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Abstract: This report is offered to the beginning project leader as a training aid to improve project team staffing effectiveness and planning in an Engineering or Technology Based (ETB) Firm. It analyzes different sources of personnel and provides guidance for selecting project team members.

PROJECT TEAM STAFFING

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1. Abstract

This paper is offered to the beginning project leader as a training aid to improve project team staffing effectiveness. The paper analyses different sources of personnel and provides guidance in selecting project team members.

2. Introduction

The purpose of this paper is to develop a systematic approach the Project Leader can follow to acquire the best possible personnel as team members. In developing this approach, the following concepts were found to be very important and each will be discussed in detail:

- When projects are or are not effective.
- Organizational factors affecting team personnel selection.
- A review of skills required of the Project Leader for personnel selection and project leadership.
- Job specifications
- Personnel qualifications
- Recruiting
- Screening and interviewing

The process of staffing project teams is becoming an increasingly more important skill that is vital to the performance and success of multidisciplinary engineering and/or technology based (ETB) organizations. The Project Leader in charge of selecting and recruiting staff for project-type work must be a social architect who understands many of the organizational and behavioral variables that contribute to the success of team projects and the organizations they contribute to.[51]

As the title indicates, the focus of this paper is the staffing of project teams. Specifically, personnel selection.

Following is a brief discussion of items not directly related to personnel selection, included so the reader will be acutely aware of the authors' intents and goals.

For the purposes of this paper the term "project team" will be defined as a group of technical professionals assembled for the purpose of working on a specific project. The project will be assumed to be of a highly technical nature and of considerable interest to upper management of the organization. It is assumed that the best available personnel are to be assembled to complete the project, and upon completion, the Project Team will be dissolved. The project will be carried out under the direct supervision of a single Project Leader, supported by a team of professionals of a size no larger than one person can adequately supervise.

By defining our team structure and size in this way, we are able to more closely focus our research, and still address situations commonly found in industry.

This paper will be structured to assist the Project Leader in the following situation:

Upper management has selected a Project Leader and explained the project they wish them to carry out. The Project Leader has been selected from the technical staff, and has no previous supervisory or managerial experience. How should the newly appointed Project Leader proceed in assembling the team members for successful project completion.

The very first question the Project Leader should ask himself is "Is the team approach really the best way to achieve the goals of the project as presented by upper management?"

This question may seem trivial at first, but some investigation is warranted. Why would upper management ask for a special team to be formed if this approach would be counter-productive to achieving project goals? Some types of work and situations are definitely not suited to the project team approach.

3. When Are Project Teams Not Effective

Formation of project teams is only appropriate when there is a strong need to improve a basic condition or process that is interfering with organizational goals. Is the project one where collaboration is essential between a close-knit group of individuals with separate areas of expertise for achievement of project goals?

Forming a project team to deal with a problem that is clearly within the domain of an existing department or sub-group of the organization will surely cause internal conflict that will adversely affect the organization. In such a situation it would definitely be difficult for the Project Leader to secure the cooperation of the functional manager(s) from whom responsibility had been subtracted, cooperation that would be necessary for assembly of staff. Project teams have definitely been proven to be effective when applicable. It is important to fully evaluate beforehand if management development, organizational restructuring, or job redesign may be more appropriate for the organizational goals desired.

Upper level management must be committed to the project team approach, and all its implications. Upper management must be familiar with the time, resources, and energy that must be expended in the project team approach. [50]

If management only wants to employ the project team approach, to an arbitrarily contrived situation, for the purpose of adopting the latest "fad" in the technical management literature, without its full support and commitment, problems will hinder its development.

Management must have time to deal with the project as it evolves and requires evaluation of its results and conclusions. Demonstrated management involvement and interest in project activities will be an important motivator for team members. Without it, the full

effectiveness of the project team will never be realized. Management must also be willing to commit the time of other professionals under their supervision and/or additional staff to the project team as required. If team members perceive their efforts toward project goals not being recognized as valuable contributions by management, motivation and project effectiveness will suffer.

Upon evaluation of project goals, the Project Leader should have confidence that management is committed to provide all the resources necessary for successful project completion. A partial list of resources would include: funds, personnel, facilities, and time. Judicious allocation of resources for the project is an important, tangible, measure of management's commitment to the project.

Consider whether management is willing to evaluate the performance of the project team objectively. Project teams are often required to look at what has been done in the past and then implement improvements and changes. A team of interdisciplinary professionals, working semi-autonomously in an atmosphere that emphasizes creative problem solving, may return conclusions and recommendations management finds disturbing. Management rigidly entrenched in organizational norms and resistant to change will not provide an environment for the project team to function effectively.

If management has already decided that a certain action must be taken or certain changes made, and if the project team is formed merely to confirm these moves and make it seem that the project team has decided these conclusions for themselves, the decisions are usually perceived as manipulative and result in resentment, resistance, and cynicism.

4. When Are Project Teams Effective

The project team approach can be particularly effective when the project is primarily involved with technology that is relatively new and developing rapidly. Project teams, by the nature of their quick and efficient channels of communication, can respond to factors in the external environment that are variable and changing rapidly and affect the organizations operations.

An organization with management that is comfortable with delegating authority and decision making, especially as related to issues critical to organizational goals of the firm, will be able to utilize project teams effectively. An atmosphere of interdependence and willingness to solve problems for the benefit of the entire organization is especially conducive to the success of project teams.

When an organization is frequently confronted with situations where technical specialists must be assembled for decision making and problem solving purposes, project team formation can be advantageous. Especially when formal communications channels are insufficient for prompt exchange of information, opinions, and decisions between key personnel.

Once the Project Leader has confirmed that indeed the project team approach is applicable to their particular situation, and management fully supports the concept, he can

proceed in assembling the required staff for the team.

5. Organizational Factors

5.1 Projects

When discussing project organization, it is helpful to understand what makes an undertaking a project, and how project management differs from functional management. This section discusses these differences and how they may affect the team selection and team organization.

