Alternative 3.2 which is to build **In-house customizable software**.

5. The Solution

5.1 Tactical Goal Analysis

Tactical goals of stakeholders are activities which give them support to achieve their strategic goals. Under this section a strategic goal model of stakeholders will be further explained and expanded to incorporate the tactical goals. And these models are used to show how stakeholders can meet their desired goals using the chosen alternative that is automated system.

Select best candidate

The major task and responsibility of the recruitment unit is to hire best candidates to the company. Therefore in order to satisfy the strategic goal (Select best candidate), the following tactical goals should be satisfied:

- ✓ Applicant registration should be made
- ✓ The system will filter out short listed candidates according to the criteria set.
- ✓ update the entire assessment process
- ✓ Notify list of short listed candidates for hiring manager
- ✓ Send e-mail to all shortlisted candidates. And the two tactical goals "retrieve short listed candidates" and "update assessment process" has positive contribution to the strategic goal select best candidate.

There should be some means of advertisement to get registered for best competitive applicants who meet all the requirements of the position posted, thus the recruitment unit should prepare a well-organized vacancy announcement which contains the needed professional skill, experiences, certificates, special skills and some other requirements depending on the nature of the vacant position and post the vacancy on the company website. Hence the tactical goal called "Applicant registration" achieved by the three tactical goals such as person specification, job description and post vacancy. The post vacancy tactical goal has a positive contribution to the applicant's strategic goal called "Get vacancy information". Selecting best candidate using system has a positive contribution to strategic goal "Avoid Decision Making under Uncertainty".

The following goal models depict strategic and tactical goals of select best candidate for the company.
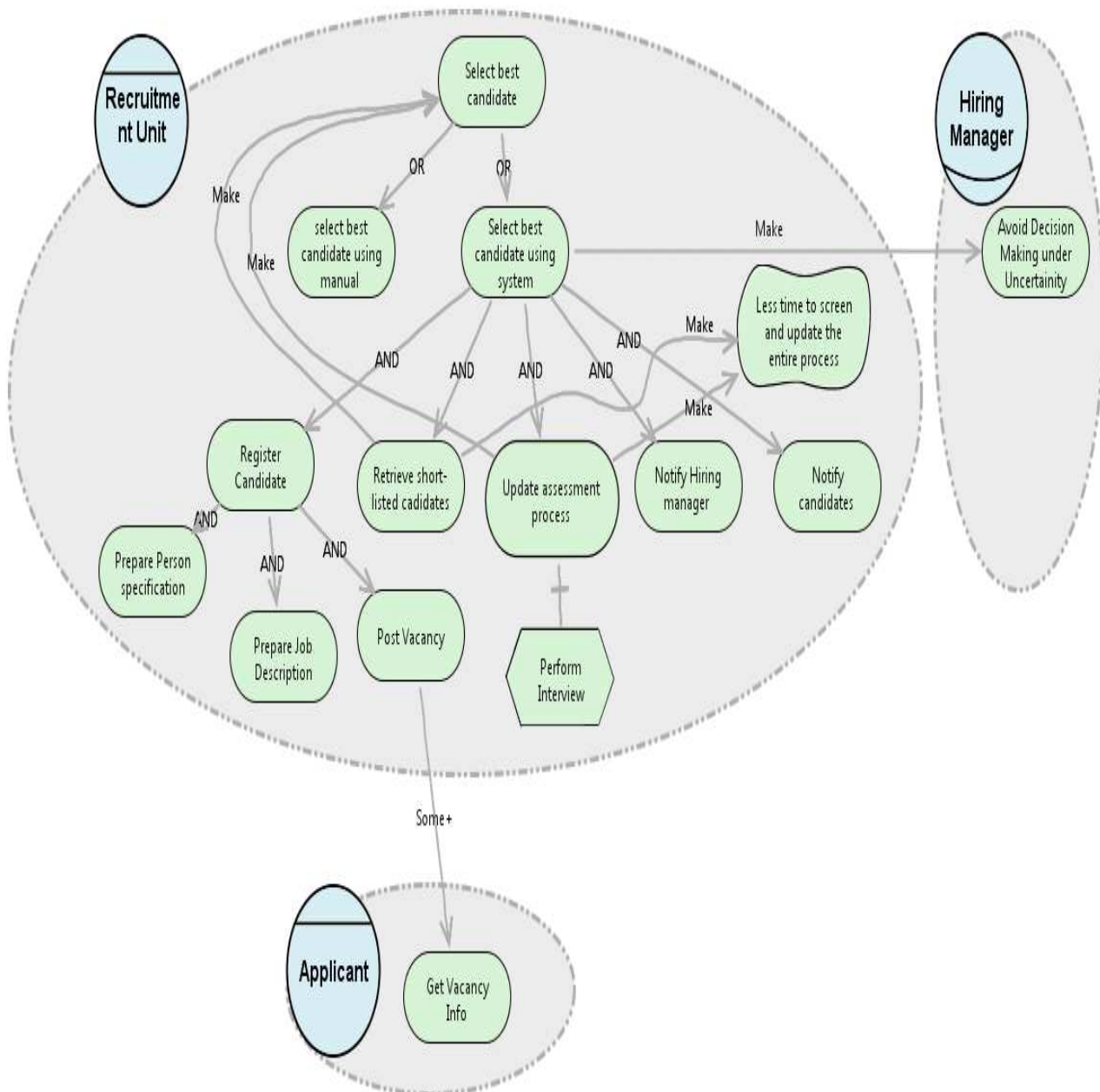
Figure 7 Tactical Goal Model for select best candidate

The following goal models depict strategic and tactical goals of manage candidate.
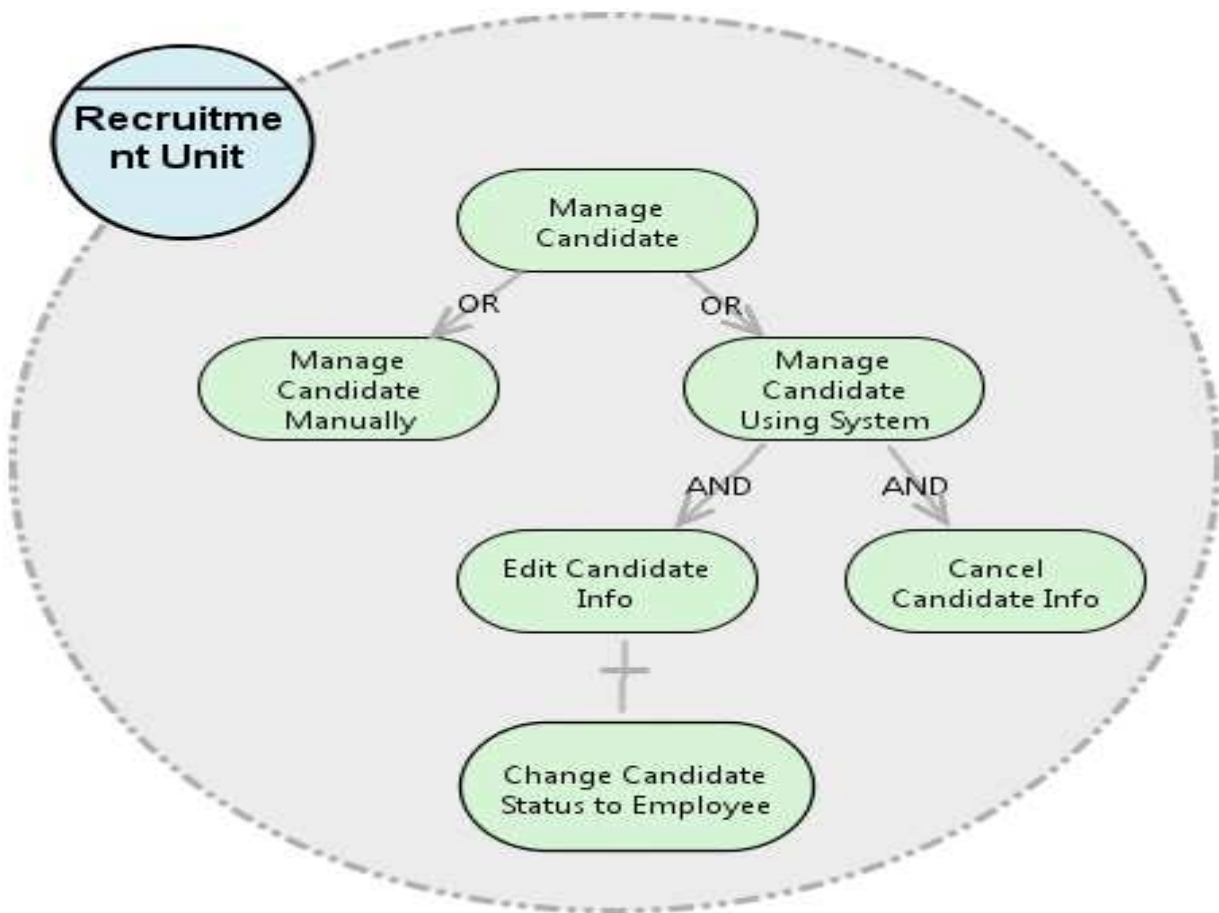
Figure 8 Tactical Goal Model for Manage candidate

Request new candidate

Departments request candidates when there is a vacant position within the department. Before requesting a new candidate the department head should do the following checking's:

1. Can the existing working employees handle the activities of the vacant position?
2. Is there any means to merge the vacant position with other similar activities?

And when the department head quite sure about the need for a new employee to cover the vacant position, therefore in order to achieve the strategic goal "request for new candidate" the department head sends employee requisition to hiring manager for approval. Here checking whether the vacant position can be handled by the existing employees and sending requisition are two tactical goals which satisfy the achievement of "request for new candidate" strategic goal. To send request to the hiring manager the department head should specify need justification or do nothing if the problem is visible. Specifying need justification tactical goal fulfills "send requisition to hiring manager for approval" tactical goal. To check whether the vacant position duties can be fulfilled by the existing employees the department head can view reports to see the workloads of the employees," View work load report" tactical goal achieved by two tactical goals such as "select report criteria" and "generate report" in order to have clear idea about how employees are overloaded.

The following goal models depict strategic and tactical goals of "request for new candidate" which could be raised from different departments of the company.
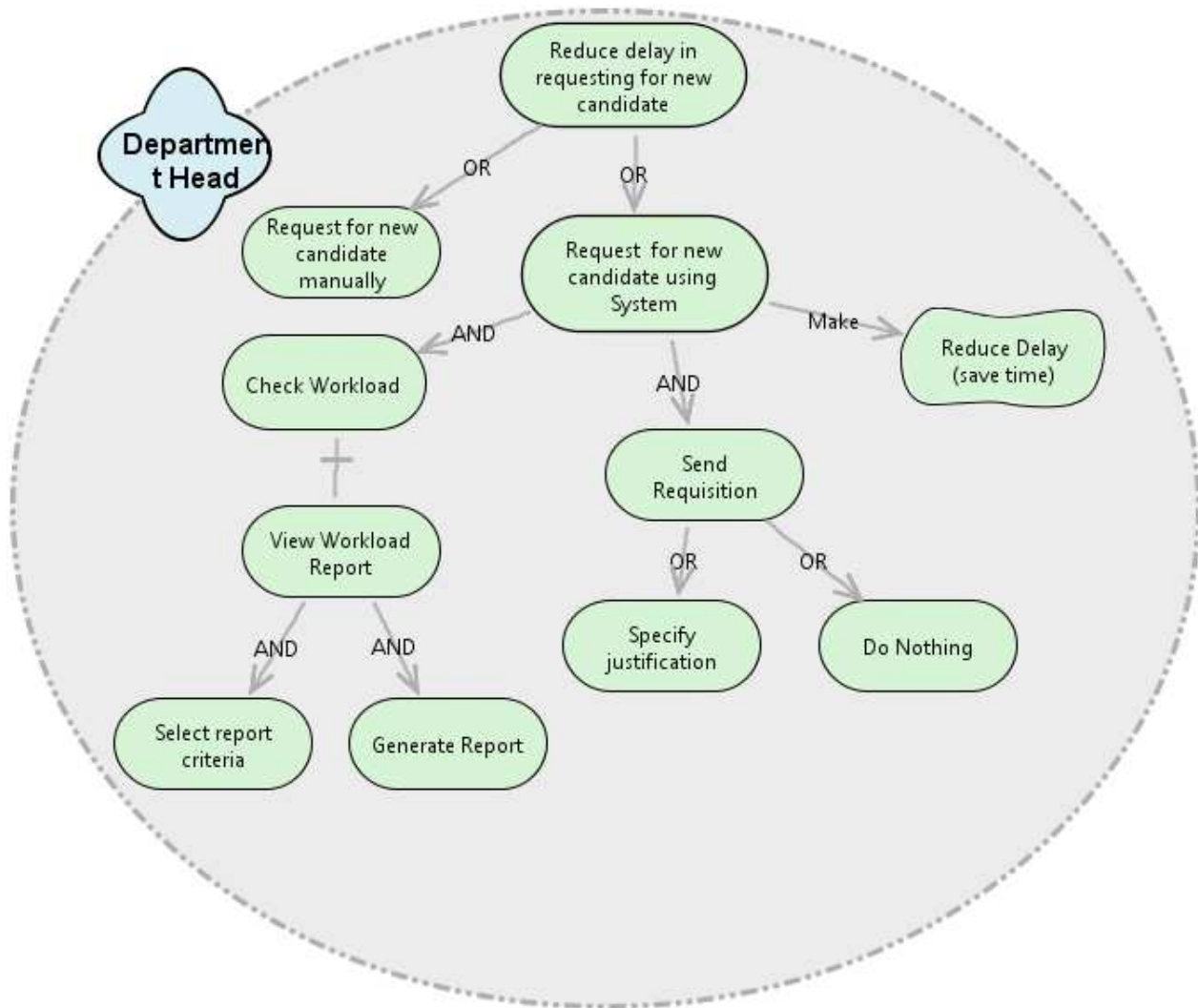
Figure 8 Tactical Goal Model for Request new candidate

Manage reports and decisions

Decision-making is one of the defining characteristics of leadership. Making decisions is what managers and leaders are paid to do. In the company top managers make decisions based on different activities that have been performed, among the activities the main activity which needs decision making is regarding recruitment process. A major part of decision making involves the analysis of a finite set of alternatives described in terms of some evaluative criteria. In the following goal decomposition the strategic goal "Manage reports and decisions" achieved by the following two activities:

- ✓ After candidates are selected and approved by the hiring manager, hiring manager should recommend candidates in order to get approval from top manager.
- ✓ Top managers view notification in order to be informed about the recruitment process as well as review recruitment. And they can see selection report based on different criterion to know how the recruitment process has been processed.
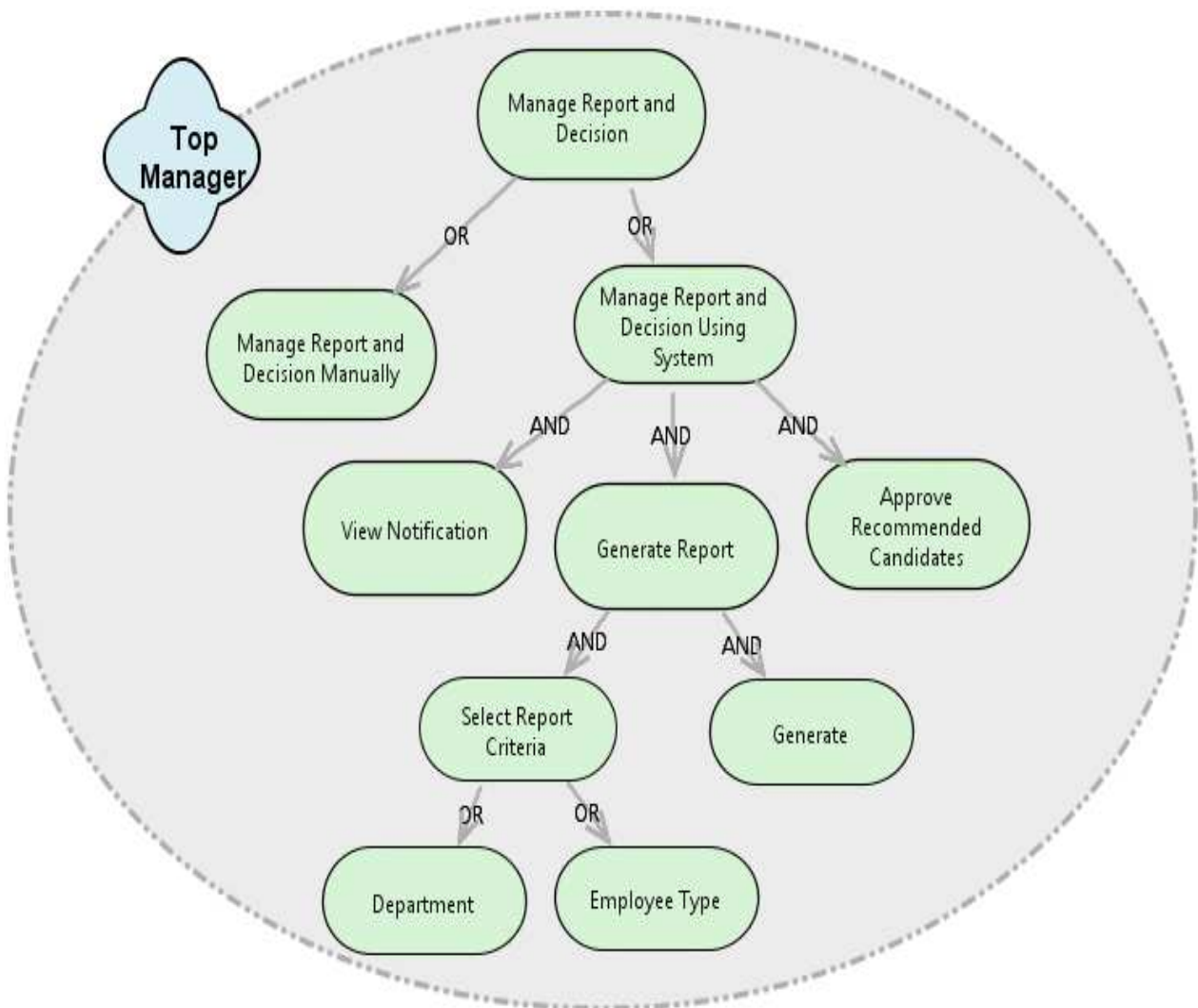
Figure 9 Tactical Goal Model for Manage reports and decisions

