HOW TO HIRE THE BEST SOFTWARE PEOPLE

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This work is devoted to some human resources (HR) management problems in the field of software production. The basic techniques for recruiting and selecting the most appropriate software people are presented, bearing in mind the specific features of the software development activities. Our approach to some problems of personnel management is described and their solutions by supporting tools are presented.

1. Introduction. Effective software project management focuses on the four P's: people, product, process and project. The order is not arbitrary. Software managers have realized that if they neglect the importance of human factor they jeopardize the success of the whole project. This is the main reason for the current interest in the software psychology research. The well known Software Engineering Institute has developed a comprehensive Capability Maturity Model (CMM) which provides a measure of the global effectiveness of a company's software engineering practices and establishes different process maturity levels [7]. Recently an extension of the CMM has been created – the People Management Capability Maturity Model (PM-CMM) so as "to enhance the readiness of software organizations to undertake increasingly complex applications by helping to attract, grow, motivate, deploy, and retain the talent needed to improve their software development capability" [2]. The PM-CMM defines the following key practice areas for software people: recruiting, selection, performance management, training, compensation, career development, organization and work design, and team/culture development.

The main purpose of this paper is to consider the problems of personnel recruitment and selection. We have chosen some techniques which seem to be appropriate for successful implementation in the software area.

2. Personnel recruitment. Recruitment covers all activities directed to finding and hiring the most appropriate applicant for a vacant position [3]. We will mention some of these activities and the corresponding techniques applied.

2.1. Recruitment planning. Recruitment begins with a clear specification of the human resources needed and the time they are needed. In the latter specification a time frame is implicitly included – the duration of the period between the first step – the resume receipt – and the moment when the new appointee starts to work. This time frame is called "the recruitment pipeline". The table below shows some recruitment events and their duration comprising a hypothetical recruitment pipeline:

Average number of days

From RESUME to INVITATION	5 days
From INVITATION to INTERVIEW	6 days
From INTERVIEW to OFFER	4 days
From OFFER to ACCEPTANCE	7 days
From ACCEPTANCE to REPORT FOR WORK	23 days

In this case the total length of the pipeline is 45 days. The pipelines vary from one organization to another and from one position to another and this is an important point to consider at the beginning of the recruitment procedures.

2.2. Recruitment sources. The *internal recruitment* involves people from the same organization. When we have to decide where and how to implement recruitment activities, some initial consideration should be given to a company's current employees, especially for filling jobs above the entry level. Among the channels for internal recruitment the most popular ones are worker pool, job posting and employee referrals.

a) worker pool

The worker pool is a repository of information about all employees, their professional characteristics, qualification, experience from previous projects, availability for full or part-time involvement. The pool can be used for two basic approaches to team construction in software development.

The first approach is to organize a few teams with permanent structure and content, defining the responsibilities of each team member. When a new project is assigned to a team, the need for additional positions is analyzed and some experts from the pool can join the team to work on that project. The advantages of this approach are:

– reliability – team members know each other well and the level of confidence, mutual support and help is high. Specialization in performing the same tasks will increase the members' competence, experience and skills;

– team loyalties – team members accepts the team goals and work for their achievement, considering the team as more important than the individuals in it.

The main drawback of this approach is the so called "groupthink", which is the resistance of members to changes in leadership and a loss of overall critical faculties. To overcome groupthinking some special techniques should be applied – formal sessions devoted to consideration of different alternatives, encouraging provocative behavior; external evaluation of group's decisions, etc.

The second approach is to construct a team according to the peculiarities of the new project. In this case the project manager is assigned to the project and then he has to define the type of team organization (democratic decentralized, controlled decentralized or controlled centralized); the number, roles and responsibilities of all team members. Having these requirements the project manager selects from the pool the appropriate people, who are free at the moment and can be involved in the project. The advantage of this approach is that the people included in the team are selected according to the characteristics of the project. The shortcoming is that the organized group of experts may not act as a team due to psychological incompatibility.

b) job posting

Advertising available jobs internally serves as a method for getting around the "old boy" network, where jobs sometimes were filled more by "who you knew" than by "what you knew". Openings are published on bulletin boards or in lists accessible to all em-

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ployees. Employees who are interested must reply within a specified number of days and they may or may not have to obtain the consent of their immediate supervisor. Some job posting systems apply only to the office in which a job is located, while other companies can relocate employees.

c) employee referrals

Referral of job candidates by present employees has been and continues to be a major source of new hires at many levels, including professionals. It is an internal recruitment method, since internal rather than external sources are used to attract candidates. Typically such programs offer cash or other bonus when a current employee refers a successful candidate to fill a job opening. Interestingly, the rate of employee participation seems to remain unaffected by such efforts as higher cash bonuses, cars or expense-paid trips. This suggest that good employees will not refer potentially undesirable employees even if the rewards are outstanding.