There are three major characteristics that distinguish an undertaking as a project they are:

- A one-time effort with a singular objective.
- Each to a degree, a unique coordinated undertaking utilizing different resources in a unique configuration.
- The environment in which they operate is always different and constantly changing.
[003][004]

Projects are finite. They have a clear beginning and end. When the objective has been met, the project team should be disbanded.[004] The fundamental driving force behind a project is accomplishment of a given goal. It is, therefore, imperative that project goals be clearly defined and articulated prior to team structuring. This will permit those involved to have a clear understanding of the needs to support goal accomplishment and proper team structuring. These needs must need be constantly reviewed for needed changes throughout the project life cycle as well as when project goals are modified.[003]

The environment is all those factors internal and external to a project that affect the project. Since each project is different so are the environmental factors and there change throughout the project life cycle.[004]

5.2 Project Management vs Operational Management

Based on the differences described above, we can refine our definition of a project to "...a unique venture with a beginning and end, conducted by people to meet established goals within the the parameters of cost, schedule, and quality." and define project management as "...the mixture of people, systems and techniques required to carry the project to successful completion." [002] This definition differs from the traditional leadership roles which are thought of more in one-dimensional; that is in terms of operating tasks as they relate to providing guidance to subordinates.[001] This comparison should not be considered as opposing management philosophies but rather as different phases of business progression. The project leader is given a resource base to explore a potential business enterprise and through a project effort, achieves the given objective. Once the goal has been reached the operational manager can take over. It is these differences that make the project leader's work different from that of an operational manager.[004]

Operational management is ongoing and constantly being refined, project management is

often a one-shot effort with little benefit from feedback. In many cases the project leader cannot utilize the past as a guide to the future. Projects are temporary and because of their self-destructing nature, the project team must work to make their jobs obsolete. This can be unsettling to individuals who are process vice product oriented.[004]

The project leader differs from his operational counterpart in his needs to meet and conquer risk. Operational managers strive for routine and predictability while the project leader abhors management by rote. Operational managers are rewarded for improving and refining while project leaders are rewarded for accomplishing objectives. [004]

The operational manager concentrates on the vertical hierarchy, the project leader operates outside the normal vertical chain of command and must also concentrate on the horizontal hierarchy.[001] In addition, he must form a web of relationships to accomplish tasks. The project leader typically has little authority to carry out this work. It will often be necessary for him to cross organizational lines and deal with personnel and resources over which he will have no formal control. His success will often depend upon his ability to coordinate and influence.[003] Where the operational manager has a single chain of command the project leader often has two.

A project leader should have a high frustration quotient. For it is not a matter of if things will go wrong with a project, it is when. Despite the best efforts of perfectionists at planning and control, things will seldom go as planned.[003][004]

5.3 Organizational Structures

When reviewing organizational considerations of project staffing, it is important to understand that people accomplish goals, not organizations. Organizations are only temporary "contrivances" to leverage people's skills and motivations. The objective of organizing them should be to find one that works and one that achieves.[002][004] Jay W. Lorsch gives the following goals for structuring the organization:

- Provides a permanent setting in which managers can influence individuals to do their particular job.
- Achieves the pattern of collaborative effort among individual employees.
- Creates an organization that is cost effective with a minimum of duplication of effort.[007]

A properly designed organization is a major contributor to project success.[004] Unfortunately, there is no one project organization which is perfect for all projects. To determine which organization is suited for a specific project one must be aware of the environment the project will operate in. The project's organization must be compatible with prevailing organizational cultures, behaviors and system and be technically capable of achieving the project's goals. Additional factors that will affect the type of structure include: the amount of autonomy desired by the project leader and client (sponsor); project duration and magnitude; project peculiarities; manager's experience; the stability and rigidity of the parent organization; the professional aspect of the project; project visibility; project location, as well as business and commercial considerations.[002][008]

In their paper presentation at the 1980 October ASCE Convention in Hollywood, Florida, Ruskin and Estes identified forty-three organizational factors in the areas of organization, staffing, client(sponsor) relationship, attitude toward risk, communications, and expectation that either enhance a project's success or threaten it. They stated that project leaders cannot have everything their way; however, they could enhance their overall chance of success by understanding the effects of each factor, and seeking courses of action that optimize the helpful effects while realizing the inherent conflicts between factors and the need to seek compromise and trade offs.[010]

5.4 Teams and Team Building

The success or failure of a project will likely depend upon the people assigned to it.[003] Since people are the basic work unit of projects, the importance of team building cannot be over emphasized. The project leaders then must have a full understanding of what teams are and how they contribute.[003][006] In their IEEE Transaction on Engineering Management article, Thamhain and Wilemon see team building as critical to project success. They recommend that team building be a primary responsibility of the project leader who should strive to create an environment conducive to teamwork .[011]

Team building in engineering groups requires some special considerations because of the basic nature of engineering projects and the technical emphasis of many engineers. Engineering groups, often comprised of intelligent, strong-willed individuals, are prone to have a lack of direction, and are prone to disagreements and conflict. Team building efforts are likely to be resisted by technicians choosing to remain in the technical field who see them as a waste of time.[006]

In his article, "In Praise of Followers", Robert Kelly says that in our 'zealous' search for leaders we tend to lose sight of the value of those within the organization who are effective followers and possess the following essential qualities :

- They manage themselves well.
- They are committed to the organization and to a principle, or person outside themselves.
- They build their competence and focus their efforts for maximum import.
- They are honest, courageous and credible.

Kelly sees the value of these followers as good team members, in leaderless groups and in groups with temporary or rotating leadership.[005]

If personnel and team building is critical, then why is there a noted lack in people skills in many project leaders? This is attributed to either their lack of appreciation of the criticality of people to project success or their inability to manage people.[004] Also, there is a wide disparity between the qualifications to become a project leader and the qualifications to be a successful project leader. Project management has been called "the accidental profession" that is, projects are often inherited or assigned to people who have little or no project management experience.[003] Additionally, scientists and engineers are frequently

assigned as project leaders based on their technical performance. Unfortunately, the characteristics that make a good scientist/engineer may doom them as project leaders. This often results in a failed project or an unhappy individual or both.[003][004][009]

W. F. Peck attributes the frequent inability of scientists and engineers to effectively deal with people and function in a complex multi-dimensional organization to the scientific personality which he identifies as:

- High analytical interest.
- Conservative.
- Zero defect, detail oriented.
- Individual thinker and doer.
- Dependent upon facts.
- Low trust and support from others.