Avoid decision making under uncertainty

This is the responsibility of hiring managers to make the best decision while hiring candidates for the company. Decision-making is a distinctly human activity but there might be corruption since the hiring process is performed by several employees who are working on recruitment process. In order to avoid decisions which arrive at a solution that ends uncertainty or dispute we use automated system which could avoid decision making under uncertainty. These enhancements to the decision making process will enable people to make better decisions in less time and with lower costs. To achieve the strategic goal called "Make decision on selected candidates" the hiring manager should view report about recruitment process, view final ranking, prepare minute and recommend candidates for approval, thus recommendation will be send to top managers through notification and those activities are tactical goals that supports the decision making. "Prepare minute" and "recommend candidates for approval" tactical goals have positive contribution to strategic goal called "manage reports and decisions" by top managers.
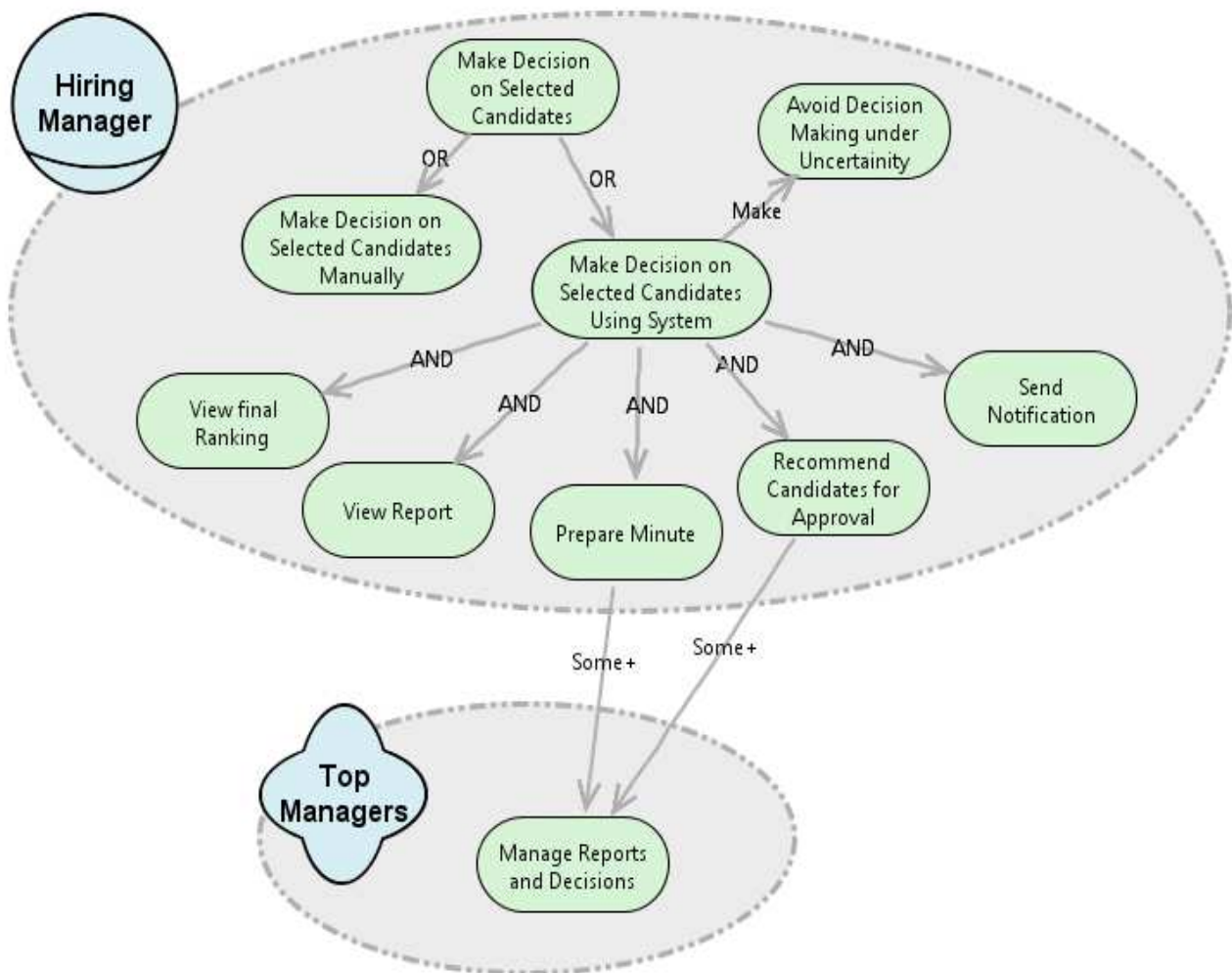
Figure 10 Tactical Goal Model for Avoid decision making under uncertainty

Get Vacancy Information

Applicants get vacancy information through the company's website; to achieve the strategic goal (Get vacancy information) an applicant should do the following activities or in other word should satisfy the following tactical goals.

- ✓ Authentication should be made(logged in)
- ✓ The applicant has to search the available vacant positions (search job)
- ✓ View list of job posts(view available vacancy)

In order to get vacancy information an applicant has to search job and view available vacancies, thus the two tactical goals "search job" and "view available vacancy" has positive contribution to strategic goal "Get vacancy information".

Get vacancy information using system strategic goal has a positive contribution to get hired goal .Before getting hired an applicant has to do the following tasks:

- ✓ Register for the application (create account)
- ✓ Apply for job
- ✓ See status.
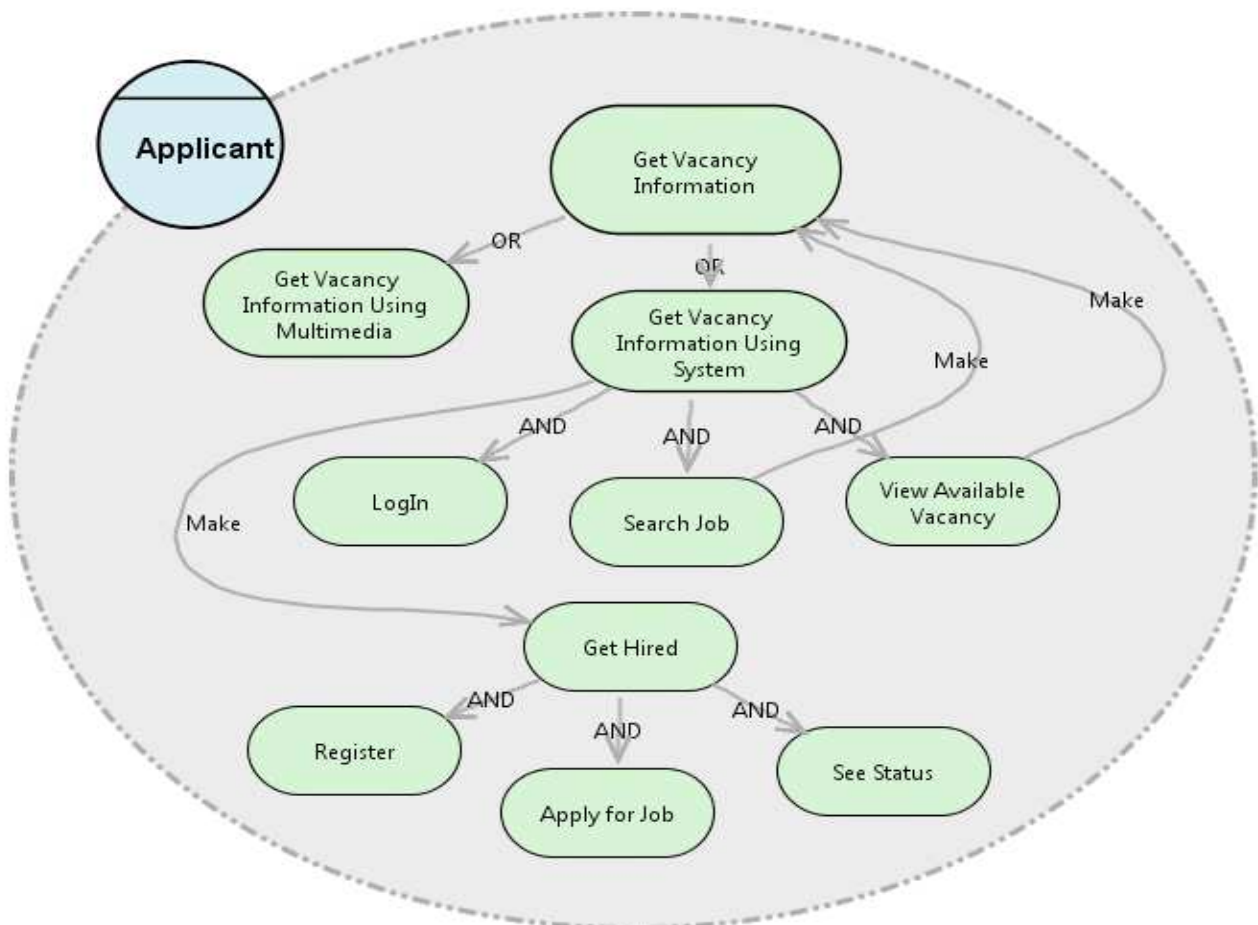
Figure 11 Tactical Goal Model for Get Vacancy Information

5.2 Use Case Diagrams

A use case is a list of steps, typically defining interactions between a role (known in UML as an "actor") and a system, to achieve a goal. The actor can be a human or an external system. Use case diagram depicts functionalities of the system a given user can perform to accomplish a task and meet his/her goal. In other words the diagram shows the interaction between the system and the user of the system. The main tasks performed by recruitment unit are:-
NB. Here applicant and candidate might be used interchangeably.

Use Case ID:	• **SUC-001**
Use Case Name:	• **Register**
Actors:	• **Applicant**
Description:	This use case is used to create account for application.
Trigger:	• Vacancy post
Preconditions:	• User has been authenticated
Normal Flow:	1. The user selects create Applicant option from main page. 2. The system displays create application page. 3. The user fills all necessary information and asks the system to save. 4. The system validates the entry. 5. The system saves the entry.
Post conditions:	Applicant information is added.
Alternative Flows:	1.4.1. The entry is not valid 1.4.1.1. The system displays error message and notifies the error sources. 1.4.1.2. The User corrects data entry. The process continues at step 5 of the normal flow
Exceptions:	• If any execution error happened due to database connection which is not happen frequently our system handle that in a common page.
Priority:	High
Frequency of Use:	Some times when vacancy is available

Use Case ID:	SUC-002
Use Case Name:	Change Candidate Status to Employee

Actors:	• **Recruitment Unit**
Description:	This use case is used to update candidate status for those who have been passed the exam and to add additional information.
Trigger:	• Candidate accepts the offer
Preconditions:	• User has been authenticated
Normal Flow:	1. The user selects Edit candidate option from main page. 2. The system displays all the information. 3. The user modifies the data. 4. The user selects update option. 5. The system validates the entry. 6. The system updates the entry.
Post conditions:	Candidate full information is added.

Alternative Flows:	2.5.1. The entry is not valid
	    2.5.1.1. The system displays error message and notifies the error sources.
	    2.5.1.2. The User corrects data entry.
	
	The process continues at step 6 of the normal flow

Exceptions:	• If any execution error happened due to database connection which is not happen frequently our system handle that in a common page.
Priority:	High
Frequency of Use:	Some times when vacancy is posted and a candidate is selected to be an employee.

Use Case ID:	SUC-003
Use Case Name:	➢ Retrieve short-listed Candidates

Actors:	• Recruitment unit
Description:	In this use case the recruitment unit can retrieve and view short list of candidate who have fulfilled the given criteria.
Trigger:	
Preconditions:	• User has been authenticated
Normal Flow:	1. The user selects retrieve short listed candidates option 2. The system display list of criteria with their corresponding information. 3. The user selects criterion from list of criteria displayed. 4. The user selects View short listed candidates' option. 5. The system displays list of short listed candidates.
Post conditions:	List of short listed candidates will be displayed.
Alternative Flows:	
Exceptions:	• If any execution error happened due to database connection which is not happen frequently our system handle that in a common page.
Priority:	High
Frequency of Use:	Sometimes when there is vacancy post.

Use Case ID:	SUC-004
Use Case Name:	➢ **Update assessment process**

Actors:	• **Recruitment unit**
Description:	This use case is used to update the whole interview and examination results of shortlisted candidates.
Trigger:	
Preconditions:	• User has been authenticated
Normal Flow:	1. The user selects View short listed candidates' option from main page.
	2. The system displays view page together with list of job.
	3. The user selects a job from the list and select view option.
	4. The system displays list of short listed applicants.
	5. The user selects applicant's name.
	6. The system displays all the applicants' info.
	7. The user selects edit option.
	8. The system displays the editable form.
	9. The user modifies some of the applicants' data and selects update option.
	10. The system validates the entry.
	11. The system updates the data and displays a confirmation message.
Post conditions:	Short-listed Candidates info updated.
Alternative Flows:	**4.10.1. The entry is not valid**
	4.10.1.1. The system displays error message and notifies the error sources.
	4.10.1.2. The User corrects data entry.
	The process continues at step 11 of the normal flow
Exceptions:	• If any execution error happened due to database connection

	which is not happen frequently our system handle that in a common page.
Priority:	
Frequency of Use:	Sometimes, when there is vacancy post.

Use Case ID:	SUC-005
Use Case Name:	View final ranking

Actors:	• **Hiring Manager**
Description:	This use case is used to view final ranking of short listed candidates.
Trigger:	
Preconditions:	• User has been authenticated
Normal Flow:	1. The user selects View short listed candidate's option from main page. 2. The system displays view page together with list of jobs. 3. The user selects a specific job from the list and selects rank candidates option. 4. The system displays names of candidates in a rank.
Post conditions:	Final ranking of candidates has been shown.
Alternative Flows:	
Exceptions:	• If any execution error happened due to database connection which is not happen frequently our system handle that in a common page.
Priority:	
Frequency of Use:	Sometimes, when there is vacancy post.