Another approach is the **external recruitment**. To meet the demands for talents brought by business growth, desire for fresh ideas, or in order to replenish the stock of employees who leave, organizations periodically turn to the outside labor market. In doing so they may employ a variety of recruitment sources. The most popular ones are university relations, executive search firms, employment agencies and head-hunting.

a) university relations

What used to be known as "college recruiting" is now considerably broader in many companies. The companies have targeted certain schools that best meet their needs and have broadened the scope of their interactions with them. Such activities may include, in addition to recruitment, gifts and grants to the institutions, summer employment and consulting projects for faculty and inviting placement officers to visit company plants and offices. To enhance the yield from campus recruitment efforts, employers should consider the following research based guidelines:

– establish a "presence" on college campuses beyond just the on-campus interviewing period;

– upgrade the content and specificity of recruiting brochures. Provide more detailed information about the characteristics of the jobs, especially those that have had a significant positive effect on prior applicants' decision to join the organization;

– ensure that the attributes of vacant positions are comparable to those of the competitors. Some of key job attributes that influence the decision of college students are promotional opportunities, job security and long-term income potential;

b) employment agencies

These are some of the most widely available and used outside sources. Agencies compete with similar companies for one placement. Fee is due only to the agency who fills the position. Employment agencies typically assign lower-level vacancies. Agents spend less time on initial research and job specification. The assignments are even handled by phone with no personal contact. The agency refers to the client a large number of applicants in order to increase the odds of a placement. Considerable human resources and management time are required to screen, interview and evaluate candidates.

3. Initial screening. The services provided by employment agencies are an example of recruitment and initial screening process. This step anticipates the selection procedure and consists in finding those among all the applicants, who match the basic

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requirements such as age, sex, professional experience (in years), familiarity with specific projects (number of projects), manager experience (number of successful previous projects), remuneration expectations, foreign language proficiency, etc.

4. Selection. The selection process following the initial screening is more rigorous. The basic characteristics alone do not provide many clues about the persons potential for management, or for any other kind of work for that matter. What is needed, of course, are samples of behavior, either through tests and personnel interviews or through the testimony of others about the candidate, as with reference checks.

The selection procedure could be performed by the company management, HR department or external consultants such as executive search firms and head-hunting agencies.

a) executive search firms

Such firms are retained typically to perform the selection for senior level positions and highly qualified specialists. The reason for doing so may include a need to maintain confidentiality from an incumbent or a competitor, lack of local resources to recruit executive-level individuals, or insufficient time. Employers evaluating a search firm should carefully consider the following indications that the firm can do competent work:

– the firm has defined its market position in the IT industries;

– the firm understands how your organization functions within the industries served;

– the firm combines research and recruiting responsibilities into one function. Doing so allows the researcher-recruiter to make a more comprehensive presentation to targeted candidates on behalf of the client.

– the firm uses primary research techniques for locating sources rather than secondary research techniques like computerized databases, resume files etc.

The Consultants in the Executive Search Firms thoroughly researches the client organization and position requirements before search. They invest 40 to 50 hours per month on each search and handle only three to four cases at once. The consultant recommends to the client two to five highly qualified candidates that match the client requirements, the team structure and the organization culture. Using an Executive Search Firm minimizes the HR and management time and involvement required. Reputable firms offer professional guarantee and commitment to thorough, ethical practices of loyalty and confidentiality.

b) head-hunting agencies

The Executive Search Firms' recruitment and evaluation efforts target broad range of candidates, most of whom are not in the job market. The head-hunting procedure for instance targets only one or two specific persons who are the only ones meeting the client's very specific requirements. Usually such persons are currently employed by a competitive company. In such a case the consultant research the employee's motivation, work conditions, remuneration package and other details that would help his client to prepare a seducing job offer and to get the specialist into his company.