Peck says the key to effectively managing in this environment is to recognize the multi-dimensional nature of organizational management, then develop role-playing skills which are normally contrary to their personality and interests.[009]

6. Establishing Personnel Requirements and Job Specifications

6.1 Project Leader Qualifications

Contemporary engineering managers and writers have devoted much attention to project team planning and to the personnel selection process. It is critical that team leaders and upper-level managers in ETB firms establish a solid foundation for their project teams in these two areas. Of equal importance, however, are the processes of establishing personnel requirements for the project team and defining the precise job specifications for each position on the team. The ETB firm which fails to commit adequate attention to these two key phases or which rushes through them, may program its newly formed project teams to failure.

Because we are assuming that the project leader this paper is designed to assist, is in his first managerial/supervisory position, a brief review of the skills and responsibilities required of the project leader is in order.

In his November 1987 article, J.W. Poirot discusses the roles and responsibilities of the managers in an ETB organization tasked with planning for and forming a project team. Poirot's concern was to program the team for success and quality performance before the personnel selection began. He recommends that the manager who will supervise the new project team's leader carefully define the team leader's responsibilities, minimum acceptable technical qualifications and functional relationships with other members of the ETB firm who work outside the project team.[120] Mr. Poirot prioritizes these three aspects of the team leader's duty position in order of importance:

- Specific responsibilities
- Functional relationships
- Minimum technical qualifications

One must note that Mr. Poirot makes his recommendations against the backdrop of a medium or large ETB firm with dozens or even hundreds of project teams operating simultaneously. We must also note that Mr. Poirot recognizes the team leader's "minimum" technical ability to be a combination of formal education, solid field experience and some level of demonstrated success in leading project teams.

At the 1986 Conference on Engineering Management, Mr. W.F. Peck examined the potential project team leader's personality, communication, personal and organizational relationship skills in much greater detail.[121] Mr. Peck provides a detailed analysis of the team leader's personality as it impacts the specific requirements of his duty position. He focuses the discussion on the importance of pinpointing desired leadership, communication and organizational skills of prospective team leaders during the team planning phase. Implicit in this discussion are two important assumptions: First is that the superior to whom the project team leader will answer must be involved in planning for the team's staffing and operations. Second, that this planning will be substantially complete when the personnel screening and selection phase begins. Mr. Peck indicates that unless a potential team leader's personality and interpersonal skill are compatible with those of the superior, the prospective team members and the project team's integral role within the ETB's overall structure, the project will encounter difficulty. Our group's experience validates this conclusion. Project teams do not exist in isolation. The work of other units in the ETB firm impacts the team; the project team's product or solution of its assigned problem must affect activities outside the team. Shannon points out that, ultimately, the success of the ETB organization depends upon the collective success of its project teams.[122]

Therefore, given the critical nature of a project team's success, engineering managers must ensure that potential team leaders possess the leadership, communications and interpersonal skills they will need to guide and direct their team's efforts. After specifying these skills, the manager must specify them clearly to those who will conduct personnel screening and interviewing operations. In his April 1988 article, Carl Nelson highlights the importance that screening and recruiting players understanding the requirements which the manager has outlined.[123]

6.2 Qualifications for Project Team Personnel

Project managers want the best people to be assigned to their staff. They may receive some people from outside recruiting and some from direct appointments from within, but regardless of where they get candidates from, they want excellent performers. Whoever is doing the choosing will need to know what qualifications to look for.

What kinds of people make good project people? These qualifications will be addressed in two categories. First, do the people possess the right attributes/capabilities to do well on a particular project? Second, are they willing/motivated to put forth the work the project

will demand?

First and foremost, project people need to be technically competent.[140] They need to be experts in their field of study. They must know their subject thoroughly and be able to make a significant contribution to the project. They also need to exhibit competent and efficient work habits. If they are not organized they will waste precious project time.

Project people need to be bright and creative in their thinking in order to meet the requirements of project work. Quick innovative thinking will be invaluable as they search for solutions to unique project problems.

People on a project must have outstanding interpersonal skills. They have to be good communicators.[142] They will be working with strangers instead of their day-to-day work companions from their functional area or old job. They must be outgoing and able to work with people they are not always comfortable with. Good working relationships develop over time but the project person must establish these quickly. The shy or withdrawn type of person, who is capable of doing good work in the right environment, will not be desirable for project work. The pace and level of interaction in a project demands that the various players interact constantly and with a high sense of purpose.

Project work is also very unstructured causing a need for flexibility.[140] They must be able to adapt quickly and easily to the changing nature of project work. They must adapt their work to project requirements as they become apparent. As certain breakthroughs occur, the amount and level of intensity will vary. If they insist on a rigid work schedule with no flexibility, they will be dissatisfied.

They must also learn to work for more than one boss, both the project leader and their functional manager. They must be able to remain focused on their part of the project and limit obligations to their functional area. Sometimes it is hard on project people when their work on a specific project is confidential and they are not allowed to discuss it with their old colleagues.

It is very important to pick people who will be on the project for its duration. People with longevity will save the project a tremendous amount of time. It will take the replacement considerable time to reach the same level of experience in the project material and also get comfortable with the new people and surroundings. The project team will experience a knowledge and experience loss in the transition from one worker to the next. Galbraith in his book "Winning at Project Management" shows graphically how the effect of replacing workers can result in a tremendous amount of capability and knowledge loss in that particular position.[130]