Use Case ID:	SUC-006

Use Case Name:	➢ **Prepare person specification**

Actors:	• **Recruitment unit**
Description:	In this use case the recruitment unit prepares person specification for the vacancy post.
Trigger:	
Preconditions:	• User has been authenticated
Normal Flow:	1. The user selects person specification option from main page.
	2. The system displays person specification page
	3. The user fills the form and selects save option.
	4. The system validates the entry.
	5. The system saves the entry and displays a confirmation message
Post conditions:	Person specification information is added.
Alternative Flows:	**Alternative flow1**
	6.4. The entry is not valid
	6.4.1. The system displays error message
	6.4.2. The user corrects the entry.
	The process continues at step 5 of the normal flow.
	Alternative flow2
	6.2.1. The user selects edit option from person specification page.
	6.2.1.1. The system display list of qualifications with their corresponding information,
	6.2.1.2. The user selects qualification from list of qualifications displayed.
	6.2.1.3. The system populates selected qualifications data on

	the person specification page.
	6.2.1.4. The user modifies qualification data.
	6.2.1.5. The user selects update option.
	6.2.1.6. The system validates the entry.
	6.2.1.7. The system updates the data.
	6.2.1.6.1. The entry is not valid
	6.2.1.6.1.1. The system displays error message
	6.2.1.6.1.2. The user corrects the entry.
	6.2.1.6.1.3. The process continues at step 6.2.1.7 of the alternative flow.
Exceptions:	• If any execution error happened due to database connection which is not happen frequently our system handle that in a common page.
Priority:	
Frequency of Use:	Sometimes

Use Case ID:	SUC-007
Use Case Name:	➢ **Prepare Job Description**

Actors:	• **Recruitment unit**
Description:	This use case is used to prepare job descriptions, which will be the responsibility of the would be employee
Trigger:	
Preconditions:	• User has been authenticated
Normal Flow:	1. The user selects Job Description option from main page.
	2. The system displays Job Description page
	3. The user fills the form and selects save option.
	4. The system validates the entry.
	5. The system saves the entry and displays a confirmation message

Post conditions:	Job description has been made.

Alternative Flows:	**Alternative flow1**
	
	     7.4. The entry is not valid
	
	       7.4.1. The system displays error message
	
	       7.4.2. The user corrects the entry.
	
	     The process continues at step 5 of the normal flow.
	
	Alternative flow2
	
	    7.2.1. The user selects edit option from job description page.
	       7.2.1.1. The system display list of jobs with their corresponding information,
	       7.2.1.2. The user selects job from list of jobs displayed.
	       7.2.1.3. The system populates selected job data on the job description page.
	       7.2.1.4. The user modifies job description data.
	       7.2.1.5. The user selects update option.
	       7.2.1.6. The system validates the entry.
	       7.2.1.7. The system updates the data.
	          7.2.1.6.1. The entry is not valid
	            7.2.1.6.1.1. The system displays error message
	            7.2.1.6.1.2. The user corrects the entry.
	
	The process continues at step 7.2.1.7 of the alternative flow.

Exceptions:	• If any execution error happened due to database connection which is not happen frequently our system handle that in a common page.
Priority:	
Frequency of Use:	Sometimes

Use Case ID:	**SUC-008**
Use Case Name:	➢ **Notify candidates**

Actors:	• **Recruitment unit**
Description:	This use case is used to notify and congratulate the shortlisted candidates and to address the reporting date and time. To accept the company offers the candidate should report in person. Also notification as a form of report is generated for managers about these new candidates so that the top management will take the matter into hand and take measures.
Trigger:	
Preconditions:	• User has been authenticated
Normal Flow:	1. The user selects View short listed candidates' option from main page. 2. The system displays view page together with list of job. 3. The user selects a job from the list and select rank candidates' option. 4. The system displays names of candidates in a rank 5. The user selects the candidates to be notified and selects notify option. 6. The system send e-mail to the selected candidates and displays a confirmation message
Post conditions:	Notification has been sent.
Alternative Flows:	
Exceptions:	• If any execution error happened due to database connection which is not happen frequently our system handle that in a common page.
Priority:	
Frequency of Use:	Sometimes, when there is recruitment.

Use Case ID:	SUC-009
Use Case Name:	➢ Notify Hiring Manager

Actors:	• Recruitment unit
Description:	This use case used to inform hiring manager about the selection result and let him to approve or disapprove the selection.
Trigger:	
Preconditions:	• User has been authenticated
Normal Flow:	1. The user selects View final ranked candidates' option from main page. 2. The system displays view page together with list of job. 3. The user selects rank candidates option. 4. The system displays names of candidates in a rank 5. The user selects the top needed candidates from the list and select notify option. 6. The system sends notification to hiring manager and displays a confirmation message
Post conditions:	List of candidates has been notified to hiring managers.
Alternative Flows:	
Exceptions:	• If any execution error happened due to database connection which is not happen frequently our system handle that in a common page.
Priority:	
Frequency of Use:	Sometimes, when recruitment process have been made.

Use Case ID:	SUC-010
Use Case Name:	➢ View Report

Actors:	• Hiring managers
Description:	The hiring manager needs to view reports on recruitment activity based on different criteria. While verifying, he can also check and find some errors if any exists.
Trigger:	When hiring manager wants to approve or disapprove the recruitment process.
Preconditions:	• User has been authenticated
Normal Flow:	1. The user selects Report option from main page. 2. The system displays reporting page. 3. The user selects reporting criteria's and selects show option. 4. The system validates the entry. 5. The system display reports.
Post conditions:	Hiring managers have seen reports.
Alternative Flows:	
Exceptions:	• If any execution error happened due to database connection which is not happen frequently our system handle that in a common page.
Priority:	
Frequency of Use:	Sometimes, if there is vacancy post and the recruitment process ends.

Use Case ID:	**SUC-011**
Use Case Name:	➢ **Prepare Minute**

Actors:	• **Recruitment unit**
Description:	This use case is used to take notes about the held recruitment process and that would be used as a report by the top managers to make decisions.
Trigger:	
Preconditions:	• User has been authenticated
Normal Flow:	1. The user selects Prepare Minute option from main page. 2. The system displays Minute page. 3. The user fills all necessary information and selects save option. 4. The system validates the entry. 5. The system saves the entry.
Post conditions:	Minute is added.

Alternative Flows:	**Alternative1**
	
	      11.4. The entry is not valid
	
	         11.4.1. The system displays error message
	
	         11.4.2. The user corrects the entry.
	
	      The process continues at step 5 of the normal flow.
	
	Alternative2
	
	    11.2.1. The user selects edit option from minute page.
	    11.2.1.1. The system display list of minute with their corresponding information,
	    11.2.1.2. The user selects specific minute from list of minutes displayed.
	    11.2.1.3. The system populates selected minute data on the minute page.

	11.2.1.4. The user modifies minute data.
	11.2.1.5. The user selects update option.
	11.2.1.6. The system validates the entry.
	11.2.1.7. The system updates the data.
	11.2.1.6. The entry is not valid
	11.2.1.6.1. The system displays error message
	11.2.1.6.2. The user corrects the entry.
	The process continues at step 11.2.1.7 of the alternative flow.
Exceptions:	• If any execution error happened due to database connection which is not happen frequently our system handle that in a common page.
Priority:	
Frequency of Use:	Sometimes when vacancy exists.

Use Case ID:	SUC-012
Use Case Name:	➢ Recommend for Approval

Actors:	• Hiring Manager
Description:	This use case is used to recommend the winner candidates to the top managers for approval.
Trigger:	
Preconditions:	• User has been authenticated
Normal Flow:	1. The user selects View short listed candidates' option from main page.
	2. The system displays view page together with list of job.
	3. The user selects a job from the list and selects rank candidates option.
	4. The system displays names of candidates in a rank
	5. The user selects the top needed candidates from the list

	6. The user selects send recommendation option.
	7. The system sends and displays a confirmation message.
Post conditions:	Selected winners have been sent to hiring managers for approval.
Alternative Flows:	
Exceptions:	• If any execution error happened due to database connection which is not happen frequently our system handle that in a common page.
Priority:	
Frequency of Use:	Sometimes

Use Case ID:	SUC-013
Use Case Name:	➢ Approve Recommended Candidate/s

Actors:	• Top Managers
Description:	In this use case top managers approve the recommended candidates who are accepted by the hiring manager.
Trigger:	When top manager gets notification.
Preconditions:	• User has been authenticated
Normal Flow:	1. The user selects show recommended candidates option from main page.
	2. The system displays recommended candidates page.
	3. The user selects job from the list and selects show recommended candidates option.
	4. The system displays list of candidates.
	5. The user selects the confirmation option.
	6. The system sends the data and display a confirmation message.
Post conditions:	Top managers approve recommended candidates.

Alternative Flows:	
Exceptions:	• If any execution error happened due to database connection which is not happen frequently our system handle that in a common page.
Priority:	
Frequency of Use:	Some times when there is vacancy.

Use Case ID:	**SUC-014**
Use Case Name:	➤ **View Notification**

Actors:	• **Top managers**
Description:	This use case is used for top managers to see notifications that are sent from hiring manager.
Trigger:	
Preconditions:	• User has been authenticated
Normal Flow:	1. The user selects View Notification option from main page. 2. The system displays Notification page. 3. The user selects notifications from the list and selects show option. 4. The system displays notifications.
Post conditions:	Notification has seen by top managers.
Alternative Flows:	
Exceptions:	• If any execution error happened due to database connection which is not happen frequently our system handle that in a common page.

Priority:	
Frequency of Use:	Sometimes

Use Case ID:	**SUC-015**
Use Case Name:	➢ **Search Job**

Actors:	• **Applicant**
Description:	This use case used to search jobs to find job listings based on some criteria set which is performed by the applicants on the company website.
Trigger:	Seek for new job by applicant.
Preconditions:	User has been authenticated
Normal Flow:	1. The user selects List all vacancies option from main page of company's website. 2. The system displays list of currently available vacancies. 3. The user selects based on his interest and select view detail option. 4. The system displays detail information.
Post conditions:	Company's vacancy notice viewed.
Alternative Flows:	
Exceptions:	• If any execution error happened due to database connection which is not happen frequently our system handle that in a common page.
Priority:	
Frequency of Use:	Some times

Use Case ID:	SUC-016
Use Case Name:	➢ Apply for Job

Actors:	• **Applicant**
Description:	This use case is used to apply job for those who are qualified and fulfill the criteria set on the vacancy post. Here basic information, full name and address of an applicant shall be registered.
Trigger:	After completion of account creation or logged in.
Preconditions:	• User has been authenticated
Normal Flow:	1. The user selects show vacancy option from main page of company's website.
	2. The system displays list of currently available vacancies.
	3. The user selects based on his interest and selects view detail option.
	4. The system displays detail information and an apply option.
	5. The user selects the apply option.
	6. The system displays a form to be filled by the user
	7. The user fills all the information and selects save option
	8. The system validates the entry.
	9. The system saves the entry and displays a confirmation message
Post conditions:	Job application has been be made.
Alternative Flows:	**16.8.1. The entry is not valid**
	16.8.1.1. The system displays error message and notifies the error sources.
	16.8.1.2. The User corrects data entry.
	The process continues at step 9 of the normal flow
Exceptions:	• If any execution error happened due to database connection which is not happen frequently our system handle that in a common page.
Priority:	

Frequency of Use:	Sometimes, when there is vacancy announcement.

Use Case ID:	**SUC-017**
Use Case Name:	➢ **Send Notification**

Actors:	• **Hiring managers**
Description:	This use case is used to inform top managers about the finalized recruitment process.
Trigger:	Completion of recruitment process.
Preconditions:	• User has been authenticated
Normal Flow:	1. The user selects Send Notification option from main page. 2. The system displays Notification page. 3. The system displays a form to be filled by the user 4. The user fills the form and selects notify option. 5. The system validates the entry. 6. The system saves the entry and displays a confirmation message.
Post conditions:	Notification has been sent.

Alternative Flows:	**17.5.1. The entry is not valid**
	  17.5.1.1. The system displays error message and notifies the error sources.
	  17.5.1.2. The User corrects data entry.
	
	 The process continues at step 6 of the normal flow

Exceptions:	• If any execution error happened due to database connection which is not happen frequently our system handle that in a common page.
Priority:	
Frequency of Use:	Sometimes when vacancy is available.

Use Case ID:	SUC-018
Use Case Name:	➢ See Status

Actors:	• Applicant
Description:	This use case is used for applicants to view the status of their application process on the web.
Trigger:	Completion of application.
Preconditions:	User has been authenticated.
Normal Flow:	1. The user selects job result option from main page. 2. The system displays view job result page. 3. The user selects jobs from the list and selects show result option. 4. The system displays list of applicants passed and list of applicants failed for that position.
Post conditions:	Applicants result has been shown.
Alternative Flows:	
Exceptions:	• If any execution error happened due to database connection which is not happen frequently our system handle that in a common page.
Priority:	Medium
Frequency of Use:	Sometimes when there is vacancy.

Use Case ID:	SUC-019
Use Case Name:	➢ Generate Report

Actors:	• Top managers and Department Heads
Description:	The top manager and department head needs to view reports on recruitment activity based on different criteria.
Trigger:	Completion of recruitment process.
Preconditions:	• User has been authenticated
Normal Flow:	1. The user selects Report option from main page.
	2. The system displays reporting page.
	3. The user selects reporting criteria's and selects generate option.
	4. The system validates the entry.
	5. The system display reports.
Post conditions:	Reports have been seen.
Alternative Flows:	**19.4.1. The entry is not valid**
	19.4.1.1. The system displays error message and notifies the error sources.
	19.4.1.2. The User corrects data entry.
	The process continues at step 5 of the normal flow
Exceptions:	• If any execution error happened due to database connection which is not happen frequently our system handle that in a common page.
Priority:	High
Frequency of Use:	Sometimes, when there is recruitment.

Use Case ID:	**SUC-020**
Use Case Name:	➢ **Specify Justification**

|	
Actors:	• **Department Head**
Description:	This use case is used for the department head when he/she has to justify why additional human resource is needed for the company.
Trigger:	
Preconditions:	• User has been authenticated
Normal Flow:	1. The user selects Justification option from main page. 2. The system displays Justification page. 3. The user fills notes. 4. The system validates the entry. 5. The system saves the note and displays confirmation message.
Post conditions:	Justification has been saved.
Alternative Flows:	**20.4.1. The entry is not valid** 20.4.1.1. The system displays error message and notifies the error sources. 20.4.1.2. The User corrects data entry. The process continues at step 6 of the normal flow
Exceptions:	• If any execution error happened due to database connection which is not happen frequently our system handle that in a common page.
Priority:	High
Frequency of Use:	Sometimes, when there is a need in human resource.
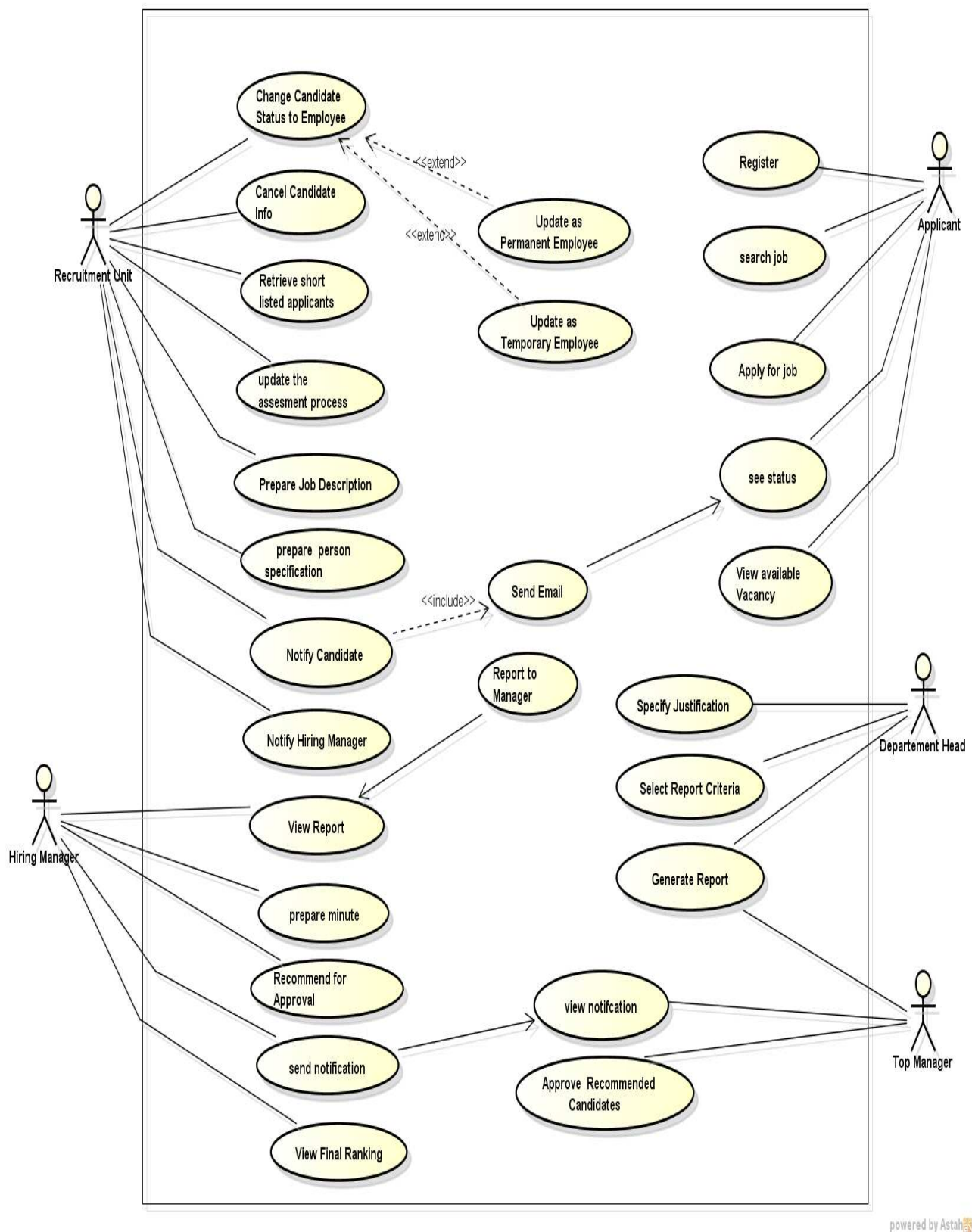
Figure 12 Use case Diagram for Employee Recruitment Management System

5.3 Entities & Relationships - Class Diagram

Class diagram describes the structure of a system by showing the system's classes, their attributes, operations (or methods), and the relationships among the classes. The classes in a class diagram represent both the main objects and or interactions in the application and the objects to be programmed. Bellow, the association among classes and their attribute and operations will be discussed.

