Engineering Management
Field Project

Selecting and Hiring Engineers at the ABC Plant

By

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Executive Summary

Hiring is one of the most important duties of a manager, especially within an engineering or technical organization. Beyond the obvious reasons for selecting the proper candidate for the job, the gravity of the hiring process lies in the fact that a mistake in this area is often costly and not easily corrected.

Mistakes tend to be even more costly for the ABC Plant. All positions require the ability to obtain and maintain a government security clearance. The duration of investigative activities for initial security clearances range from 3 to 6 months from initiation to completion. During this time period, and depending on their work assignment, the effectiveness of the newly hired engineer is often impeded by their lack of a security clearance. They are unable to access critical information and locations in the facility to perform their intended job function. This cost of hiring new engineers is incurred by the organization on top of the inefficiencies typical of new employee that is learning their role in a new position. If they are unable to acquire or maintain their security clearance, the engineer is not a viable option for employment and the selection and hiring process must start over again at the expense to the ABC Plant.

The hiring process at the ABC Plant is generally sound, but there is room for improvement. Senior Management and Human Resources at the ABC Plant should consider increasing the amount of training around the hiring process so that Technical Managers are more confident in their ability to select the best candidate for the position. The ABC Plant needs to have an increased emphasis on the behavior of leadership impact and making a positive impact on other engineers in the organization when they

screen candidates during the hiring process. In addition, the company could benefit from encouraging the existing staff to increase their leadership potential by leading small projects or becoming a mentor for a less experienced engineer. Finally, the culture at the ABC Plant is unique compared to other engineering firms. Candidates should be made aware of the mission of the facility as a manufacturer of components as opposed to design. Designs are created and controlled by a separate entity from the ABC Plant and an engineer that desires control over all aspects of the engineering process may not be a good fit for the organization.

Introduction

ABC Plant History

The roots of the ABC Plant stretch back to the intermediate years of World War II. The facility was established in 1943 by the United States Navy and operated by Pratt-Whitney to assemble engines for fighter planes. At the end of the war, fighter plane technology accelerated and the need for vast quantities of engines diminished. In February, 1949 the Atomic Energy Commission changed the mission of the ABC Plant to focus on the manufacture of nonnuclear components for nuclear weapons and requested the ABC Corporation to manage the facility.

Over the past 60 years, products manufactured at the ABC Plant have become smaller and much more complex and the facility has evolved into a high-tech research production facility that specializes in science-based manufacturing.

ABC Plant Mission

The ABC Plant is one of the nation's most diverse low-volume, high-reliability production facilities and is an important production agency of the National Nuclear Security Administration (NNSA). The NNSA is a separately organized agency within the U.S. Department of Energy (DOE) and is responsible for the management and security of the nation's nuclear weapons, nuclear non-proliferation, and naval reactor programs.(NNSA 2012) The ABC Plant provides high-tech production services to government agencies with high-quality requirements. Traditional work comprises taking product requirements from the NNSA and designs from the national laboratories, procuring supplies as needed, and producing quality components and systems for the

NNSA. The ABC Plant also performs work for Homeland Security, the Department of Defense and other government agencies.

National Security

Due to the nature of the work performed at the ABC Plant, employees are required to be a U.S. Citizen as well as obtain and maintain a DOE security clearance. Since 2006, the vast majority of all security clearance investigations for the federal government have been performed by the Office of Personnel Management (OPM). (Henderson 2010) The monetary cost of the security clearance is not directly funded by the ABC Plant, however, the organization does incur costs from the clearance process in the form of reduced employee efficiency. Employees that are hired by the ABC Plant often start employment without an active security clearance. As shown by Figure 1, in the 1st quarter of Fiscal Year 2010, the activities performed by the OPM (shown in blue) for 90% of initial security clearances ranged 58 to 127 days from initiation to completion. (Henderson 2010) However, if there is additional investigative activity required, this duration can extend upwards of a year or more.