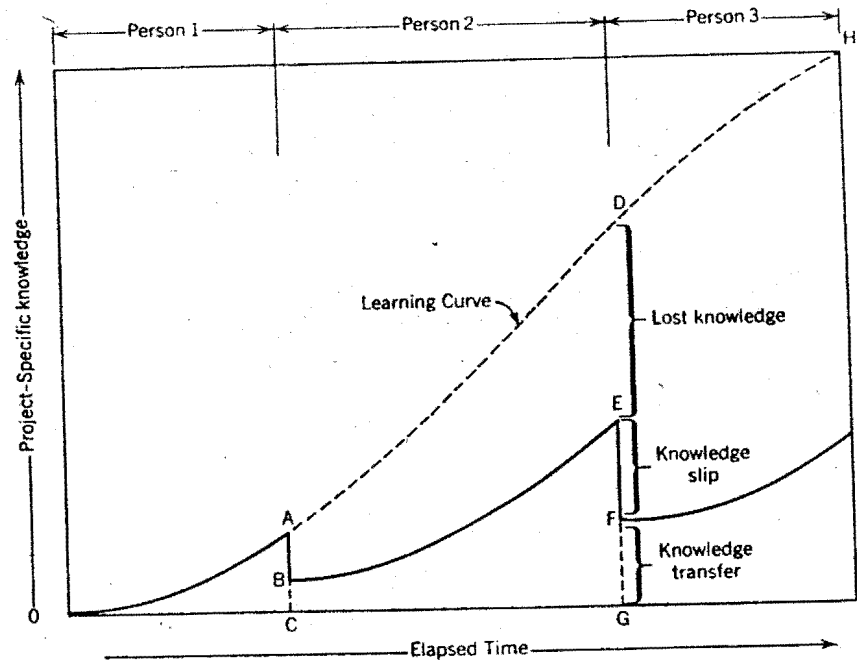


Figure 3-2. The broken learning curve.

Curve OADA represents Person #1's growth of knowledge over time. It will quickly rise and taper off at the end of the assignment. But if Person 1 is replaced not all the knowledge is transferred, for it will be very hard to transfer all of his experience. As a result, progress on the project will lag while the new person works his way back up the learning curve.

One other very important qualification to look for in project personnel would be experience on previous projects. Look into their past work record to see if they have ever worked on a project before. Have they ever been pressured by demanding work schedules, limiting costs and making deadlines, while maximizing performance. Look at examples, if possible, of actual work completed. Past experience on another successful project will usually indicate a desirable choice for selection unless someone else was carrying the ball for him. References should be contacted as well as other managers he has worked for in the past.

Above, we have discussed many attributes/qualifications to look for in selecting project personnel. There are also a few personal and attitude traits to look for. The first and probably the most important one is commitment.[141] Project personnel have to have a strong sense of commitment to their work. They need to be willing to work long hard hours if necessary, to keep the project on schedule. They need to be the kind of people who will take satisfaction in their contributions to the project alone, instead of saying "now, what is all this extra effort going to get me?" Basically this is selfless service for the good of the project. The individual who will do what ever is necessary to get the job done right the first time and on schedule, is the one who is totally committed to his work.

He would also be what you would call goal oriented.[130] He would not be concerned with the processes used as much as that the goal is actually reached. He is not as concerned

with what it took to get there, but more so with the end result being achieved. This is a different orientation than expected in people working in a non-project environment such as a purely functional area.

Project people also need to be self motivators.[141] They need to be excited about what they are doing and develop a sense of ownership in the project. The project leader will not have the time to be constantly counseling people about duty performance and conduct. Project people need to work to their potential without a lot of prodding from the boss. These people need to work well under conditions of less recognition as well as less admonishment. The manager will probably not have a lot of time for psychological stroking. Much of the time on a project is a team effort. Individual accomplishment in the advancement of the project will not always be easy to recognize, but a good project person will drive on, committed to his work until results are achieved.

7. Recruiting

Once the team needs and personnel requirements are identified the next step is to put together an effective recruiting program. Before any recruiting program gets underway it is important to determine who will conduct the recruiting, know what sources are available, evaluate ones that would produce the most best people, and identify the best means to reach these sources. During the recruiting process it is essential to keep in mind that the success the project leader achieves in hiring competent people is a direct result of how effective the recruiting program has been.[7]

Recruiting programs represent a large expenditure of considerable money, time, and effort. Although many techniques have been used in the past, each recruitment effort requires the organization to evaluate its own situation and decide how it may best attract the highly qualified professional talent.

7.1 Who Will Do the Recruiting

One of the first things that needs to be determined is who is going to be in charge of recruiting the right people for the project. It is ultimately the responsibility of the team leader to insure that he has the right people to complete his project effectively. Based on that, it is important for the team leader to devote a great deal of time to recruit the appropriate people. In many cases once the project leader has completed the job specifications for his staffing requirements, and has a pretty good idea of what he wants and what he is willing to pay he can have the human resource manager or personnel expert assist in finding the suitable people.

According to Stanton the team recruiter should perceive himself as some what of a marketing specialist; whose major part of a successful recruiting campaign is selling the company to prospective applicants.[7]

7.2 Sources of Professional Talent

There are two basic approaches to recruiting; internal and external. Either has advantages and disadvantages. Whether it is better to do one or the other depends on the team's

unique requirements, but both alternatives should be considered.[2]

Evaluating various recruiting sources is a very significant task, because as can be seen the list of sources is fairly long and the search for potential employees could be a very long and tedious process. It is important that the hiring manager makes an assessment at an early stage as to what is the best source for him to focus on for the job openings he has. Some of the considerations that the manager needs to keep in mind when selecting the sources of recruitment are budget and time constraints, required skills and expertise, and the length of the project.

The main thing the manager needs to remember is that he needs to attract a sufficient number of job applicants if he is to succeed in filling the team positions with well qualified people.[7]

7.2.1 Recruiting From Within the Company

Potential recruits can be found within the company; either in the leader's own department, other departments in the organization, or other organizations within the company.

Internal recruiting has distinct advantage in that better-qualified applicants are generally obtained for the available positions. This is because the person recruited from within will have more familiarity with the people, procedures, policies, and special characteristics of the organization than an applicant recruited from outside.[3] Some times there are difficulties in getting internal people to move into new positions in the organization due to their satisfaction with their current jobs. The project leader may need to entice those satisfied people away from their present jobs as a growth path; especially in the situation where the manager can't find the expertise outside the company.