Candidate class: This class contains basic information of an applicant. The major attributes are name, status and email. The methods that are hold by this class are:

- ✓ *uploadResume()* method is used to upload documents of the applicant to the system.
- ✓ *serachJob()* method is used to search job lists based on different criteria set.
- ✓ *applyJob()* method is used to perform the application for the job.
- ✓ *registerCandidate()* used to register applicants who has interest on the given vacant position.
- ✓ *getCandidateInfo()* this method helps to get candidates detail information based on selected criteria set mainly by their id.
- ✓ *viewStatus()* this method is used to view status of the candidate to know whether they are passed or not.
- ✓ *updateCandidateInfo()* method is used to edit candidates information.

Recruitment: The methods that are contained in this class are:

- ✓ *selectResume()* this method is used to select good resumes from group of resumes that have been uploaded using some criteria set.
- ✓ announce() method is used to announce the status of the candidates.
- ✓ *viewApplicant()* This method allow to view candidates who are interested to the application.

Job Post Class: The main attributes of this class are category, JobDescription, numberOfCandidate and jobName and this class contains detail information of job post. The methods contained in this class are:

- ✓ *getJobList()* This method is used to show list of jobs which are posted.
- ✓ *insertJob()* In this method available jobs will be inserted.
- ✓ *updateJobList()* In this method some modification can be made.

Contact Info Class: this class holds contact information and has a relationship with Candidate class; the attributes are address, phone and E-mail. The method contained by this class is *getAddress()* which is used to get address of a candidate.

Department: This class contains department information. The attributes which is included in this class is deptName, the methods contained in this class are:

- ✓ *viewPerformanceReport()* this method allows a department head to see performance reports based on different criteria set.
- ✓ *requestCandidate()* this method helps the department head to ask for additional employee/s.

Screening: This class contains a method called *sortCandidate()* which allows the recruitment unit to do screening very easily and two attributes such as screeningType and totalScreening.

Criteria: This class contains attributes such as qualification, cgpa and serviceYear in addition it contains a method called *getListOfCriteria()* which allows to see list of criteria's in order to help applicants to know the required criteria's or qualifications.

Recruitment Unit: The methods contained in this class described below.

- ✓ *viewCandidate()* this method is used to see candidates.
- ✓ *manageInterview()* method manages the interview process and evaluations.

Top Managers: In this class three methods are contained which are:

- ✓ *approve()* method used to approve the given selected candidates.
- ✓ *Disapprove()* method used to disapprove the nominated candidates.
- ✓ *generateReort()* method used to generate different reports based on the given criteria.
- ✓ *viewNotification()* method used to view notification from hiring manager.

Hiring Manager: This class contains methods such as:

- ✓ *approveRecruitment()* method used to approve the selected candidates.
- ✓ *rejectRecruitment()* method used to reject the selected candidates.
- ✓ *sendNotification()* this method notifies top managers about the performed selection process.
- ✓ *generateReport()* method used to generate different reports based on the given criteria.
- ✓ *prepareMinute()* method used to prepare minute about the selection of candidates.
- ✓ *sendRecommendedCandidatesList()* method used to send recommended candidate list to top manager.

Application: This class is an association class of candidate and Job post. In this class one method *isSelectedCandidate()* and two attributes (hireDate and terminationDate) are included.

- ✓ *isSelectedCandidate()* method Used for checking whether a given candidate is selected or not.

Exam and Interview Result: This class contains two attributes called examCode and examResult and One method which is *updateExamResult().*

- ✓ *updateExamResult()* method is used to update exam result of candidates in every step of the process.
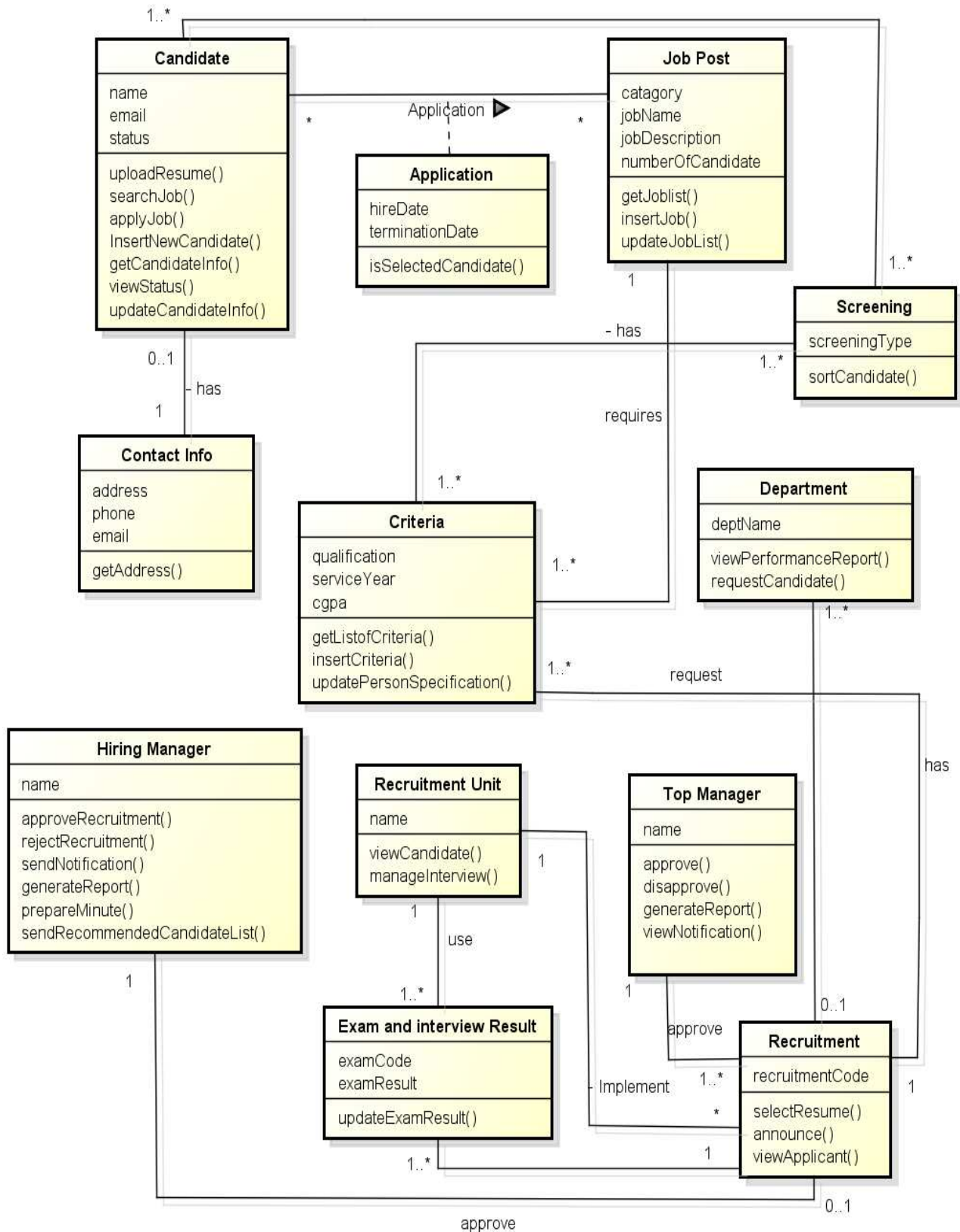
Figure 13 Class Diagram for Employee Recruitment Management System

Table 3 Explanation of Multiplicity in Class Diagram

Classes	Multiplicity	Explanation
Job Post – Candidate	Many- to- Many	Many candidates could see and apply to zero or more job positions.
Job Post – Criteria	One - to - One..Many	A single job post could have so many criteria's.
Criteria – Screening	One..Many- to- One...Many	Based on one criterion one or more screening could be made and one screening could have one or more criteria's.
Candidate – Screening	One...Many- to- One...Many	A candidate could be screened one or many times and in one screening process one or more candidate could be evaluated.
Candidate – ContactInfo	Zero..One to – One	A candidate could have zero or one contact information.
Criteria – Recruitment	One..Many- to- One	A recruitment could have one or more criteria.
Department - Recruitment	One...Many- to- Zero...One	One or more departments request for a recruitments or don't request.
Recruitment – Recruitment Unit	Many –to-One	Many recruitments are handled by one recruitment unit.
Recruitment – Top Manager	One...Many- to-One	One or many recruitments could be approved by a top manager.
Recruitment - Hiring Manager	Zero... One- to – One	There could be no recruitment that need approval or one which needs approval from hiring manager.
Recruitment –Exam and Interview Result	One - to - One..Many	One recruitment could have one or more exam and interview questions.
Recruitment Unit –Exam and Interview Result	One – to - One..Many	a recruitment unit uses one or more exam an Interview results for the ranking purpose.

5.3.1 OCL constraints

OCL is a specification language that uses simple logic for specifying the properties of a system. We try to represent some of the constraints in the recruitment and selection process using the language.

1. **Department** for each instances of the class Department, deptName of the department must be unique.

> **context** Department **inv**
>
> Department.allInstances()->forAll(c2|c1<>c2 implies c1. deptName <>c2. deptName)

2. **Candidate** for each instances of the class **Candidate**, email of the candidate must be unique.

> **context Candidate inv**
>
> **Candidate**.allInstances()->forAll(c1,c2|c1<>c2 implies c1. email <>c2. email)

3. Before registering a candidate, the candidate must not exist in the system.
> **context** c: Candidate:: RegisterCandidate(name,surname,email,address)
> **pre** : c.allInstances() -> forAll(c1 | c1. email <> email)
> **post** : c.allInstances() -> includes(self)

4. A Candidate termination date cannot less than hire date.
> **context** c: Candidate
> **inv**: self.hireDate<self.terminationDate

5. Before registering a candidate, a job specification and job description must exist in the system.

> **context** c:Candidate:: RegisterCandidate(), criteria:Criteria, jobPost:JobPost
>
> **pre**: criteria.qualification->notEmpty and jobPost.jobName->notEmpty
>
> **post**: c.allInstances() -> includes(self)

5.4 Sequence Diagrams

Sequence diagram is used to describe interaction between classes in terms of exchange of message over time. It clearly depicts the sequence of events, illustrate when object are created and deleted, and show concurrent operations. From the identified potential use cases at section 5.2, we select some of the complex ones to show using sequence diagrams for demonstration purpose.

1. **Sequence diagrams for Registering Candidate**
   N.B: The following sequences are needed when the candidate wants to apply for job.
   - ✓ The candidate wants to apply for job and sends criteria.
   - ✓ The system provides list of jobs together with corresponding information using the method *getJobList().*
   - ✓ The candidate selects specific job.
   - ✓ *The* system *r*eturns the specific job information using the method *getListOfCriteria().*
   - ✓ For the corresponding specific job the candidate enters information and select add option.
   - ✓ The system validates the data
   - ✓ The system insert the information in to the database using *insertNewCandidate()* method and reply with a confirmation message.

   Alternative course of Action
   If the entry is not valid
   - ✓ The system notifies the candidate displaying error message.

   Alternative course of Action
   N.B: The following alternative sequence will be applied when the candidate wants to update his/her info.
   - ✓ The candidate enters search criteria to retrieve his/her information.
   - ✓ The system displays the candidates information using *getCandidateInfo()* method.
   - ✓ The candidate modifies the data and selects update option.
   - ✓ The system update the candidate data using *UpdateCandidateInfo()* method and returns confirmation message.
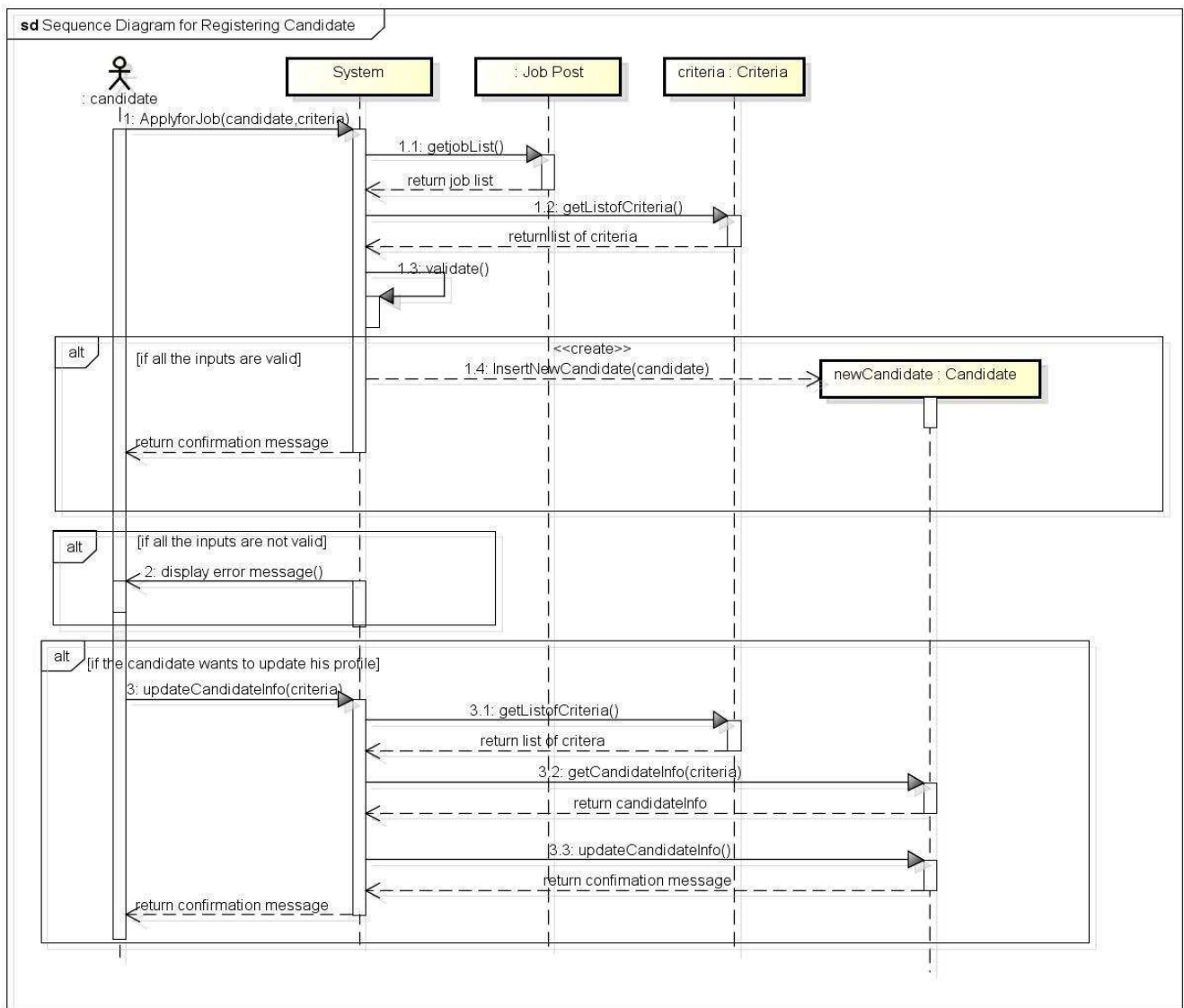
Figure 14 Sequence diagrams for Registering Candidate

2. Sequence diagrams for Update Assessment Process

N.B: This sequence diagram is needed when the recruitment unit wants to update the assessment process.