AGENCIES	PERCENT OF WORKLOAD	INITIATION TIME (DAYS)	INVESTIGATION TIME (DAYS)	ADJUDICATION TIME (DAYS)	TOTAL DAYS END-TO-END
All Agencies	**100%**	**11**	**46**	**14**	**71**
Army	37.4%	6	42	10	58
Navy	17.4%	16	43	12	71
Air Force	13.2%	12	40	28	80
DoD Industrial	**19.6%**	**14**	**44**	**20**	**78**
DHS	2.3%	29	48	48	125
DOE	0.9%	9	47	11	67
DOJ	0.7%	12	60	42	114
NRC	0.3%	23	55	49	127
Transportation	0.3%	15	39	11	65
Treasury	0.2%	18	54	54	126
HHS	0.3%	27	52	13	92
OPM	0.1%	6	70	10	86
Interior	0.1%	18	55	47	120
Commerce	0.1%	9	42	9	60
VA	0.0%	23	54	31	108
CIA			78	49	127
DIA		41	55	9	105
FBI		35	76	6	117
NGA		7	25	31	63
NRO		3	27	31	61
NSA		7	70	10	87
State			43	11	54
USCG	0.8%	11	42	12	65
CBP	0.0%	30	233	31	294
ICE	0.0%	8	36	131	175
USAID	0.1%	24	45	20	89
BBG	0.0%	29	264	14	307
USSS	0.0%	14	104	18	136
ATF	0.0%	23	54	26	103
AF OSI	0.0%	1	71	20	92
DHS HQ	0.0%	8	40	7	55
Peace Corps	0.0%	11	33	4	48
TVA	0.0%	2	30	1	33
BEP	0.0%	8	24	2	34
BPD	0.0%	10	16	1	27
Postal Inspect.	0.0%	9	43	2	54

Figure 1 – Security Clearance Processing Duration (Henderson 2010)

Engineering at the ABC Plant

The engineering organization at the ABC Plant, like many engineering firms, is hierarchical in nature. As of January 2012, the engineering organization is structured as follows: At the apex of the organization are the Director and Associate Director. A group of eleven Senior Technical Mangers report to the Directors. Likewise, a group of fifty-

one Technical Managers report to their respective Senior Technical Manager in their functional area. Technical Managers are responsible for the hiring of engineers for the organization and the human resources activities they perform are the primary focus of this project.

Engineering forms a substantial technical body of skill and knowledge for the plant and this makes the selection and hiring of the right engineers important to the success of the mission for the ABC Plant. As of January 2012, the number of engineers at the plant was approximately 715 and they alone accounted for approximately 26 percent of the plant population.

Selecting and Hiring Engineers

The engineering base at the ABC Plant is important to the organization. Therefore, one of the most important responsibilities for a Technical Manager is the process of hiring the best candidate for a position from a talent pool of potential employees. The ultimate responsibility for making a hiring decision that impacts everyone from the work group to the entire organization often rests on the manager's shoulders. As true in 1959 when it was written as it is today, "All companies, over the long run, have an equal opportunity to share the same markets, the same materials and the same technologies. If one company is to enjoy a competitive edge over other organizations, then that edge must be attributed to superior personnel." (Noggle 1959)

How do Technical Managers at the ABC Plant select a particular engineer for a particular position? Do Technical Managers at the ABC Plant have the best tools to help with this decision? After an engineer has an established career in the organization, how

does their performance correlate to the manager's expectations that led them to be selected? Can this information be used to help Technical Managers improve their selection process?

"Hiring is one of the most important duties of a manager and is especially crucial within an engineering or technical organization. Beyond the obvious reasons for selecting the proper candidate for the job, the gravity of the hiring process lies in the fact that a mistake in this area is not easily corrected." (Venturato 1979) In fact, hiring mistakes are costly in more ways than one. "With the rise of big labor and the present fashionable emphasis on the rights of the individual, a manager nowadays must gather considerable evidence in support of firing someone." (Venturato 1979)

Mistakes tend to be more costly for the ABC Plant than a typical engineering firm. All positions require the ability to obtain and maintain a government security clearance. During this time period, and depending on their work assignment, the effectiveness of the newly hired engineer is often greatly reduced by their lack of a security clearance. They may be unable to access information and locations in the facility that are critical to their job function within the organization. This cost of hiring new engineers is incurred by the organization on top of the inefficiencies typical of new employee that is learning their role in a new position. If they are unable to acquire or maintain their security clearance, the engineer is not a viable option for employment and the selection process must start over again at the expense of the ABC Plant.