Another reason that recruiting from within tends to obtain better-qualified personnel is because management, by its observations of an individual's performance over a period of time, can make a more realistic assessment of the person's skills than those of an applicant recruited from outside. Consequently, the margin of error in evaluating the capabilities of the present employee should be much less than that associated with the assessment of an outsider's capabilities.[3]

Internal recruits will usually require less time to come "up to speed" for the assigned tasks. According to Shannon it also helps in motivation; ambitious people will generally work harder if they feel that this will lead to advancement, but they will have little incentive to perform if it is management policy to fill the more prestigious positions through outside recruiting. Another advantage is that this alternative is generally less expensive than recruiting outside.[2]

The team project leader must consider three aspects when recruiting from inside. First, what will happen as a result of the candidate leaving the position he has held. The second thing he must consider is its impact on the candidate, and how he perceives the transfer to the new position. Finally its impact on the rest of the organization must be taken into account.[2] An aspect that should be taken into consideration when recruiting from other

organizations in the company is the manager needs to be extremely careful so he is not accused of raiding. This can result in poor relations and problems with the management of that organization in the future.

7.2.2 Recruiting From Outside the Company

The time to recruit from outside is when candidates availability doesn't exist inside. The advantages of hiring from outside the company are numerous. Hiring from outside serves to bring new talent, thereby enhancing the effectiveness and efficiency of the organization. According to Cohen, organizations that never hire above entry-level professionals tend to suffer from narrowness and stereotyped thinking. No one with the objectivity or prospective of a senior outsider is ever around to challenge or question the standard ways of doing things.[2]

Hiring from outside eliminates the disruption of an existing smoothly functioning team due to the removal of a competent, conscientious worker from that team. Additionally, It may be cheaper and less risky to hire someone from outside for a critical R&D job; someone who has successfully done this type of work before, rather than to promote someone from within and hope the person can grow into the job.[2]

On the down side, hiring from outside can be costly and more time consuming. The individuals would have to be brought up speed with the company's methodologies and procedures due to the lack of familiarity with the organization. In a situation where the new position can be a promotion to members in the manager's own organization, hiring from outside may be a dissatisfier. People in the manager's own organization could get the idea that they can not be promoted to a higher position.[2]

7.2.2.1 In Another Company

This is a good source to hire a key professional with the required area of expertise, motivated and ambitious enough to be looking at a better opportunity. It is generally accepted that if you can offer a better opportunity, an individual should be free to go and the other organization free to hire him or her. The hiring manager needs to present the job situation in its best light and make it sufficiently attractive in terms of compensation to motivate the candidate to switch.[2]

7.2.2.2 Probable Layoffs Due to Cutbacks, Project Completions

To exploit this source of candidates effectively the manager needs to keep his eyes and ears open. When he reads or hears about a pending cutback, project completion or cancellation, merger, or acquisition, he should contact the company's personnel department and let the manager know that he is hiring and what he is looking for. Ask for resumes of suitable candidates, if available, and ask to call him should the needed technical expertise become available.

7.2.2.3 Unemployed

There are quite a few candidates who are unemployed due to various circumstances; layoffs, the candidate has quit, or sometimes has been fired. Generally these candidates are looked upon unfavorably, but there may be a possibility that a match may be found for

the mutual benefits of both the company and the candidate.

In considering an unemployed candidate it is important to determine the reason of unemployment. Due to the negative aspects of being unemployed the candidate may be somewhat more apprehensive than an employed candidate due to his situation and may be uncomfortable in an interview.[2]

7.2.2.4 Job Shops

These are private employment agencies that are good source of temporary professional help. essentially the job shop hires the technical professional and provides his fringe benefits. The person is then rented out to various companies on "as needed" basis. The personnel office normally has a list of those organizations that the company does business with regularly.

The advantages of using a job shop is that the manager does not have to retain excess personnel for jobs that require peaks of labor that will not be sustained. One disadvantage is that it is more difficult to make them a part of the organization and they are not likely to be as fully committed to its goals as permanent employees. additionally, it would be more difficult to control proprietary information with temporary employees.[2]

7.2.2.5 Consultants

Consultants are another source of temporary professional help. Consultants are generally used to assist in solving specific technical problems in their areas of specialty. Finding consultants is not an easy task; professional societies, and trade or business associations provide good starting points in trying to locate the needed consulting specialty.

Considerations for using consultants are the same as for job shops. In addition, consultants are expensive to use.

7.2.2.6 Newly Graduated or About to Graduate

Universities and colleges are another potential source for employees that can be obtained without extensive recruiting efforts. Most large organizations maintain a separate college relations function and conduct extensive recruiting programs. The manager can contact his/her college recruiting office for resumes of applicants that will meet his needs and for those that don't have that luxury they can contact the placement offices and sometimes faculties of colleges and universities.

If the determination is made that the need is limited to experienced personnel, it makes little sense to hire people from schools who will bring with them no industry experience. Additionally, recruiting from schools is sometimes costly due to expenses incurred for travel, for recruiters, and prospect employees, in addition most companies offer relocation packages for those who don't live near of the hiring company.

7.2.2.7 Other Sources

There are many other recruiting sources that the hiring manager can consider to fill some of his open positions. Here is a partial list.

- Public employment agencies.
- High schools; trade and technical schools.
- Unsolicited("Walk-in") applicants.
- Community organizations.

These sources are normally used for general non-technical staffing needs, and the likelihood of finding technical personnel is almost null.

7.3 Methods of recruiting

7.3.1 Advertising

Advertising is the the first suggestion made when a need for additional staffing arises. Advertising can take various forms each of which has to be evaluated to determine the best approach for the specific recruiting situation. The manager can advertise with or without an advertising agency. Advertising can be accomplished through the internal company newsletter, newspapers, technical and professional magazines, radio, and television.[5] A great deal of the advertising involves selling and presenting the company and its position in the best light.

One advantage of the advertising method of recruitment is that the manger can locate candidates to be interviewed rapidly.[2] The major disadvantage of advertising is that it can be fairly expensive. In addition, respondents to employments ads apply in great numbers, but they are of variable quality. Shannon suggests that this problem can be partially alleviated by judicious selection of the advertising medium, particularly if recruitment of a particular technical discipline or population segment is the objective.[3]

According to Cohen if the manager is looking for a specialty that doesn't exist in large numbers it is difficult to find potential candidates through advertising. He mentions another disadvantage, advertising will only reach candidates who are looking for this type of position during the advertising period. He suggests that either people unhappy with their present jobs or people out of work will respond and it will rarely reach high performers in their current organization.