5. Our approach to personnel recruitment and selection. When the triple "hardware, software, peopleware" is considered, progress in the first two components can be observed, with modest achievements in the third one so far. We believe in Sneed's statement that "each software system is as good as the people involved in it" and have tried to elicit some efficient procedures for personnel recruitment and selection. We would like not only to share our findings with the software community but to suggest some tools

supporting the techniques described above.

A personnel information system has been developed. It comprises all data which can be analyzed during the recruitment and selection procedures and creates the lists of applicants satisfying a specific request.

In [6] we proposed a methodology for continuous improvement in software development through benchmarking. This methodology is based on a general ranking technique (the method and the software tool) which can be applied to a set of arbitrary homogeneous objects. In order to apply this technique one has to define the items of the following scheme:

TO <analysis or assessment>

FROM THE VIEWPOINT OF <kind of software personnel>

TARGET OBJECT <object to be studied>

SO AS TO <objective>

Then the set of measurable characteristics should be specified and the corresponding ranking procedure will produce the sorted (ranked) list of the objects.

We are going to apply this technique to human resources management. As an illustration three real-life situations will be considered. It will be shown that it is possible to define the relevant characteristics for which certain special psychological techniques (tests, interviews, questionnaires, etc.) exist, leading to numerical marks as quantitative measures.

Problem: How to select the most appropriate candidate for a vacant position?

Three different types of positions can be free:

a) Low level management

In this case the characteristics and the corresponding measuring methods can be:

CHARACTERISTICS	MEASUREMENT
Intellectual ability	IQ tests, i.e. Henmon-Nelson Tests of Mental Ability, Amtauer test, California Test of Mental Maturity, Raven Test etc.
Overall knowledge	Checklists, interview
Verbal fluency	Amtauer test, interview
Originality of thinking and creativity	Cattle 16PF Personality Inquiry
Energy, ambition, persistence	Cattle16 PF Personality Inquiry, Myers-Briggs Test
Social potency	Guicent Test

b) Project managers (PM)

The main purpose can be how to select a task-oriented or a social-oriented PM. The applied measurement method can be the LPC scale of Friedler and Chemers [4].

– The task-oriented PM is appropriate when the situation is highly favorable (the task is clear and the leader has the power to ensure that the subordinates follow the rules and procedures and maintain the performance standards).

– The socio-emotionally oriented PM is required when the groups are not engaged in satisfying and clear tasks and the power relations are vague.

Another problem can be how to improve the team-leader efficiency since the upper management can modify the leader – member relations, the task structure and the position power [5].

c) Software developers

Much of research work results in proposing the characteristics which can be considered in order to produce the personality profile of the person working in the field of Computer Science. Our suggestion is to evaluate the most significant of them – stress resistance and adaptability.

CHARACTERISTICS	MEASUREMENT
Stress resistance	
Evaluating stress copying strategies	Spielberger Inquiry, Tylor's test
Adaptability	
Intellectual aspects	IQ test, i.e. – Amtauer test
Personality aspects	Cattle 16PF Personality Inquiry

6. Conclusion. Some procedures for hiring the best software people have been described. They have been selected expressly for software organizations and seem to be feasible and cost-effective.

There are several possible directions for further research and practical work. We will try to apply the proposed procedure in a small software house, hoping that the post-implementation analysis will confirm the feasibility of our approach and may provide some new ideas.

Our study shows that most software companies in Bulgaria underestimate the impact of the human resources management. So it seems possible to create standard descriptions of several types of recruitment practices and save them in the repository.

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КАК ДА СЕ НАЕМАТ НАЙ-ДОБРИТЕ СОФТУЕРНИ СПЕЦИАЛИСТИ

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Настоящата статия разглежда някои проблеми, свързани с управление на човешките ресурси. Представени са основни техники за набиране и подбор на най-подходящите софтуерни специалисти, като са отчетени особеностите на дейностите по разработване на софтуер. Нашият подход към подбор на кадрите е описан с прилагане на разработени от нас методи и съответни софтуерни средства.