- ✓ The recruitment unit wants to update the assessment process and selects job list option.
- ✓ The system provides list of job information using *getJobList()* method.
- ✓ The recruitment unit selects a job from the list.
- ✓ The system displays list of candidate's assessment information.
- ✓ The recruitment unit modifies the specific candidate's assessment data and selects update option.
- ✓ The system validates the data.
- ✓ The system updates the candidate information using *updateCandidateInfo()* method and displays confirmation message.

Alternative course of Action
If the entry is not valid
- ✓ The system notifies the recruitment unit displaying error message.
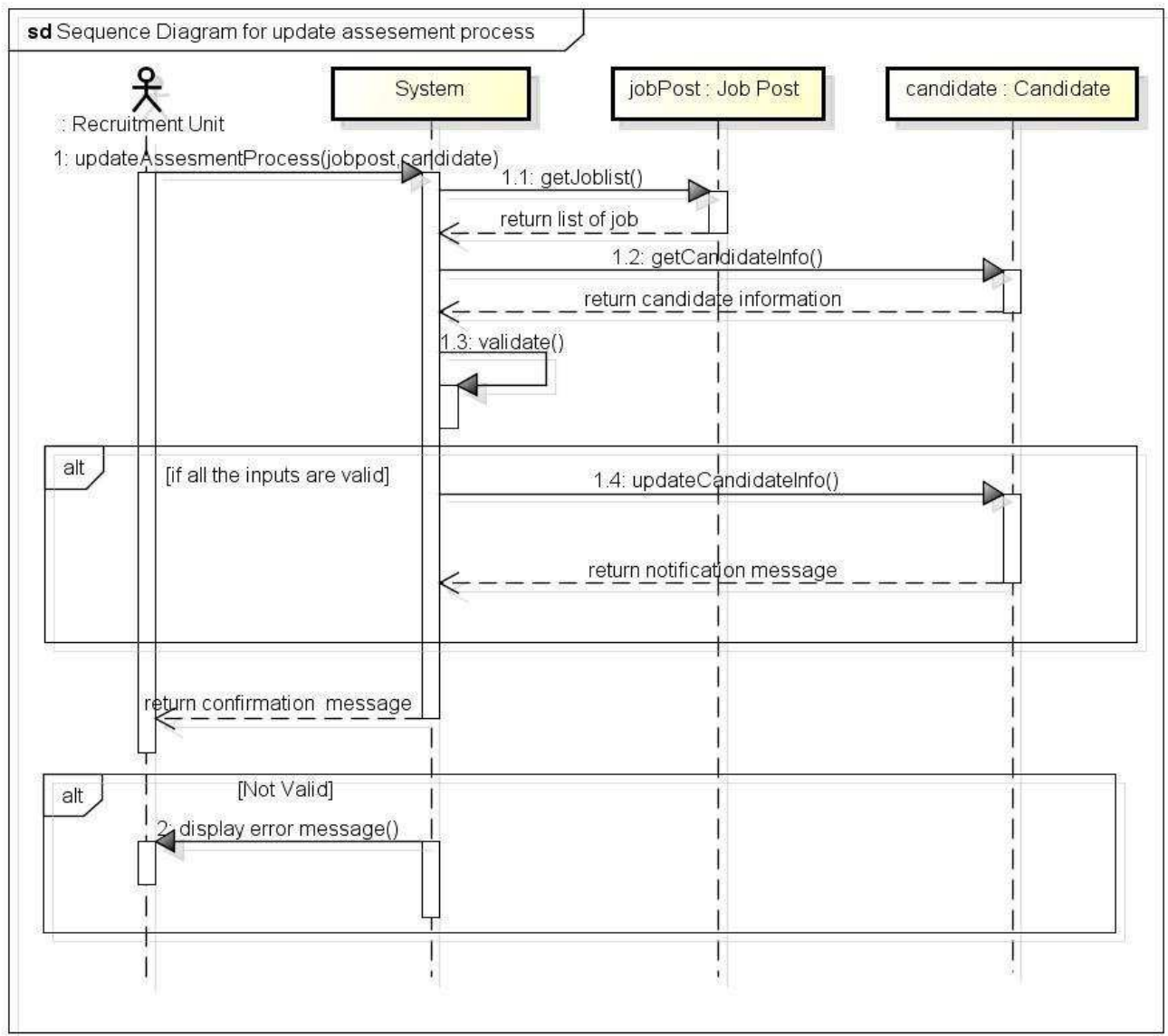
Figure 15   Sequence diagram for Update Assessment Process

3. Sequence diagram for job description

- ✓ The recruitment unit wants to add a new job description, fill the job description information and select add option.
- ✓ The system validates the data.
- ✓ The system saves the new job description using *insertJob()*method and displays a confirmation message.

Alternative course of Action

If the entry is not valid
   - ✓ The system notifies the recruitment unit by displaying error message.

If the recruitment wants to update job description

- ✓ The recruitment unit enters search criteria.
- ✓ The system displays list of job information using *getJobList()* method.
- ✓ The recruitment unit modifies the job description information and selects update option.
- ✓ The system updates the modification using *updateJobList()* method and displays confirmation message.
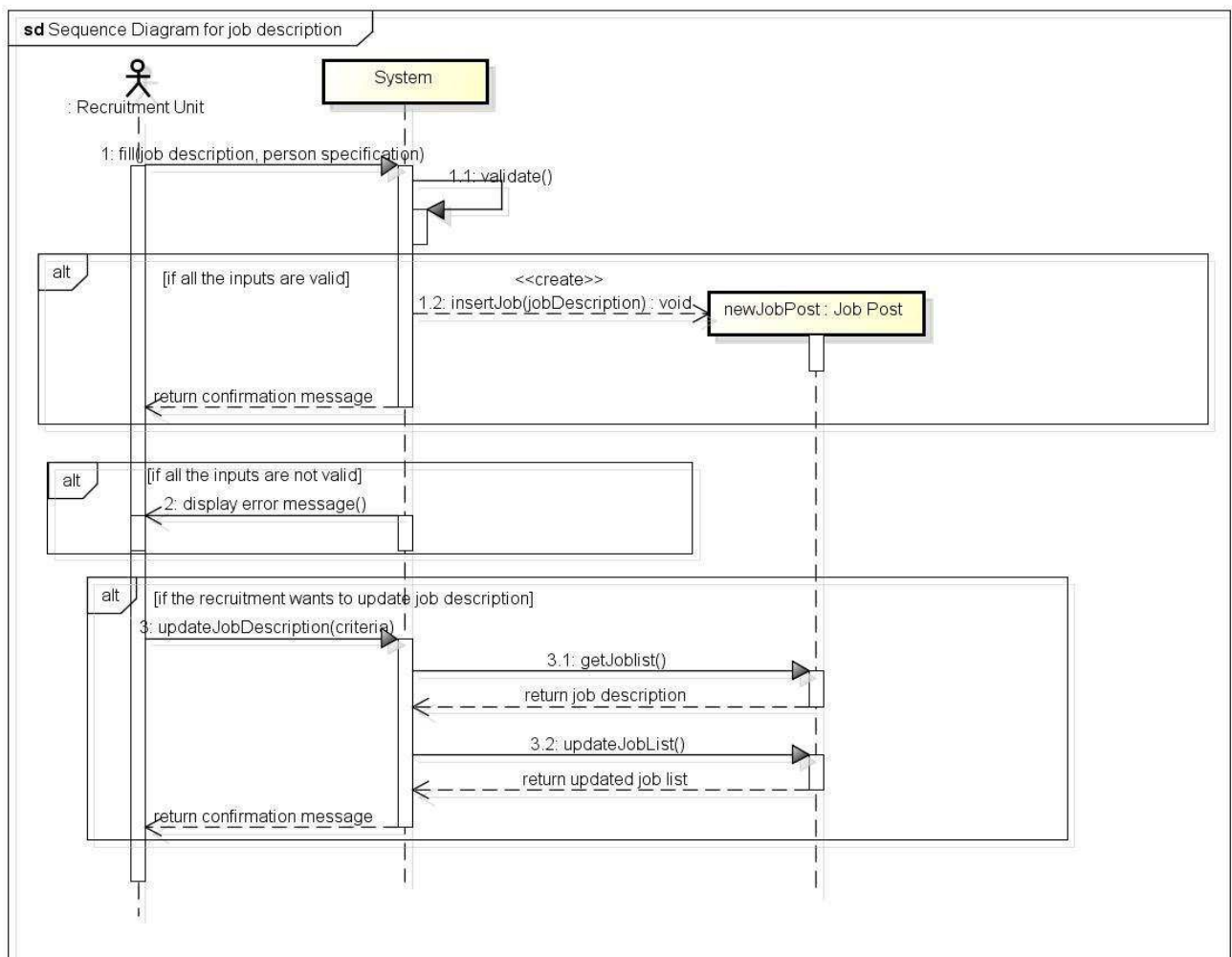
Figure 16 Sequence diagram for job description

4. Sequence diagram for person specification

N.B: This sequence diagram is needed when the recruitment unit wants to register person specification.

- ✓ The recruitment unit wants to register a new person specification, enters person specification information and selects add option.
- ✓ The system validates the data.
- ✓ The system saves the person specification using *insertCriteria()* method and displays a confirmation message.

Alternative course of Action
If the entry is not valid
- ✓ The system notifies the recruitment unit by displaying error message.

If the recruitment wants to update person specification

- ✓ The recruitment unit enters search criteria.
- ✓ The system displays list of criteria information using *getListofCriteria()* method.
- ✓ The recruitment unit modifies the person specification information and selects update option.
- ✓ The system updates the modification using *updatePersonSpecification()* method and displays confirmation message.
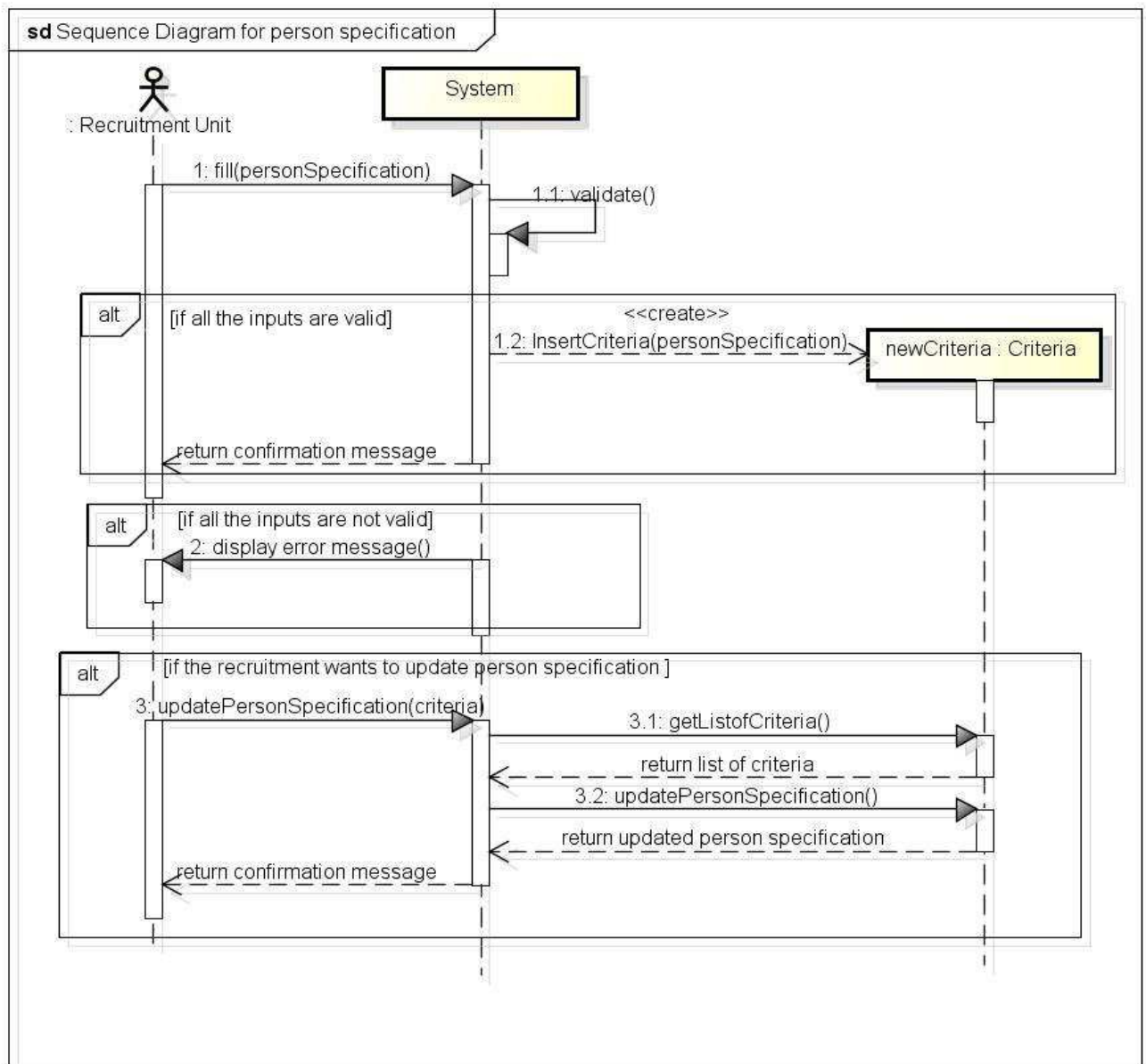
Figure 17 Sequence diagram for person specification

5. Sequence diagram for generate report

N.B: The following sequence is needed when a user wants to view employee recruitment reports.

- ✓ The user wants to view a recruitment report and selects view report option.
- ✓ The system provides list of criteria using *getListofCriteria()* method.
- ✓ The user selects criteria**.**
- ✓ The system displays the specific report for the given criteria.

Alternative course of Action

If the criteria did not match

- ✓ The system displays error message.
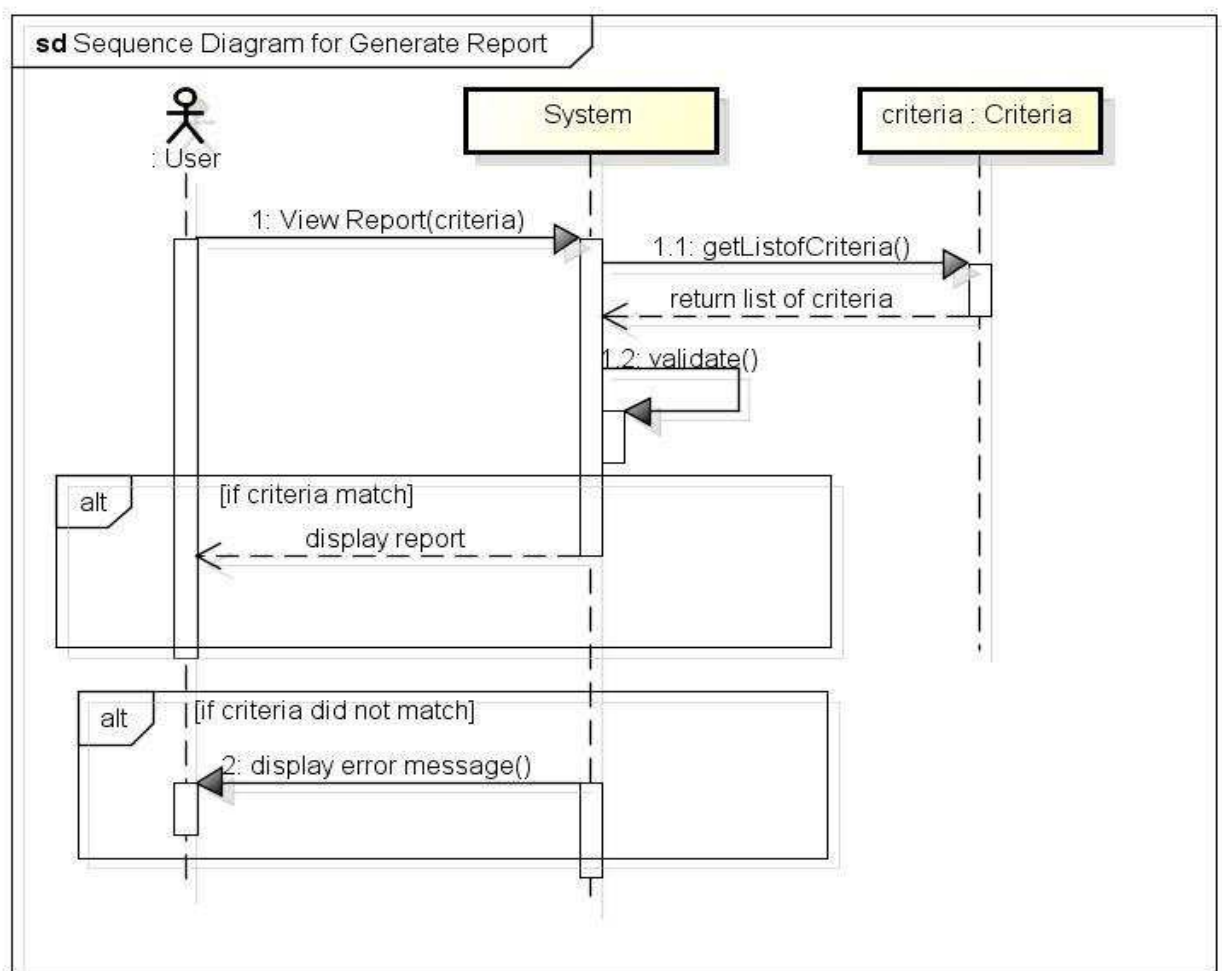
Figure 18 Sequence diagram for generate report

5.5 State Diagrams

State diagrams show the flow of control using states and transitions. It is used to model the dynamic behavior of the system. Based on this fact we show the different states and their transitions for candidates.