Finally, Erwin Stanton cautions managers about writing advertisements; he says the manager must not inadvertently violate any of the equal employment opportunity laws or court rulings.[7]

7.3.2 Recommendations and Referrals

This is the easiest way of recruiting, but it is inefficient. This word-of-mouth pertaining to potential applicants has several advantages. It doesn't cost anything, or costs very little, it is easy and informal.[2]

According to Erwin Stanton[7] "probably the best recruiting source available is people already familiar with the company." The quality of applicants recommended by people who know the company and its standards and requirements is usually of a higher level

than, the candidates coming from a totally unscreened source, such as a newspaper or magazine ads.[7] Conscientious employees want to assure the maintenance of a professional organization of the best kind.[5]

Additionally, many individuals who share similar training and work experiences become acquainted with one another and develop wide circles of friends and associates. As a result, through professional society meetings, day-to day business dealings; such relationships are extremely fertile recruitment areas. [3]

The big disadvantage of the word-of-mouth recruiting is that the manager may not reach as many potential candidates as he would otherwise. Friendship commitments may also lead to a waste of time interviewing people the manager doesn't need. Lastly, it would be difficult to control the news of a quiet search.[2]

7.3.3 Government Employment Agencies

Government employment agencies can be of help in finding someone, but usually they are not effective. Most professional people don't go to government employment agencies until they have tried other means of finding employment. Therefore, if the manager is being selective in hiring, he will discover that candidates from government employment agencies usually possess some negative factors that limits their desirability in comparison with other sources. It is helpful to check government employment agencies, but the chances of finding what he is looking for are slim.[2] These agencies charge neither the employer nor the prospective employee for their services. Many organizations therefore have turned to these agencies only as a last resort.[3]

7.3.4 Private Recruiters and Personnel Agencies

Unlike the government employment agencies these agencies charge for their services, and the fees may be substantial. These agencies may conduct nationwide searches for professional talent especially for highly specialized experience and prescribed personality traits.[3]

According to Edwin Stanton the quality of these employment agencies leaves a good deal to be desired based on a general consensus of a number of participants at recruiting and selection workshops he has conducted throughout the country. He suggests that the manager exercise a good deal of care in selecting the particular agencies with which he wishes to deal. It is a good idea to limit oneself to no more than three or four truly competent agencies. Properly used these employment agencies can do a competent job of prescreening suitable candidates and referring only people who are truly qualified for further consideration.[7]

When done properly, recruiting through private search firms has a number of advantages. The manager can be much more precise in the requirement set for potential candidates, and can save much time that might otherwise be wasted on interviewing and screening. There is probably a greater chance of succeeding. If not then the manager can usually get his money back or have the firm recruit for the manager until he finds a suitable candidate. Additionally, if the candidate hired is from a competitor then legally he has lowered the possibility of a lawsuit for raiding.[2] One major disadvantage of this recruiting

alternative is the high cost. The generally accepted fee rate is about 30% of the hired professional salary.[2]

Reviewing aspects of various recruiting sources and methodologies, it is apparent that recruiting from internal sources is usually more fruitful than external sources. External sources should be used when specific expertise is not available internally. The best methods of external recruiting are advertising in periodicals and using private recruiting agencies.

8. Screening and Interviewing

The project leader enters the screening and selection portion of project staffing with a list of requirements prepared in the planning function, and a list of candidates obtained in the recruiting phase. The screening and selection phase require an initial screen of the applicants, a selection interview with the applicants, and evaluation of the results of the interviews. Since people are often considered a company's most valuable asset, the staffing function should receive careful attention. Managers often attribute their success to their ability to select good people. Yet others say that the interview and selection process is a poorly used management tool. [101] The following screening and interviewing guide is offered from which the reader may improve their own style.

8.1 Mechanistic Approaches

There is some mention of mechanistic methods of selecting the candidate that should be hired for the project. One of these is Minnesota Multi-phasic Personality Inventory (MMPI). [108]. This method compares the characteristics of a person against the characteristics of people that have been previously evaluated with respect to the target situation. This was proposed as a method to avoid placing people into security situations in which they might fail. With respect to Technical hiring, another source [113], proposes that success is accounted for by many combinations of characteristics and that this evaluation is best done by the project leader. Reliance on MMPI was also depreciated on the basis that "in many cases measures of personality have been used in a shotgun approach to prediction where several variables were evaluated simultaneously without a prior theoretical justification" [110].

Behavioral consistency was also proposed as a means of determining the best candidates [107]. This method relied on evaluating the characteristics of people presently employed in similar jobs against the characteristics of the applicant. This method a short coming in that a large percentage of the candidates declined to fill out the extensive application questionnaire and were consequently disqualified from the application process. These mechanistic methods depreciate the skill of the project leader to correlate a number of partially explored aspects of the person and come to a decision.

The methods discussed here rely on the skill of the project leader to prepare requirements that should be met by the candidate and their ability to effectively evaluate the individual in an interview situation. In obtaining the staff for a project the preparation of the selection criteria is important for the staffing function because the project leader first

articulates the needs of the project and then derives the description of the individual team members from project plan. Their personal involvement in the selection process is needed. The project leader must evaluate their own ability to achieve the objective of the project through these people.

8.2 Screening and Selection Criteria

In preparing a list of characteristics for a member of the project team the items should be separated into "must have," "desirable," and "nice to have categories." This is important so that the entire process can be done objectively. The boundaries between the different items can be adjusted to yield the right number of candidates for the selection process which follows the initial screening.

The number of candidates must be reduced to a manageable number. [117] The purpose is that the interviewers be able to do a good selection job. If too many candidates are interviewed, or if the interviews stretch over too great a period the interviewers will not be able to remember which candidate had which characteristics.