The manager may also come to realize that hiring the wrong engineer for the position can cause morale problems that begin to negatively affect others in the

organization. “In some instances, this can have more negative consequences than not hiring anyone.” (Kanouse 1981)

Literature Review

The Job Description

There is a significant amount of work that needs to be performed up front prior to introducing any information notifying candidates of a job opportunity. A significant amount of research gathered that addresses the topic of job descriptions is in agreement that there needs to be a carefully crafted job description to provide basis for selection criteria for the position before a manager can even think about hiring a new engineer. In addition, a good job description allows potential candidates to decide up front if they have the necessary skills and interest in the position and organization to warrant the effort of pursuit.

There are various methods for developing a job description but arguably the most efficient is to copy from an existing job description for a similar position. Research in the article “Hiring Techniques: It’s What’s Up Front that Counts” by Tony Venturato promotes using this method to leverage work that has already been completed and to make modifications where needed to meet the needs of the position. Well written job descriptions can be stored in a database for use by future managers in the organization. However, the manager shouldn’t use this as an opportunity to become complacent. Research by Haas & Associates, a consulting company specializing in helping software development companies improve their hiring practices, shows that “managers are busy and often don’t take time to carefully analyze the required job skills. Instead, they copy a previous job description (perhaps changing a line or two) or they use a generic description from human resources. This can be a big mistake.” (Haas 1997)

The hiring manager must give careful thought to the content of the job description to make sure it meets the needs of all parties involved in the hiring process, including any external recruitment services. According to Melissa Rogge, Personnel Administrator for electronics manufacturing firm Power-One Inc., “The nontechnical recruiter needs numerous support fronts to maintain a successful hiring program. Technical management, a good source base and a thorough definition of the job description are essential in finding the perfect match.” (Rogge 1989) When the screening of applicants has been outsourced to a staffing agency, the hiring manager needs to pay particular attention to the details of the job description to ensure that the right candidates make it to the next step in the selection process.

The first commonly cited aspect of a good job description is a listing of required job skills. “Successful hires usually begin with a clear idea of the role of the employee and the environment he or she will be working in. Which skill sets are critical and which are merely desirable?”(Kariya 2001) Establishing these requirements creates the minimum benchmark that candidates must fulfill to even be considered for the position. When written effectively, they can screen out unqualified people from applying for the position and reduce the amount of work the manager must do to compile a list of viable candidates. Again, the hiring manager should think carefully about the defining skills for a particular position. As stated in the article “Programming Success into Employee Hiring” by Daniel Kanouse, “Often technical skills can be overstated at the expense of other types of skills, such as communications ability and administrative ability.” (Kanouse 1981)

The hiring manager can make the mistake of defining either too many required skills, or those that are impossible to meet. “Don’t build a job description with a list of skills too long for any single human being to meet. Instead, prioritize the list. Pick three or four must-have skills. Pick another three or four that aren’t absolutely required but would round out your team; use these as tiebreakers.” (Haas 1997) “In looking at the technical skills, it is advisable to establish a range of skills within which the potential candidate could fit.” (Kanouse 1981) Making a mistake here will potentially screen out what would have been the perfect engineer for the job and the hiring process may take much longer than was expected.

Daniel Kanouse also discusses the importance of climate and culture within the firm when creating job descriptions. “One of the predominant factors determining the success or failure of a new hire is the ability of that individual to adapt to the climate of the organization” (Kanouse 1981) Kanouse indicates that it is important to provide a description of the working climate for the organization in the job description to allow each candidate to determine if it meets their personal working style. This is done early in the hiring process so that both the candidate and hiring manager have not invested a lot of time and energy only to find out that the organization is not a good fit.