The following state machine diagram depicts the various states that an applicant may be in and the transitions between those states starting from application submission until he/she passed the final Interview or becomes an employee.

Explanation of states of applicants (of candidate class)

✓ All interested applicants submit their application when the application is opened.
✓ After screening took place the applicants would be on the state called *short listed candidates* who are *qualified.*
✓ After they completed the interview and/or examination they shall be on the state of *waiting* for the final result.
✓ If the applicants passed the interview they will be an *employee* of the company, if they failed they will be on the state of *unqualified*, qualified candidates might not be chosen because of the limitation in number of required candidates.
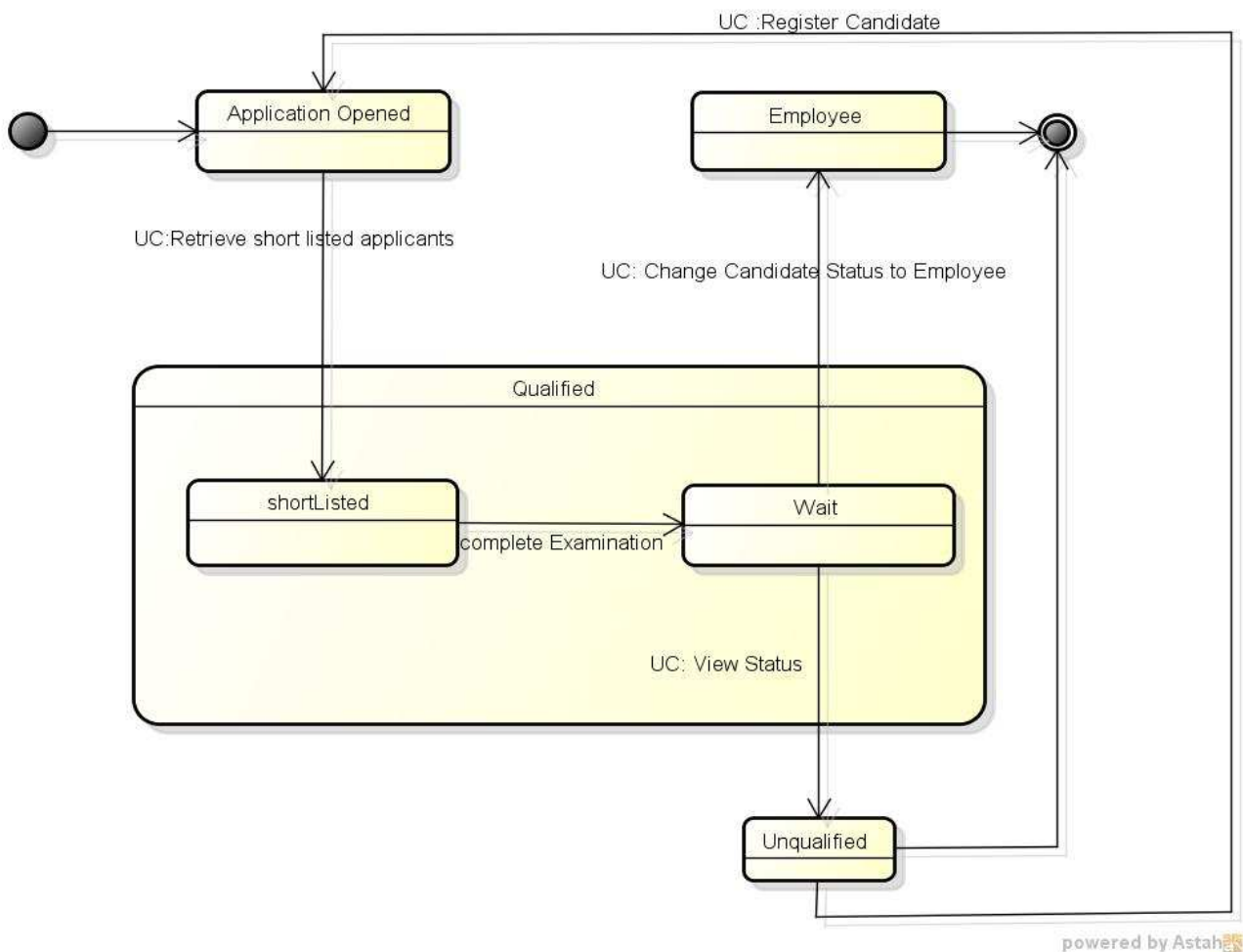

Figure 19 State machine diagram for Applicants

5.6 Business Process - Activity Diagram

Activity diagrams enable you to depict both the basic course of action as well as the alternate courses. The following activity diagram illustrates the whole activity that is done during the hiring process. In the activity diagram we tried to show the whole activities that are performed throughout the recruitment process.

Explanation of Activity diagram for recruitment operation

The diagram illustrates different steps that will be performed in the recruitment process, which will be discussed below.

- ✓ In the beginning if a user is registered he/she can log in and access the job information by entering his/her registration id; otherwise he/she must be registered as a new applicant.
- ✓ After logged in an applicant can search a job.
- ✓ If the registered user found a convenient job, he/she can apply for it.
- ✓ The recruitment unit is responsible to post jobs on web and follow what the applicants do. And to check the status of the posted jobs.
- ✓ After the recruitment unit notices that there are enough candidates to start the selection, then the official selection process will be started.
- ✓ After the selection processes have been made, the recruitment unit set interview for the selected candidates; those who are not selected can see their status.
- ✓ Those applicants who passed the interview will be approved by the top managers but those who did not pass receive an e-mail or can see their status on the web.
- ✓ After approval the selected candidates shall be announced or congratulated by e-mail.
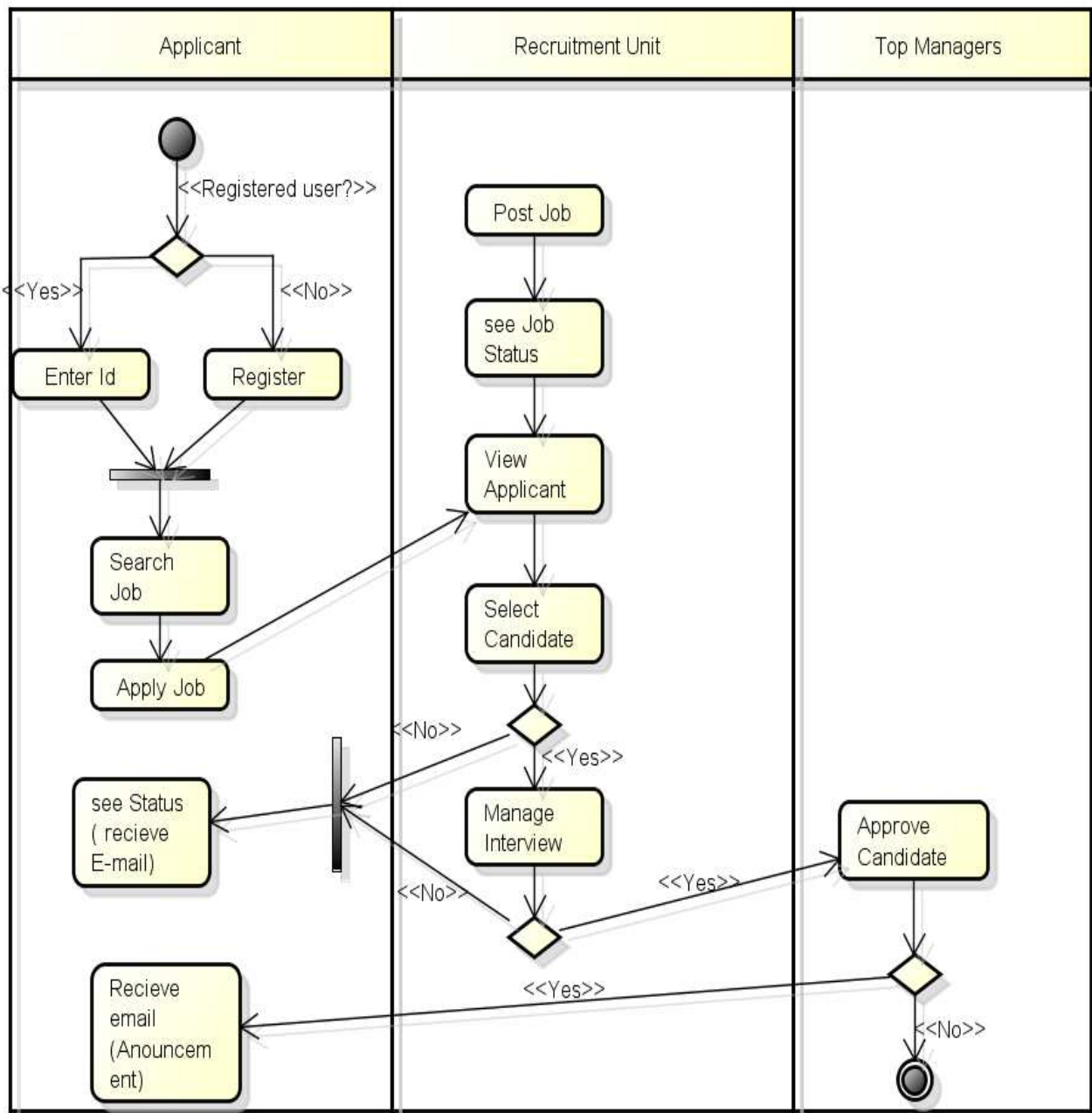
Figure 20 Activity Diagram for recruitment and selection process

The activity diagram depicted on Figure 21 shows the activities that the recruitment process which starts from the stage the department heads recognizes the need of an additional human resource until an applicant get employed, and this requisition may come from any departments through hiring manager.

Explanation of activities of recruitment operation

- ✓ In the beginning before any job gets posted there should be the need for human resource.
- ✓ If there is a need or extra task the department head has to be sure whether they should hire a new candidate or not thus he shall *check performance and work load*.
- ✓ After the checking's(whether the work could be handled by the existing employees or not) made , if the job could be handled by the existing employees the department head *assigns the corresponding task* to the free employee/s, if not he *request for the new candidate*.
- ✓ After the requisition hiring manager checks whether the request is appropriate or not, if it is inappropriate, he/she *rejects* the requisition, if not he *Approve*.
- ✓ After approval of hiring manager recruitment unit shall process the selection.
- ✓ Finally the candidate shall be hired.
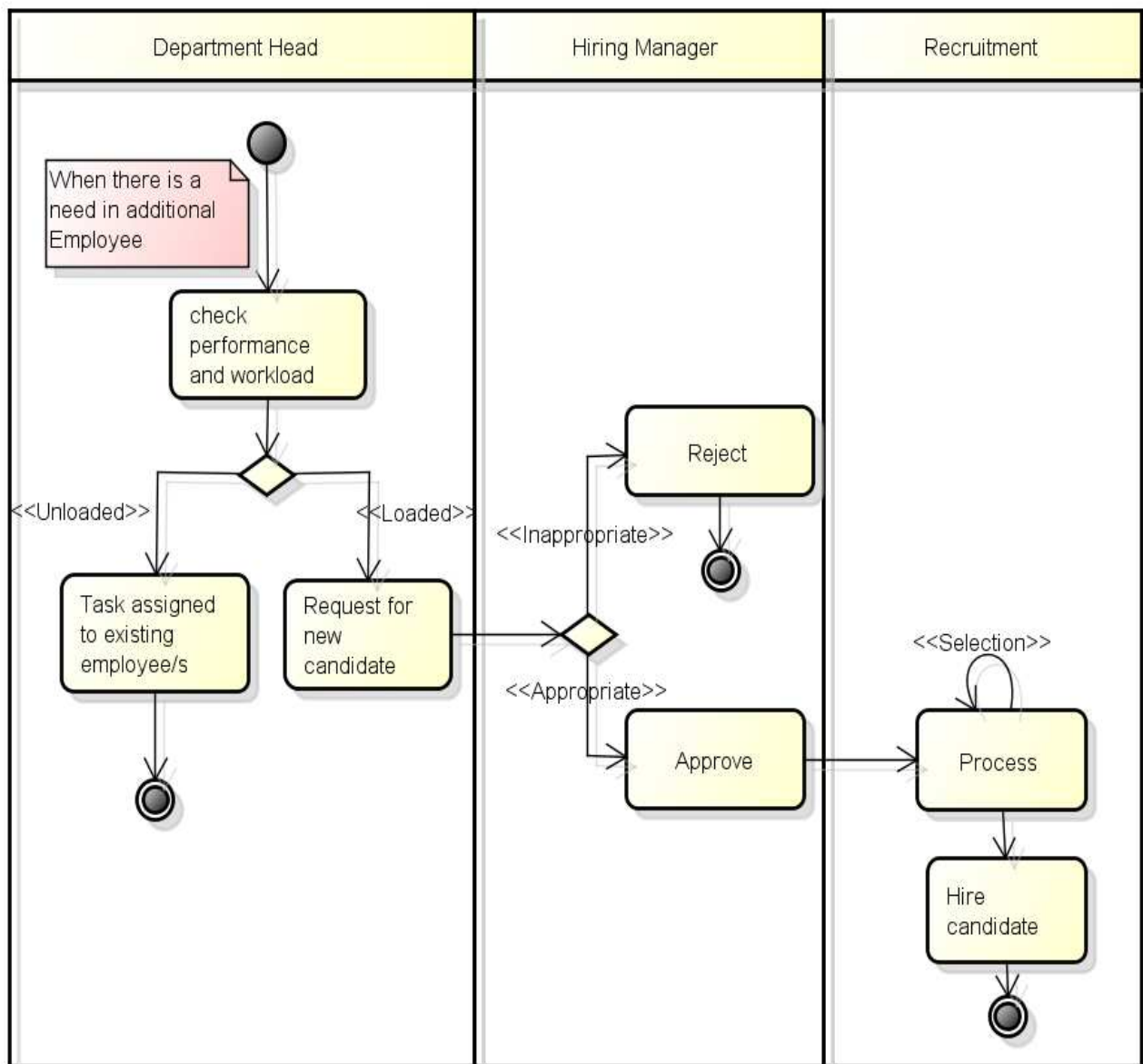
Figure 21 Activity Diagram for Employee Recruitment Management system

6. Composite System Requirements

CR1. The proposed system to be developed is a web based application with client/server architecture. The system will be deployed in a server machine to be accessed by the client machines of the company connected in an intranet network.

CR2. A technical person is required to administer the system, manage database backup and manage errors which might occur.

CR3. The top managers have to check notifications every time, since requisition is asked through notifications.

7. Software Requirements Specification

7.1 Domain Assumption

1. Notifying candidates through email or post on the website to inform their screening and final result is based on the assumption that they check their e-mail as well as visit the website regularly.

2. Notifying top managers through email or using the system is based on the assumption that he/she checks the e-mail or use the system regularly.