The job descriptions for recruitment were carefully written. This provides the initial screen. The normal return from recruitment are resumes, cover letters, application forms and references. These should be carefully evaluated against the requirements. At this point it is important to check with the applicant on certain specific items of the requirements. Items like; certification, willingness to travel, willingness to relocate, and specific experience can be verified by telephone before incurring the expense of bringing the candidate in for the selection interview. The candidate should also be apprised of the risks of project employment. If you do not expect your company to continue their employment after this project, you should discuss this with the candidate.

The candidate will bring both technical experience and a job approach to the position [117]. Both must be placed into the project team for the project to be successful. In both of these, each team member needs to support the other members.

Regarding job approach among engineers I have observed three major categories. There are those that are able to see opportunities and needs, those that are able to synthesize solutions to meet those needs, and those that are able to finish development of the solutions in preparing the product for the customer. It is unlikely that a single candidate will encompass all three of the functions. Each function needs the support of the others. If some of the functions are left out of the job descriptions that are used in the personnel search, the team will not do all of the project well.

The value and use of references were mentioned several times in the literature. There was not an agreement on when to contact the references. The candidate could be unwilling to expose their references too early before there was much specific interest between the project leader and the candidate. It was also proposed that the reference should be contacted after the selection interview as a final verification of the candidate. One reference [102] proposed the "Threat of a Records Check." That author suggested that the interviewer ask the candidate what their reference would say if they were asked to evaluate their

performance on their last job, thus saving the interviewer the trouble of calling the reference.

8.3 Question Preparation

In preparation for the selection process a discussion of how to ask questions is valuable. One source preferred leading the candidate to tell of themselves in a story fashion. [115] The method was to direct the candidate to go deeper into important areas in a non threatening manner. In general let the candidate do most of the talking. This method promotes the candidate to talk freely of themselves where in a more threatening situation they would close up and keep important aspects of themselves hidden.

In asking questions there are several types of questions that can be employed. Each has its place. Open ended questions will have a broad range of responses. These should be used to gain background information. Close ended questions are used to gain specific answers, as name and address. Probing questions are used to get deeper information in a specific area. [115] In each of these types the interviewer should have a specific reason for asking the questions so as to remain in control of the interview.

The interviewer should be careful to use techniques that cause the candidate to give the right information. A good understanding of the terms used in the question is important. The candidate's understanding of the question is often seen in their face. You should in addition obtain a response that indicates the candidate understands the question. The interviewer should explain the purpose of obtaining the information. This should prompt the candidate to feel easier about giving the information and, they may add additional supporting information beyond the direct question. Finally the interviewer should be careful not to telegraph the desired answer to the applicant, avoid showing your feelings toward the question by your words or emphasis. That way you will get the interviewee's answer rather than your own answer.

Preparation for the selection interview should also include forming the structure of the interview process. "All interviewers should follow a structured, systematic interview process to gather the information necessary to judge the candidate fairly and objectively." [101] Preparation should include the format of the interview and consideration of how to lead the candidate to discuss themselves. In the selection interview the objective is to evaluate the candidate to determine how they will perform in the project team. Each interviewer should develop their own typical set of questions. As interviewers use the same set of questions over many times they will be able to spend more of their attention evaluating the responses of the applicant, rather than trying to keep the conversation going.[113]

8.4 Interviewing

There are many lists of questions that have been proposed for use in interviewing project candidates. We appreciated a list of 4 factors upon which questions can be based that are both consistent and applicable.[113]

- Intellectual skills and aptitudes
- Motivational characteristics
- Personality strengths and limitations
- Knowledge and experience

8.4.1 Intellectual Skills and Aptitudes

In forming your evaluation of the applicant's intellectual skills you need to form questions that will reveal how they think. Most important, in a project setting, is how the person approaches problem solution. One way of finding out how they think is to guide them in telling about themselves. You could ask them about a particularly interesting problem that they solved in their previous job. Be careful not to accept surface or general answers but rather probe to find the person's involvement in the solution. The interviewer is interested in how they defined the problem, how they sought the solution, and how they implemented it. Next; what creativity did they lend to the problem, and how deeply did they think through the issues.

8.4.2 Motivational Characteristics

In evaluating their motivational characteristics you are evaluating the level of commitment that they will bring to the project. Are their personal interests and aspirations directed in a way that will promote the success of your project? Be aware that this is a standard area of questioning so that the applicant may have slick prepared answers. Probe for the reasons that they have these interests and aspirations. The interviewer is interested in the stability of the applicant.

A part of the motivational characteristics of the applicant are reflected in their energy level. They should be asked to describe a typical day. The interviewer is looking to see what drive the person has and what they apply that drive to. How much energy are they committing to the job and also to outside interests. "Tigers" will be found to have a high energy level and are looking for stimulation and motivation. [114]. Since they are high producers, it is important to ask questions that will help the interviewer recognize them in the interview.

8.4.3 Personality Characteristics

The candidate's personality strengths and limitations will determine how they will fit into the project team. It is very important that this person fit with the members of the project team that have already been chosen.[100]. A business seminar acquainted me with 4 basic personality types. The importance of recognizing the existence of these personality types is that the project team should not be overloaded with any one of the 4.[115] These personality types can be recognized through asking the applicant to relate aspects of a previous project that they enjoyed, and aspects that they disliked. These 4 types are:

- Controllers
- Analysts

- Supporters
- Promoters

8.4.3.1 Controllers

The controllers are decisive and active. They like to be in control and work well alone. They like to have maximum freedom to work by themselves. Too many controllers on a project will require extra effort to resolve their differences. The interviewer needs to ask questions which will reveal whether the person is a controller. Ask whether the person got along with their previous managers and what characteristics of the situation contributed to this. If this person has been a leader, ask them how they got the people to achieve the group objective. The controllers will be able to tell of key decisions that they made in the project.

8.4.3.2 Analysts

Analysts are cautious with decisions. They like organization and structure but dislike involvement with others. They prefer objective tasks where the answers are arrived at by collecting and evaluating data. Analysts need external control to draw the answer out and then assign them to another task. Otherwise they may be stalled doing excessive analysis on one problem. An analyst will be able to tell the interviewer many intricate details about some aspect of their previous project.