An alternative to listing the desired skills is to identify the key success factors for the position. This type of approach is described by Kanouse. “Success factors, if adequately described, become guidelines by which an incumbent measures his or her progress; however, they can be used as part of the selection criteria for new hires. An example of a success factor statement would be, ‘The project manager will be demonstrating success in this position when he or she establishes a project accounting

system, including a manpower projection forecast that will ensure completion of the project within budgeted dollars and hours at a variance not to exceed one percent in time and cost.'" (Kanouse 1981) When written correctly, the key success factors can introduce a *situational* factor to the job description. This information can be very useful during the interview process which is explored later in this paper.

Taking this concept a step further, Patty Grigoryev promotes the use of competency models to significantly improve the hiring process. "Effective competency models are developed by analysis of the critical components of a job linked directly with the goals of the organization." (Grigoryev 2006) "Model development is best handled with a reverse engineering approach. This approach begins with the end, in that the first analysis is on the desired outcomes expected for success in a position. Once the outcomes are delineated, the behaviors that drive success in such outcomes are outlined. Finally, a model of the core competencies that surround and drive those subscribed behaviors is developed." (Grigoryev 2006) This concept is interesting in that it deviates from the traditional skill based job description for a more comprehensive approach that targets the behaviors needed for success in the position and within the organization. A potential downside to this approach is that it may make screening of applicants more difficult by requiring the hiring manager to evaluate the application and/or resume from each candidate against the competency model.

Not all research sources agreed with the application of defining required skills in the job description. According to Stever Robbins, the principle of Venture Coach, an executive coaching and consulting business in Cambridge, MA, "You need to keep clear in your own mind how much you want to hire someone who has specific skills as

opposed to someone who demonstrates the ability to think technically and learn quickly, even if they aren't already up to speed on your particular system," he says. "Specific skills are transient in the technical arena. Quick learners and clear thinkers, long term, are usually the preferable employees." (Barber 1999) In addition, when asked about the biggest mistake IT hiring managers make when they prepare to hire someone, Johanna Rothman, author of the book Hiring the Best Knowledge Workers, Techies & Nerds, finds that mistakes are made "hiring based on a tools checklist as opposed to hiring someone who can adapt his/her knowledge to the product at hand." (Melymuka 2004) Therefore, hiring managers should carefully tailor the job description to the needs of the organization. There will be positions that require an employee to possess a set of critical skills as well as positions that require an employee with the capacity to learn and acquire new skills.

An aspect of creating job descriptions that is not discussed in any of the identified literature is the impact of the Internet on job search techniques. Since its creation, the Internet has increased the effectiveness of job postings. Rather than being limited to newspaper publications in a few neighboring cities of the location of the position, the hiring manager now effectively has access to a world of potential candidates. On the other hand, the level of effort candidates are required to expend applying for positions has been greatly reduced. Having a poorly defined job description opens the hiring manager to a deluge of applicants that he/she couldn't possibly screen through. An organization can combat some of this applicant "noise" by using software or a third party consultant to screen applications and resumes for key skills.

The sources of information acquired regarding job descriptions provide varying suggestions for creating job descriptions. Creating a job description with sufficient detail and appropriate requirements to allow candidates to be appropriately screened is one key for success. This is critical if an outside staffing agency is performing the screening of candidates because they need to know what is important to the hiring manager to allow the right candidates to proceed to the next step in the hiring process. A hiring manager can choose to create a job description based around critical skills needed for the position or key factors for success in the position such as the capacity to learn new processes and systems. In addition, the latter can aid in formulating specific situational based interview questions. Identifying the company culture in the job description can be helpful for both the candidate and hiring manager to determine if there is appropriate fit within the organization. It is ultimately up to the hiring manager to decide the best approach based on the type of position. With a good job description in hand, the hiring manager is now ready to post an opening for the particular position. As candidates apply, they often submit a resume as part of the application process.

The Resume

The resume is a document that candidates create to showcase their skills, accomplishments, education, and previous job experience. It is also a document that is often used by hiring managers to screen candidates against the required and desired skills and their relevant experiences.