3. First screening is Performed based upon the assumption that applicants upload their resume and other documentation accurately and the data obtained from there is accurately entered to identify the discrepancies. This is important because screening once finalized cannot be reverted.

7.2 Functional Requirements

In software engineering, a functional requirement defines a function of a software system or its component. A function is described as a set of inputs, the behavior, and outputs. Functional requirements may be calculations, technical details, data manipulation and processing and other specific functionality that define *what* a system is supposed to accomplish. Generally, functional requirements are expressed in the form "system must do *requirement*". Functional requirements for each of the uses cases described below.

Apply for Job

FR1 . The system shall have options from which the applicant can apply for all the vacant positions, apply for one vacant position or apply for some job only.

FR2 . The system shall provide the step-by-step wizard that ensures applicants provide all the information the company needs.

FR3 The system shall include feature to check the applicant information or status.

FR4 The system shall allow applicants to enter the necessary information (first name, last name and address), upload curriculum vitae, and enter some evaluative criteria from which the system can calculate grading and made the first screening.

FR5 The system shall display all list of applicants awaited along with their position interest and application.

Selecting candidate

FR6 The system shall use a dynamic screening system that allows accurate real-time analysis of how much applicant should be selected, based on the needed number of applicant.

FR7 The system should rank candidates based on the criteria set.

FR8 The system should be flexible to set criteria's based on the company interest.

Retrieve short-listed Candidates

FR9 The system should accept criteria to short list candidates.

FR10 The system should make some mathematical logics to short listed candidates.

FR11 The system shall display only short listed candidates.

Update assessment process

FR12 The system should provide candidates information to update the assessment result.

FR13 The system shall provide a form to add applicants' interview and exam result after the manual assessment has been made.

FR14 The system should save the data filled by the recruitment unit.

View final ranking

FR15 The system shall add results based on the recruitment unit interest and rank applicants in ordered manner.

FR16 The system should display ranked candidates in a list.

FR17 The system should accept criteria as an input to make the final ranking.

FR18 The system should provide detail information when one needs to see detail about a single applicant.

Prepare person specification

FR19 The system should provide a form to be filled by the recruitment unit.

FR20 The system should save the data to the database.

FR21 The system should have a way to identify which person specification is for which job type.

FR22 The system should have a way to check the validity of the data to be saved.

Prepare Job Description

FR23   The system should provide a form to be filled by the recruitment unit. The data to be filled is information about the requirement of the job. All necessary informations must be catched in a database.

FR24   The system should display detail job description when an applicant wants to see.

Notify candidates

FR25   The system shall notify all candidates by generating automatic e-mail.

FR26   The system should save e-mails of candidates.

FR27   The system should identify the candidates who need notification.

Notify Hiring Manager

FR28   The system shall distinguish hiring managers from other system users and send notification message.

FR29   The system shall provide list of candidates' together with the respective full information.

FR30   The system shall allow users to view any notes attached during notifying hiring managers.

View Report

FR31   The system shall offer user to enter job code to view the report for every jobs recorded.

FR32   The system shall display report for all jobs posted if user prefers to see.

FR33   The system shall offer user various options like viewing jobs whose status is on progress, finalized, or in any recruitment stage.

FR34   The system shall provide report about the newly hired employees.

FR35   The system shall have a feature to print any form of reports.

Prepare Minute

FR36   The system should offer the user a minute registration page whenever the user wants to add to it.

FR37   The system shall offer the user to view registered minutes.

FR38   The system shall allow user to edit registered minutes any time the user wanted.

Recommend for Approval

FR39   The system shall provide candidates list anytime when a user wants to see it.

FR40   The system shall provide a means to send list of candidates for approval.

Approve Recommended Candidate/s

FR41   The system shall list candidates in a rank when a user wants to view recommended candidates.

FR42   The system shall also show candidates basic info (name, result, etc.) for a user to help him decide during the approval process.

View Notification

FR43   The system should have a view option for the user to see any notifications sent.

FR44   The system shall provide several view options (view notifications in group, or a single notification)

Search Job

FR45   The system shall provide a search facility for a user.

FR46   The system should display a search result.

FR47   The system shall incorporate several search criteria's to make the searching activity more user- friendly.

Apply for Job

FR48   The system shall display list of jobs.

FR49   The system shall provide all jobs requirement before the user applies for that specific job type.

FR50   The system shall provide a form to save applicants information.

FR51   The system shall also have the capacity to hold applicants document like curriculum vitae.

Send Notification

FR52   The system shall send notification automatically through e-mail.

FR53   The system should have a default notification message.

See Status

FR54   The system shall provide applicants status info when a user requests status info.

FR55   The system should have a status change notification to the user.

Specify Justification

FR56   The system should provide a justification entry form.

FR57   The system shall accept user justification request.

FR58   The system should display justification results.

7.3 Non-functional requirements

A non-functional requirement is a requirement that specifies criteria that can be used to judge the operation of a system, rather than specific behaviors. Non-functional requirements are "system shall be *requirement*". Non-functional requirements are often called *qualities* of a system. Other terms for non-functional requirements are "constraints", "quality attributes", "quality goals", "quality of service requirements" and "non-behavioral requirements. Some of the non-functional requirements are mentioned below.

Quality Requirement	Evaluation Criteria
1. Usability	
The system shall have a clean interface with only needed features, clear terminology and tool tips wherever necessary. Warnings or alerts shall be specified in clear way. • More than one type of user can use the system at a time, specifically an applicant and the recruitment unit can use the system at the same time. • There is no need of training to use the system. Someone who has basic computer knowledge can open the page and apply for jobs. • The system is easy to learn because there are several types of users having different system usage capability. • The system shall protect users not to make any errors during filling application forms and making decisions. • The navigation labels shall be explanatory so that anyone can understand easily.	The system's functionality can be tested by layman who didn't develop the system; and those persons have a contribution for the system to be approved or rejected. In this way, it can be known whether the system is easy to use or not. Check the speed with which user can apply for a job, or use any other functionality offered by the system. The new user interface design shall increase the speed with which users can apply and upload his/her documents by some amount of percent. A person with minimum computer skill can learn to use the job application page in a short period of time. Navigation among pages should be done in no effort.
2. Efficiency	
2.1. Performance ✓ The system shall respond to different searches being conducted like searching particular job, search applicant, etc. in a very fast way. ✓ The system shall generate the report in less time. ✓ The system shall rank candidates in reasonable amount of time. ✓ The job announcement must be updated in	Testing must be done on different machines with different capabilities in order to check the response time of the system. The system shall respond to search requests within 2 seconds while handling up to 50 transactions per second for eight hours. The reports should be generated within 1-2 minutes. In case if the data file is too large then the system should take no more than 5-6 minutes. The maximum data upload limit will be 4M when an

real time. ✓ The system shall respond confirmation message in lesser time after an applicant's saved their data. ✓ The system shall accept a big size of data's especially when a user wants to upload documents like curriculum vitae.	applicant tries to upload related documents. The system response time shall not exceed 10 seconds to confirm a data is saved.
3. Interoperability	
The system shall be able to interact with other systems. The system should able to be supported at least one software which has a relationship with recruitment process.	Check whether the figures obtained after exporting of information to some of the software (budget analyzing) is accurate or not. The system have some functionalities (job application page) shall be accessed from another system.
4. Portability	
The system shall be independent of the specific technological platform used to implement it.	Check whether the system runs well on different platforms like Linux, Microsoft Windows (x86, x86-64), Mac OS X (PowerPC, x86, x86-64) etc.
5. Security	
The system shall have a full permissions system, allowing each user's access to functions to be controlled. A user log shall be maintained allowing an audit of which user performed which actions. A user access to any data or the system itself shall be controlled. The physical security shall be maintained.	There should be no complaints regarding the unauthorized use of the system. The log information should display all significant user interactions. When there is a report of unauthorized usage of system resources (for instance if someone access the recruitment unit role and send notification to applicants) the system shall provide a way to trace it. The system should be physically secured.
6. Documentation	
The system shall provide context sensitive help that takes the user to the specific help topic related to their present screen. The system shall have a demo version available. The system shall provide user specific documentation. The documents shall address the following system users: 1. Applicants 2. Recruitment unit 3. Hiring managers	There should not be any complaints or doubts related to using system features. All system users shall access the system satisfactorily. Documentation should be available when one wants to refer.
7. Manageability	
7.1. Automatic Backup : System back shall be maintained by system administers and the system shall provide automatic backup options **7.2. Mistake Tolerance**: The system shall allow easy recovery from errors like allowing merging of duplicate entry of same applicant information; the system shall have data update mechanism until	Do some cyclic redundancy checks or md5 check of the data file, and then back up the data file. Then restore the backed up data file and do md5 checksum on restored data file and check whether the data on restored file is correct or not. The backup file shall be checked (weather it is corrupted file or not) every time. There should not be any duplicate entries of same item in an applicant's info or while creating new application. The administer should have a capability to admin

recruitment process begins. **7.3.** System maintenance and installation shall be done by in-house system developers.	the system these includes backup and maintenance.
8. Reliability	

Reliability defined as a measure of the time between failures occurring in a system (measures how frequently the system fails), so that the system shall operate without any failure for a particular period of time.
  ✓ Users expect the system to be reliable which means applicant's information registered yesterday in the system shall be there today.
  ✓ Accuracy is part of the sense of reliability – the system checks and reports must be mathematically correct, including ranking candidates.
	Check whether there is any critical failure for a consecutive 72 hour period when heavy operations being carried out.
	
	The system shall not allow unauthorized personnel to access to the data.

9. Availability	
Availability measures the percentage of time the system is in its operational state so that the system shall be available for use 24 hours per day and 365 days per year.	There should not be any complainant regarding the availability of the system. The system should be capable of serving its intended function. The system shall be available 24/7 and 365/year.
10. Error Handling and Extreme Conditions	
The system shall manage Input errors while a user fills application form. The system shall have a way to notify the system administers when an extreme conditions happens.	Input validation has to be performed in detail in order to notify each and specific errors occur while a user is filling forms. When a system faces extreme conditions like accessing a big data or uploading a big file or any other conditions there must be a way to notify the condition to the user.

Table 4 Non Functional Requirement for Recruitment Management System

7.4 Conclusion

In this report we have analyzed the problem of a company in hiring their employees' and managing their data. We described different alternative solutions and we have reported the result of goal analysis of the stakeholder and goal analysis criteria. We have reported the result of feasibility study, which was accomplished for evaluating alternatives and we have also recommended best alternative, which is to build in house customizable software.

After selecting the right solution we have reported tactical goal modeling to show how the tactical goals satisfy the strategic ones. After we provided a description for the use cases of all leaf level tactical goals, we reported the identified system functionalities. We presented class diagram of the system and then we generated OCL constraints, pre-conditions and post-conditions. Sequence diagram and activity diagram have been presented to describe complex processes use cases and activity sequences, respectively. Composite system requirements have been described to specify requirements on the environment of the system. Last but not least, we presented software requirements specification to show the domain assumptions, functional and non-functional requirements of the system.

8. Appendix A

1. Cost-Benefit Analysis for Current System

Fixed costs for Development

Qty	Description	Unit	Cost per unit	Total cost
	No Development Cost required			€ 0.00
				€ 0.00
				€ 0.00
			Total Development costs:	**€ 0.00**

Annual Operating Cost

	Personnel			
Qty	Description	Hour	Cost per hour	Total cost
	Position Requsition	36	€ 32.00	€ 1,152.00
	Attract Candidates	90	€ 32.00	€ 2,880.00
	Sourcing Candidates	200	€ 32.00	€ 6,400.00
	Interview Candidates	40	€ 32.00	€ 1,280.00
	Management Time	20	€ 48.00	€ 960.00
	Background checks	72	€ 32.00	€ 2,304.00
	OnBoarding	16	€ 32.00	€ 512.00
	Training	36	€ 32.00	€ 1,152.00
	Career Coaching	36	€ 48.00	€ 1,728.00
			Total Cost Per Hire:	**€ 18,368.00**
	Hires/year			**01**
			Annual Operating Cost	**€ 18,368.00**

Figure 22 Cost for Current System

Fixed Benefit

#	Description	Estimated Benefits
01	Inaccurate Information	-€ 20,000.00
02		
03		
	Total estimated fixed benefits:	**-€ 20,000.00**

Annual benefits

#	Description	Estimated Benefits
01	Loss of employee morale	-€ 10,000.00
02	Resource Cosumption interms of paper, time	-€ 30,000.00
03		
	Total estimated annual benefits:	**-€ 40,000.00**

Figure 23 Benefits for Current System

Cost-benefit Analysis

Average annual return	10.00%						
Cash flow description	**Year 0**	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**
Fixed costs	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00
Annual costs	-€ 18,368.00	-€ 18,368.00	-€ 18,368.00	-€ 18,368.00	-€ 18,368.00	-€ 18,368.00	-€ 18,368.00
Total costs	-€ 18,368.00	-€ 18,368.00	-€ 18,368.00	-€ 18,368.00	-€ 18,368.00	-€ 18,368.00	-€ 18,368.00
Discount factors	1.000	0.909	0.826	0.751	0.683	0.621	0.564
Cost adjusted to present value	-€ 18,368.00	-€ 16,698.18	-€ 15,180.17	-€ 13,800.15	-€ 12,545.59	-€ 11,405.08	-€ 10,368.26
Cumulative adjusted costs	-€ 18,368.00	-€ 35,066.18	-€ 50,246.35	-€ 64,046.50	-€ 76,592.09	-€ 87,997.17	-€ 98,365.43
Fixed benefits	-€ 20,000.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00
Annual benefits	-€ 40,000.00	-€ 40,000.00	-€ 40,000.00	-€ 40,000.00	-€ 40,000.00	-€ 40,000.00	-€ 40,000.00
Total benefits	-€ 60,000.00	-€ 40,000.00	-€ 40,000.00	-€ 40,000.00	-€ 40,000.00	-€ 40,000.00	-€ 40,000.00
Benefits adjusted to present value	-€ 60,000.00	-€ 36,363.64	-€ 33,057.85	-€ 30,052.59	-€ 27,320.54	-€ 24,836.85	-€ 22,578.96
Cumulative adjusted benefits	-€ 60,000.00	-€ 96,363.64	-€ 129,421.49	-€ 159,474.08	-€ 186,794.62	-€ 211,631.47	-€ 234,210.43
Net result for the year	-€ 78,368.00	-€ 53,061.82	-€ 48,238.02	-€ 43,852.74	-€ 39,866.13	-€ 36,241.94	-€ 32,947.21
Cumulative net result	-€ 78,368.00	-€ 131,429.82	-€ 179,667.83	-€ 223,520.58	-€ 263,386.71	-€ 299,628.64	-€ 332,575.86

Figure 24 Cost Benefit Analysis for Current System

2. **Cost Benefit Analysis for Hiring More Recruitment Staff**

Fixed costs for development

Qty	Description	Unit	Cost per unit	Total cost
	No Fixed Cost			€ 0.00
			Total fixed costs:	**€ 0.00**

Annual Operating costs

Qty	Description	Unit	Cost per hour	Total cost
06	Recruitment Staff	100	€ 20.00	€ 12,000.00
	Position Requsition	36	€ 32.00	€ 1,152.00
	Attratct Candidates	90	€ 22.00	€ 1,980.00
	Sourcing Candidates	200	€ 20.00	€ 4,000.00
	Interview Candidates	40	€ 20.00	€ 800.00
	Management Time	20	€ 40.00	€ 800.00
	Background checks	72	€ 22.00	€ 1,584.00
	OnBoarding	16	€ 22.00	€ 352.00
	Training	36	€ 32.00	€ 1,152.00
	Career Coaching	36	€ 48.00	€ 1,728.00
			Total Cost Per Hire:	**€ 25,548.00**
	Hires/year			**01**
			Annual Operating Cost	**€ 25,548.00**

Figure 25 Cost for Hiring Recruitment staff

Fixed benefits

#	Description	Estimated Benefits
01	Inaccurate Information	-€ 5,000.00
	Total estimated fixed benefits:	**-€ 5,000.00**

Annual benefits

#	Description	Estimated Benefits
01	Boost of employee morale	€ 10,000.00
02	Resource Cosumption interms of paper, time	€ 10,000.00
03		
	Total estimated annual benefits:	**€ 20,000.00**

Figure 26 Benefits for Hiring Recruitment Staff

3. Cost Benefit Analysis for Buying off the shelf Recruitment Management system

Fixed costs

New Hardware and Software

Qty	Description	Unit	Cost per unit	Total cost
01	Development Server		€ 20,000.00	€ 20,000.00
01	Server Software		€ 5,000.00	€ 5,000.00
01	DBMS server Software		€ 7,000.00	€ 7,000.00
02	DBMS client Software		€ 5,000.00	€ 10,000.00