8.4.3.3 Supporters

Supporters are amiable but are slow to take action and make decisions. The supporter will work cohesively with others so that they will help hold the group together. The largest number of people on the project will be supporters. These people should not be rejected because they are not controllers of forcible people. They will do a major amount of the work once the project is in the implementation phase. The supporter's reference will probably express appreciation for how this applicant helped on the last project.

8.4.3.4 Promoters

Promoters are often the idea people on the project. They want to be involved but will be spontaneous and jump from one activity to another. They will be persuasive and promote their beliefs. Promoters need the the control of controllers and the analysis of analysts to increase their effectiveness. Promoters will be quite talkative and will relate the issues that were important to the last project.

8.4.3.5 Leader's Personality

The project leader should also consider his own leadership personality and compare that with what is seen in the applicant.[116] External deterministic leadership and self direction are at two ends of a continuum. Some exploration should be done to find how far the project leader and applicant should be placed toward these extremes. The further apart they are the less likely they will be compatible. A second axis is the matter of delegated authority. Each needs to be comfortable with the level of authority to be delegated to this position for this project. Both of these issues can cause sufficient friction in themselves to jeopardize the project's success.

8.4.4 Knowledge and Experience

To evaluate the knowledge and experience of the candidate, experts in the candidate's field should be included in the interview team. These interviewers should ask the candidate to explain a project that they have recently participated in. The interviewer should be cautious of sweeping statements.[103] Here the interviewer should probe with questions concerning the candidate's personal responsibility and contribution to the project. Expert interviewers can probe to find if the candidate has specific experience that will benefit the project. If a person is selected as an interviewer that will need to work with the person that is hired, their commitment and opinion will be vital to the success of the project.[111]

8.5 The Evaluation Meeting

To close the selection process the several interviewers need to compare evaluations of the candidates. The evaluation meeting should be held shortly after the interviews so that mental impressions are not lost. Very short notes should have been made during the interview so as to not distract the candidate. More extensive notes should be made immediately after the interview to be used in the evaluation meeting. It is helpful to interview all of the applicants in a short period of time so that there is mental continuity between the interviews.

An important aspect of the evaluation meeting is to draw out any subliminal feelings that the interviewers have.[114] There have been things about candidates that interviewers could not express but later turned out to be significant. These feeling should signal the need for further checking. This is a key time to use the candidate's references. The references will have had a longer relationship with the candidate and be able to add their view for this aspect of the interview.

One article cautioned against evaluating the person against yourself.[105] The tendency to guard against is; selecting someone that is less than yourself. In time, this practice will produce an organization that is less qualified than it used to be. The staffing need considered here is driven by the need to accomplish the project goal. The best candidate should be chosen consistent with the capability of the project to use this person's level of expertise. In choosing excellent employees, the project leader should recognize that one of his important side products for the organization is highly qualified employees that can be used for later projects.

8.6 Offering a Position

Once a decision has been made to make an offer to a candidate, it should be made promptly. The candidate likely is having other interviews and may slip away if the offer is delayed. It is important to recognize an excellent match and pursue that candidate with diligence appropriate to their value.

In making a salary offer to the candidate, the project leader should carefully consider the amount. The candidate will likely have chosen the maximum that they think that they can get as their indication of their minimum acceptable salary.[111] The project leader should be aware of what is a fair salary for the position. The project leader should not

offer so low a salary that the candidate will be dissatisfied and leave the company after only a short time. Neither should he offer more than he needs to to get the candidate to accept the position.

9. Conclusion

Most competent engineers have served on a project team, but few have a solid command of the skills needed to plan, assemble and organize the teams. Today's successful ETB firm must balance an accelerated rate of technology expansion and the fierce competition of other firms in the market place with the need to develop, refine, and extend the useful life-cycle of its own products and services. ETB firms require prompt, expert and directed action to solve problems ranging from product improvement, to software design, to construction site supervision. For many problems, especially ones which are time sensitive, the project team is an effective tool.

We have defined a project team as an interdisciplinary group of technical professionals, tasked with solving a problem that is highly technical in nature and is of considerable interest to the firms upper management. The team will have a well defined mission, a finite tenure, and will dissolve once its project is complete. The team's leader and members may be recruited from within the ETB firm, or from outside. The activities of the team once the members have been selected and the team formally established are outside the scope of this paper.

From research and experience, our group has designated five main phases to project team staffing within an ETB firm. The phases may occur as discrete steps, or may overlap. In chronological order they are:

- Plan the project - (establish task milestones, and resource parameters).
- Establish team requirements - (number, mix and experience of the technical staff).
- Recruit candidates - (attract team members whose qualifications satisfy team requirements).
- Screen candidates - (reject obvious mismatches, choose qualified candidates for interviews).
- Selection - (choose the best qualified candidates for the team).

We view professional qualifications for engineers and scientists being screened for project teams as rock-bottom screening criteria: their training and formal education are the bare minimum. Their ability to work with and complement the efforts of fellow team members will be critical to the team's success. To insure that the prospective engineer, scientist or technician is a solid "match" for the project leader and the team, we propose that the team manager and personnel specialists examine the candidate's aptitude in three other key performance areas:

- Intellectual skills and aptitudes.

- Motivational characteristics.
- Personality strengths and limitations.

We believe this paper to be a valuable and useful tool in smoothing the project team personnel selection process, not only for upper management, but especially for the newly selected, inexperienced project team leader. This paper balances theory with practical application to promote an understanding of the unique personnel considerations and requirements of project team work.

The table of contents with corresponding numbered paragraphs serves as a checklist providing chronological steps and considerations in the project team staffing process. This paper will guide the project team selection process in the following manner:

1. Help upper management decide if a project team will be an effective way of solving their engineering or design problem.
2. Discuss the organizational factors unique to project functional and organizational environments.
3. Review for upper management some important personal qualifications to consider in selection the project leader.
4. Outline and explain a list of personal qualifications for the project team leader to look for in selecting his team's members.
5. Provide the project team leader an extensive list of personnel sources and technique to assist his recruiting efforts.
6. Provide the project team leader with a comprehensive list of screening considerations an interviewing techniques. These will assist him in selecting the right people from his applicant base.

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