Much of the research material regarding the use of resumes cautions the manager to give critical thought to their content. The hiring manager should always realize that the resume is created from the perspective of the candidate. “Remember

that the person writing a resume will never minimize. Exaggeration on the part of the resume writer should be counterbalanced by skepticism on your part." (Venturato 1979) The hiring manager should take a critical look at each resume to look for clues to the candidate's *authentic* experiences. "Try to read between the lines to ascertain what the person's exact role has been in the scheme of things alluded to in the resume." (Venturato 1979)

In addition, the hiring manager should look for trends in the candidate's employment history. "Look for action verbs to describe what a candidate accomplished. Look for some quantifiable benefit of what the candidate accomplished. See if you can see an ever-increasing range of responsibilities." (Melymuka 2004) Unexplained employment gaps or sudden shifts downward in responsibility should be investigated further.

A newspaper article source "Skills-based management – a more effective tool for hiring technical people" written by Hank Riehl takes a particularly harsh stance against resumes. "Resumes, by their very nature, are written to put the best spin on an individual's skills. Keywords and buzzwords abound, years of experience are touted, but does the resume really indicate how skilled a person is? Don't we all know many people with 10 years of experience who still can't get the job done (the underachiever)?" (Riehl 1998) The article promotes the usage of a questionnaire to gauge the candidate's level of proficiency in skills applicable to the position and proposes the use of skills-management software to manage the information and compare and contrast candidates. On the surface, this appears to be a more valid method for screening candidates than a resume and this may be the case for a highly technical position such

as for a technician or technologist. However, the article does not indicate how to effectively judge other non-technical but essential skills such as: communication, problem solving, and project management. Further research of the author of this source also identified potential bias towards a skills-based assessment of candidates. Mr. Riehl is in the profession of creating and marketing a particular brand of skills-management software and thus has a vested interest in promoting this process.

In the case of a candidate just finishing school, their resume may not be a great indicator of their skills and potential as a new employee. According to Ronald Rorrer, author of “Credentials for the Job”, “When you look to hire an entry-level engineer graduating with a bachelor’s degree for a technical position, you need look no farther than the senior design report.” (Rorrer 2003) The candidate is asked to bring the final report or an interim end of semester report for the hiring manager to review. The hiring manager spends time reviewing the report in advance or while the candidate is off being interviewed by other managers. According to Rorrer, this review gives the manager insight into the most important traits companies are looking for in engineers: teamwork, written communication, and technical ability. (Rorrer 2003) When it is the hiring manager’s turn to interview the candidate, they now have some questions they can ask regarding the candidate’s individual contribution to the project and/or report.

In addition to knowing more about their project, according to Rorrer, the manager can also determine the candidate’s passion for the engineering profession. “Virtually every engineering society has a project suitable for senior design. If these projects or other like them do not excite students, they are not going to be real mechanical engineers.” (Rorrer 2003) This statement appears to be very polarizing regarding the

potential career success of any engineering student. Engineering is a very broad profession with many different types of positions available for many different types of engineers. A candidate may not have enjoyed the topic of their senior design project or there may have been difficulties working as a team that were not the fault of the candidate. As a result, a hiring manager should consider using information gained from the senior design report to augment other information from the candidate's application and resume during selection process.

The resume can be useful for learning more about the candidate's skills and behaviors. However, the hiring manager is cautioned to be skeptical of information provided in a resume. If a candidate is a student fresh out of engineering school with little experience, their senior design project report may provide some insight into their skills and behaviors. However, this project is often a team effort that may not properly reflect the candidate's potential. "Perceptive managers can discern from a resume not just an applicant's technical skills, but also clues to the person's work habits and personality." (Kariya 2001) In addition, the content of a resume can serve as a source of questions to be asked of the candidate during the interviewing process.

The Interview

One of the most important phases of the hiring process is the interview. This is often the first and only time to interact directly with each candidate and ask questions related to their experience and the open position. In addition, the interview process can be a challenge. "Probably one of the most difficult jobs for a manager is the interview process. Part of the problem is that managers go into the interview situation unprepared. They have no structure to guide them through the process and in many

instances are not really clear on what they are looking for in a candidate." (Kanouse 1981) However, if the manager has created a good job description and has screened candidate resumes, it becomes a much easier task.