Expense

Qty	Description	Unit	Unitary cost	Total cost
	Product Registration Fee	1	€ 2,000.00	€ 2,000.00
	Client license	2	€ 1,000.00	€ 2,000.00
	Server License	1	€ 5,000.00	€ 5,000.00
	User License	500	€ 50.00	€ 25,000.00
			Total fixed costs:	**€ 76,000.00**

Annual Operating costs

Personnel

Qty	Description	Unit	Cost per hour	Total cost
01	Update Fee	01	€ 6,000.00	€ 6,000.00
01	Yearly Subscription Fee	04	€ 2,000.00	€ 8,000.00
02	Training	150	€ 20.00	€ 6,000.00

Expenses

Qty	Item		Unitary cost	Total cost
01	Maintenance cost of server		€ 1,000.00	€ 1,000.00
01	Maintenance cost DBMS server software		€ 500.00	€ 500.00
			Total annual costs:	**€ 21,500.00**

Figure 27 Costs for Buying off the shelf product

Fixed benefits

#	Description	Estimated Benefits
01		
02		
03		
	Total estimated fixed benefits:	**€ 0.00**

Annual benefits

#	Description	Estimated Benefits
01	Better use of Management Time	€ 15,000.00
02	Cost/Error Reduction	€ 20,000.00
03	Accurate selection of candidates	€ 15,000.00
	Total estimated annual benefits:	**€ 50,000.00**

Figure 28 Benefits for Buying off the shelf product

Cost-benefit Analysis

Average annual return	10.00%						
Cash flow description	**Year 0**	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**
Fixed costs	-€ 76,000.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00
Annual costs	-€ 21,500.00	-€ 21,500.00	-€ 21,500.00	-€ 21,500.00	-€ 21,500.00	-€ 21,500.00	-€ 21,500.00
Total costs	-€ 97,500.00	-€ 21,500.00	-€ 21,500.00	-€ 21,500.00	-€ 21,500.00	-€ 21,500.00	-€ 21,500.00
Discount factors	1.000	0.909	0.826	0.751	0.683	0.621	0.564
Cost adjusted to present value	-€ 97,500.00	-€ 19,545.45	-€ 17,768.60	-€ 16,153.27	-€ 14,684.79	-€ 13,349.81	-€ 12,136.19
Cumulative adjusted costs	-€ 97,500.00	-€ 117,045.45	-€ 134,814.05	-€ 150,967.32	-€ 165,652.11	-€ 179,001.92	-€ 191,138.11
Fixed benefits	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00
Annual benefits	€ 50,000.00	€ 50,000.00	€ 50,000.00	€ 50,000.00	€ 50,000.00	€ 50,000.00	€ 50,000.00
Total benefits	€ 50,000.00	€ 50,000.00	€ 50,000.00	€ 50,000.00	€ 50,000.00	€ 50,000.00	€ 50,000.00
Benefits adjusted to present value	€ 50,000.00	€ 45,454.55	€ 41,322.31	€ 37,565.74	€ 34,150.67	€ 31,046.07	€ 28,223.70
Cumulative adjusted benefits	€ 50,000.00	€ 95,454.55	€ 136,776.86	€ 174,342.60	€ 208,493.27	€ 239,539.34	€ 267,763.03
Net result for the year	-€ 47,500.00	€ 25,909.09	€ 23,553.72	€ 21,412.47	€ 19,465.88	€ 17,696.26	€ 16,087.51
Cumulative net result	-€ 47,500.00	-€ 21,590.91	€ 1,962.81	€ 23,375.28	€ 42,841.17	€ 60,537.42	€ 76,624.93

Return On Investment (ROI) Analysis

(267,763.03-191,138.11)/191,138.11= 0.40

PayBack Period

21590.91/(1962.81+21590.91)=0.91

Figure 29 Cost Benefit Analysis for buying off the shelf product

4. **Cost Benefit Analysis for Developing in-house customizable product**

Fixed costs for Development

Labor Cost

Qty	Description	Unit	Cost per unit	Total cost
01	System Analyst	300	€ 50.00	€ 15,000.00
02	Programmer	200	€ 40.00	€ 16,000.00
01	System Designer	100	€ 35.00	€ 3,500.00
02	Database Specialist	150	€ 35.00	€ 10,500.00
03	Testing Team	200	€ 35.00	€ 21,000.00

New hardware and Software Cost

Qty	Description	Unitary cost	Total cost
01	Development Server	€ 15,000.00	€ 15,000.00
01	Server Software	€ 5,000.00	€ 5,000.00
01	DBMS server Software	€ 7,000.00	€ 7,000.00
01	DBMS client Software	€ 5,000.00	€ 5,000.00

Training Expenses

Qty	Description	Hour	Cost per unit	Total cost
02	Trainer	60	€ 20.00	€ 2,400.00

			Total Development costs:	€ 100,400.00

Annual Operating costs

Labor Cost

Qty	Description	Unit	Cost per hour	Total cost
02	Programmer/Analyst	150	€ 40.00	€ 12,000.00
01	Training	100	€ 30.00	€ 3,000.00

Expenses

Qty	Item	Unitary cost	Total cost
01	Maintenance Cost for Development Software	€ 1,000.00	€ 1,000.00
01	Maintenance Cost for Client Software	€ 500.00	€ 500.00

		Total annual costs:	€ 16,500.00

Figure 30 Cost for In-house Developed customizable product

Fixed benefits

#	Description	Estimated Benefits
01	Availabilty of Information	€ 10,000.00
02	Efficiency and Effectiveness	€ 15,000.00
03	Fairness of Selection	€ 5,000.00
	Total estimated fixed benefits:	**€ 30,000.00**

Annual benefits

#	Description	Estimated Benefits
01	Better use of Management Time	€ 15,000.00
02	Cost/Error Reduction	€ 25,000.00
03	Accurate selection of candidates	€ 20,000.00
	Total estimated annual benefits:	**€ 60,000.00**

Figure 31 Benefit for In-house Software Product

Cost-benefit Analysis

Cash flow description	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Average annual return	10.00%						
Fixed costs	-€ 100,400.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00
Annual costs	-€ 16,500.00	-€ 16,500.00	-€ 16,500.00	-€ 16,500.00	-€ 16,500.00	-€ 16,500.00	-€ 16,500.00
Total costs	-€ 116,900.00	-€ 16,500.00	-€ 16,500.00	-€ 16,500.00	-€ 16,500.00	-€ 16,500.00	-€ 16,500.00
Discount factors	1.000	0.909	0.826	0.751	0.683	0.621	0.564
Cost adjusted to present value	-€ 116,900.00	-€ 15,000.00	-€ 13,636.36	-€ 12,396.69	-€ 11,269.72	-€ 10,245.20	-€ 9,313.82
Cumulative adjusted costs	-€ 116,900.00	-€ 131,900.00	-€ 145,536.36	-€ 157,933.06	-€ 169,202.78	-€ 179,447.98	-€ 188,761.80
Fixed benefits	€ 30,000.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00
Annual benefits	€ 30,000.00	€ 60,000.00	€ 60,000.00	€ 60,000.00	€ 60,000.00	€ 60,000.00	€ 60,000.00
Total benefits	€ 60,000.00	€ 60,000.00	€ 60,000.00	€ 60,000.00	€ 60,000.00	€ 60,000.00	€ 60,000.00
Benefits adjusted to present value	€ 60,000.00	€ 54,545.45	€ 49,586.78	€ 45,078.89	€ 40,980.81	€ 37,255.28	€ 33,868.44
Cumulative adjusted benefits	€ 60,000.00	€ 114,545.45	€ 164,132.23	€ 209,211.12	€ 250,191.93	€ 287,447.21	€ 321,315.64
Net result for the year	-€ 56,900.00	€ 39,545.45	€ 35,950.41	€ 32,682.19	€ 29,711.09	€ 27,010.08	€ 24,554.62
Cumulative net result	-€ 56,900.00	-€ 17,354.55	€ 18,595.87	€ 51,278.06	€ 80,989.15	€ 107,999.22	€ 132,553.84

Return On Investment (ROI) Analysis

(321,315.64-188,761.80)/188,761.80= 0.70

PayBack Period

17,354.55/(18,595.87+17,354.55)=0.48

Figure 32 Cost Benefit Analysis for In-house Customizable Product

5. Cost Benefit Analysis for Recruitment Process Outsourcing

Fixed costs for development

		Personnel			
Qty	**Description**		**Unit**	**Cost per unit**	**Total cost**
	Cost of selecting the vendor			€ 20,000.00	€ 20,000.00
	Transition Cost of Managing an Offshore Contract			€ 50,000.00	€ 50,000.00

		New Hardware and Software			
Qty	**Description**			**Unitary cost**	**Total cost**
01	Development Server			€ 15,000.00	€ 15,000.00
01	Server Software			€ 5,000.00	€ 5,000.00
01	DBMS Server Software			€ 7,000.00	€ 7,000.00
01	DBMS Client Software			€ 5,000.00	€ 5,000.00

		Training Expenses			
02	Trainer		120	€ 20.00	€ 4,800.00

				Total Development costs:	**€ 106,800.00**

Annual costs for Development

		Personnel			
Qty	**Description**		**Unit**	**Cost per hour**	**Total cost**
02	Programmer/Analyst		150	€ 40.00	€ 12,000.00
01	Training		100	€ 30.00	€ 3,000.00

		Expenses			
Qty	**Item**			**Unitary cost**	**Total cost**
01	Maintenance Cost for Development Software			€ 1,500.00	€ 1,000.00
01	Maintenance Cost for Client Software			€ 1,000.00	€ 1,000.00

				Total annual costs:	**€ 17,000.00**

Figure 33 Cost for Recruitment Process Outsourcing

Fixed benefits

#	Description	Estimated Benefits
01		
02		
03		
	Total estimated fixed benefits:	€ 0.00

Annual benefits

#	Description	Estimated Benefits
01	Better use of Management Time	€ 10,000.00
02	Cost/Error Reduction	€ 25,000.00
03	Accurate selection of candidates	€ 20,000.00
	Total estimated annual benefits:	€ 55,000.00

Figure 34 Benefits for Recruitment Process Outsourcing

Cost-benefit Analysis

Average annual return	10.00%						
Cash flow description	**Year 0**	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**
Fixed costs	-€ 106,800.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00
Annual costs	-€ 17,000.00	-€ 17,000.00	-€ 17,000.00	-€ 17,000.00	-€ 17,000.00	-€ 17,000.00	-€ 17,000.00
Total costs	-€ 123,800.00	-€ 17,000.00	-€ 17,000.00	-€ 17,000.00	-€ 17,000.00	-€ 17,000.00	-€ 17,000.00
Discount factors	1.000	0.909	0.826	0.751	0.683	0.621	0.564
Cost adjusted to present value	-€ 123,800.00	-€ 15,454.55	-€ 14,049.59	-€ 12,772.35	-€ 11,611.23	-€ 10,555.66	-€ 9,596.06
Cumulative adjusted costs	-€ 123,800.00	-€ 139,254.55	-€ 153,304.13	-€ 166,076.48	-€ 177,687.71	-€ 188,243.38	-€ 197,839.43
Fixed benefits	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00
Annual benefits	€ 55,000.00	€ 55,000.00	€ 55,000.00	€ 55,000.00	€ 55,000.00	€ 55,000.00	€ 55,000.00
Total benefits	€ 55,000.00	€ 55,000.00	€ 55,000.00	€ 55,000.00	€ 55,000.00	€ 55,000.00	€ 55,000.00
Benefits adjusted to present value	€ 55,000.00	€ 50,000.00	€ 45,454.55	€ 41,322.31	€ 37,565.74	€ 34,150.67	€ 31,046.07
Cumulative adjusted benefits	€ 55,000.00	€ 105,000.00	€ 150,454.55	€ 191,776.86	€ 229,342.60	€ 263,493.27	€ 294,539.34
Net result for the year	-€ 68,800.00	€ 34,545.45	€ 31,404.96	€ 28,549.96	€ 25,954.51	€ 23,595.01	€ 21,450.01
Cumulative net result	-€ 68,800.00	-€ 34,254.55	-€ 2,849.59	€ 25,700.38	€ 51,654.89	€ 75,249.90	€ 96,699.91

Return On Investment(ROI)

294539.34-197839.43/197839.43=0.48

PayBack Period

2849.59/2849.59+25700.38=0.09

Figure 35 Cost Benefit Analysis Recruitment Process Outsourcing

6. Cost Benefit Analysis for E-Recruitment

Fixed costs for Development

	Personnel			
Qty	Description	Unit	Cost per unit	Total cost
	Advertising Vacancies in job sites	05	€ 2,000.00	€ 10,000.00
	Developing Website or an online Application Form	05	€ 1,000.00	€ 5,000.00
				€ 0.00

	New Hardware and Software			
Qty	Description		Unitary cost	Total cost
01				
01				
01				
			Total fixed costs:	€ 15,000.00

Annual Operating costs

	Personnel			
Qty	Description	Hour	Cost per hour	Total cost
	Position Requsition	36	€ 32.00	€ 1,152.00
	Attract Candidates	05	€ 32.00	€ 160.00
	Sourcing Candidates	100	€ 32.00	€ 3,200.00
	Interview Candidates	40	€ 32.00	€ 1,280.00
	Management Time	05	€ 48.00	€ 240.00
	Background checks	72	€ 32.00	€ 2,304.00
	OnBoarding	16	€ 32.00	€ 512.00
	OnBoarding	16	€ 32.00	€ 512.00
	Training	36	€ 32.00	€ 1,152.00
	Career Coaching	36	€ 48.00	€ 1,728.00
			Total annual costs:	€ 11,728.00

Figure 36 Costs for E-Recruitment

Fixed benefits

#	Description	Estimated Benefits
01	Inaccurate Information	-€ 5,000.00
	Total estimated fixed benefits:	**-€ 5,000.00**

Annual benefits

#	Description	Estimated Benefits
01	Boost of employee morale	€ 10,000.00
02	Resource Cosumption interms of paper, time	€ 10,000.00
03		
	Total estimated annual benefits:	**€ 20,000.00**

Figure 37 Benefits for E-Recruitment

Cost-benefit Analysis

Cash flow description	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Average annual return	10.00%						
Fixed costs	-€ 15,000.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00
Annual costs	-€ 11,728.00	-€ 11,728.00	-€ 11,728.00	-€ 11,728.00	-€ 11,728.00	-€ 11,728.00	-€ 11,728.00
Total costs	-€ 26,728.00	-€ 11,728.00	-€ 11,728.00	-€ 11,728.00	-€ 11,728.00	-€ 11,728.00	-€ 11,728.00
Discount factors	1.000	0.909	0.826	0.751	0.683	0.621	0.564
Cost adjusted to present value	-€ 26,728.00	-€ 10,661.82	-€ 9,692.56	-€ 8,811.42	-€ 8,010.38	-€ 7,282.17	-€ 6,620.15
Cumulative adjusted costs	-€ 26,728.00	-€ 37,389.82	-€ 47,082.38	-€ 55,893.80	-€ 63,904.18	-€ 71,186.35	-€ 77,806.50
Fixed benefits	-€ 5,000.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00
Annual benefits	€ 20,000.00	€ 20,000.00	€ 20,000.00	€ 20,000.00	€ 20,000.00	€ 20,000.00	€ 20,000.00
Total benefits	€ 15,000.00	€ 20,000.00	€ 20,000.00	€ 20,000.00	€ 20,000.00	€ 20,000.00	€ 20,000.00
Benefits adjusted to present value	€ 15,000.00	€ 18,181.82	€ 16,528.93	€ 15,026.30	€ 13,660.27	€ 12,418.43	€ 11,289.48
Cumulative adjusted benefits	€ 15,000.00	€ 33,181.82	€ 49,710.74	€ 64,737.04	€ 78,397.31	€ 90,815.74	€ 102,105.21
Net result for the year	-€ 11,728.00	€ 7,520.00	€ 6,836.36	€ 6,214.88	€ 5,649.89	€ 5,136.26	€ 4,669.33
Cumulative net result	-€ 11,728.00	-€ 4,208.00	€ 2,628.36	€ 8,843.24	€ 14,493.13	€ 19,629.39	€ 24,298.72

ROI

135000.00-82096.00/82096.00=0.64

PayBack Period

3456/(4816+3456)=0.41

Figure 38 Cost Benefit Analysis for E-Recruitment