Venturato and Kanouse describe a very similar process for performing successful candidate interviews. The interviewer is encouraged to freshly review the candidate's resume and organize their thoughts in a manner to effectively guide the discussion. "First and foremost, the interviewer must be prepared to take charge of the interview situation." (Kanouse 1981) "You will also want the candidate to do most of the talking; you are primarily the listener; minimizing your part of the conversation to simply direct the discussion into relevant areas." (Venturato 1979)

However, the two researchers do not prescribe an identical process and differ in their management of candidate questions during the interview. Venturato suggests first giving the candidate an opportunity to ask any questions about the position both to ease some anxiety on the part of the candidate and get an idea of candidate's interest in the position. During most interviews, the candidate must wait until the end of the interview to ask questions that may have helped the hiring manager guide the interview in a more productive direction. This style of interview is supported by Kanouse who accordingly warns that a potential consequence of the former "is to provide the candidate with all of the ammunition needed to tailor his or her remarks directly to what should be said as opposed to drawing upon actual experience." (Kanouse 1981) Kanouse suggests that at the end of the interview "the interviewer should always encourage the candidate to make any summary comments or ask any questions which he or she may have, and the interviewer should answer these questions candidly." (Kanouse 1981)

Similar to Rorrer promoting the idea of using the senior design report as a source for interview questions, Venturato suggests asking the candidate to bring samples of their work for discussion during the interview. The interviewer is encouraged to lead a discussion where the candidate is asked about their previous experience, levels of responsibility, ability to solve problems, technical competency, interpersonal relationships, and any other qualities important to the position. (Venturato 1979) The interviewer uses the candidate's resume and their answers to determine their fit for the position.

As a summary of the interviewing process, Venturato states that "it takes a certain amount of skill and concentration to be an interviewer. An interviewer must artfully probe to gain information about the applicant's technical ability and capabilities while trying to judge one's personality, anticipating where to next lead the discussion based on the comments and making mental notes about the findings." (Venturato 1979) Making mental notes is encouraged to once again keep the candidate from getting nervous during the interview. However, there is no discussion regarding how the interviewer is to successfully complete the interview process and retain information about the candidate during a process that can last over an hour! To refrain from writing down information would be challenging for any interviewer considering the amount of burden placed on them to assess the candidate in such a short period of time.

As previously alluded, Kanouse recommends asking questions that are based around situations the candidate should have experienced based on the job description and their resume. This type of interviewing strategy is often called behavior-based. "For example, if preparing manpower schedules is one of the major elements of the job, the

interviewer may say something like, ‘Our project managers often are required to prepare detailed manpower schedules. Can you tell me how you have gone about preparing manpower schedules in your past experience?’” (Kanouse 1981) Johanna Rothman is also a proponent of this type of interviewing strategy. According to Rothman, the most crucial thing to learn about a candidate during an interview is, “whether the candidate has actually performed work claimed on his or her resume. The way you learn this is with a combination of behavior description questions to see if the candidate can actually work the way he or she claims.” (Melymuka 2004) This type of process allows the hiring manager to gauge the depth of the candidate’s experience as well as their attitude towards the experience. This can prove to be invaluable to the hiring manager.

The interview process as described by Venturato and Kanouse is centered on the process being executed by a single hiring manager. This may be the case at a small engineering firm due to staffing constraints. However, according to a number sources discovered during research, the hiring manager can and should take advantage of utilizing other engineering managers to assist in the interviewing process. According to Hass, “Microsoft, IBM, Compaq, Nortel, Tandem, AT&T, and Sun have employed multiple interviewers.” (Haas 1997) Utilizing this strategy, each interviewer can focus on the generating questions and evaluating answers from the candidate regarding a specific skill set and more than one manager has the chance to assess each candidate’s behaviors. “Think of it as having a 360-degree applicant evaluation.” (Herrera 2001) A very important aspect of this process to be followed is that all the interviewers should be brought together for a discussion and grading of the candidate as soon as possible. “One interviewer’s comments may remind another of something

they observed. If you wait to get the interviewers together, they'll forget the nuances." (Haas 1997)

As an alternative to performing interviews with multiple managers in succession, the process can be performed using a small group of interviewers concurrently. "Interviewers sometimes get preoccupied with formulating their questions and fail to heed the candidate's verbal and physical responses. A group interview avoids this problem and also allows piggyback questions." (Kariya 2001) Using this type of process, each manager experiences the responses from the candidate at the same time. When this information is reviewed during the discussion and evaluation of each candidate, each interviewer can gauge the other's impression of the candidate and more effectively create an objective evaluation of the interview.

Interviewing can be a very difficult process for managers to effectively perform. There is little time for the hiring manager to gauge each candidate's skills and ascertain how well they will perform as an employee with the organization. However, this can be overcome through practice and gaining experience. Using multiple interviewers either as a group or in succession can help the hiring manager gain other perspectives of the candidate that can be invaluable in selecting the best candidate for the position. Each interviewer can also target a specific skill or behavior that is viewed as critical for success.

References

One of the most consistently utilized sections found in resumes is a listing of references provided by the candidate. Ideally, the references are a listing of individuals

that can vouch for the candidate's skills and experience. However, many times they are friends or family members that may know the candidate on a personal level but have little knowledge of their work experience. In fact, the references section may be the most worthless part of the candidate's resume.

Research reveals little information regarding references when compared to the other topics previously discussed in the hiring process. Venturato is the most prominent source that addresses this topic and advocates "obtaining the names and contact information of previous supervisors for each and every company mentioned in the resume. Although some former superiors may appear in a 'reference' section of the resume (recognize that resume reference listings are biased), verify that these were immediate supervisors, ones who have first-hand knowledge of the candidate's work." (Venturato 1979) The few other sources that discuss references are similarly insistent on the importance of contacting references. According to Kariya, "Reference checks often get ignored in the excitement of finding a promising candidate, but hiring without checking references is leaving a job half-done". (Kariya 2001)

There are many glaring issues with this information gathered during the literature review. First and foremost, none of the articles discuss a path forward if the candidate prefers not to have their current supervisor contacted. This reasonable request protects the candidate from the ramifications of their current employer discovering that they are actively seeking a new source of employment. The current employer would potentially question the employee's commitment to the organization for their remaining tenure. This creates a significant amount of risk for the candidate to bear considering the lack of commitment from the perspective employer in this stage of the hiring process. If the

employee decides to stay in their current position, their employment may not exist for the long term!

In addition to the potential negative impact against the candidate, their current manager may not be willing or able to divulge any information of use to the hiring manager. Many organizations are fearful of the potential for litigation stemming from an inappropriate response from an employee.

The Selection

"If you've carried out the selection process through the stages discussed thus far, giving each the careful attention it deserves, the final choice of candidate is virtually automatic." (Venturato 1979) This is a very confident message signaling the importance of investing the time and energy into the early steps of the hiring process. However, with the amount of effort expended in the hiring process up to this point, there is little corresponding guidance in the research for selecting between potential candidates. The selection process has the potential to be more effective with multiple interviewers providing input into the selection process. However, the final decision is often left up to the hiring manager.

Soft Skills vs. Technical Skills

The concepts of soft skills and technical skills have received a great deal of attention in recent decades. One definition of these concepts which appears to encompass their meaning is that "technical skills are defined as those skills acquired through training and education or learned on the job and are specific to each work

setting while soft skills are defined as “the cluster of personality traits, social graces, language skills, friendliness, and optimism that mark each one of us to varying degree.” (Charles, Kirk et al. 2004)

The relative importance of evaluating an engineer’s soft skills along with their technical skills has increased in recent decades. Employers have discovered that engineers do not work autonomously, but are often working on multiple projects within multiple teams and with multiple members. They are required to interact throughout the hierarchy of the organization.

According to information gathered in a piece of literature authored by Charles Litecky, Kirk Arnett, and Bipin Prabhaker titled “The Paradox of Soft Skills Versus Technical Skills in IS Hiring”, the hiring decision involves the analysis of multitudes of criteria, most of which are beyond a simple comparison of the candidate’s technical competencies. The engineering manager must look at both the technical skills and “soft skills” of the candidates. In fact, a Stanford Research Institute and Carnegie Melon Foundation study found that 75 percent of long term job success depends on soft skills and only 25 percent on technical knowledge. (Charles, Kirk et al. 2004)

In their two-stage model for hiring technical employees, the authors promote a system of filtering and then selection. “The first step in decision-making is seen as focusing on what is wrong with the options and screening out the unacceptable options – in essence a filtration step. The second step then consists of choosing the best options from among the remaining – a final selection or choice.” (Charles, Kirk et al. 2004) The filtration of candidates is performed by evaluating resumes and determining if the

candidate has the technical skills required for the position. The choice of candidates is performed by evaluating each candidate's soft skills against the skills required for the position, often during the interviewing stages. This model is shown in figure 2 below.

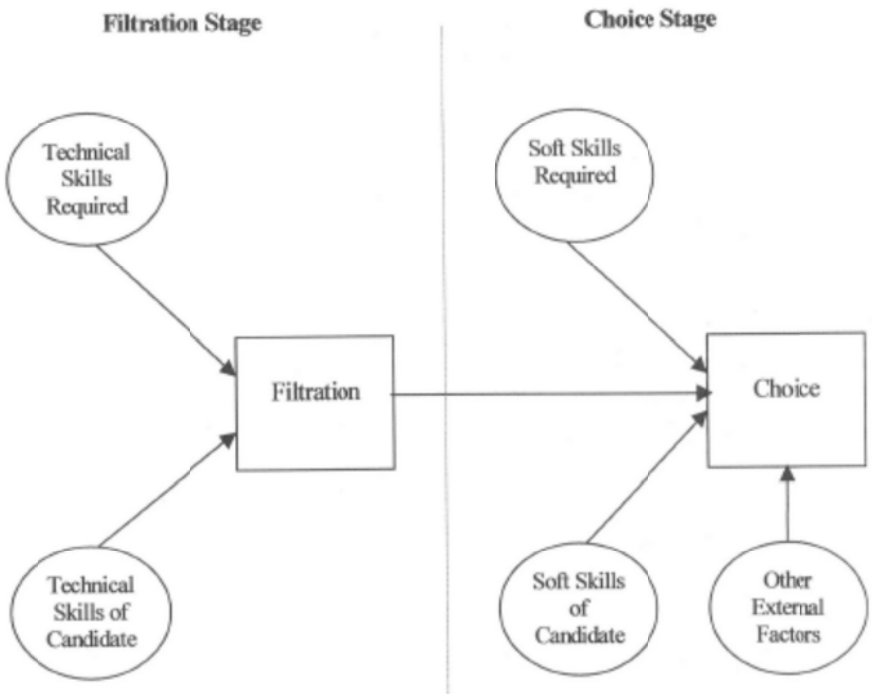

Figure 2 - Two-stage Model of Hiring (Charles, Kirk et al. 2004)

Given the information provided, there should be no doubt to the importance of choosing the best candidate available for the job. In fact, there are numerous examples of employees that are hired without rigorous consideration to both their technical and soft skills which in turn can translate into a tenuous relationship between manager and employee.

Intel Case Study

During the years of 1994-1998, the Intel Corporation tracked the performance of college graduate engineers during the interview process along with their corresponding

performance as employees within the organization. After acquiring this information, Intel performed a comparison with hopes “that beyond the pass/fail outcome of the interview process, there would be a correlation between higher interview scores and likelihood of doing well at Intel.” (Colwell, Brown et al. 1999)

The company expected to show that their interview process was effective in screening out undesirable candidates. However, other than Intel’s strong performance as company, they found no strong correlation between the aggregate scores of accepted candidates and their career trajectories after being hired. This lack of correlation can be shown by the amount of scatter and poor linear fit in the data shown in Figure 2. (Colwell, Brown et al. 1999)

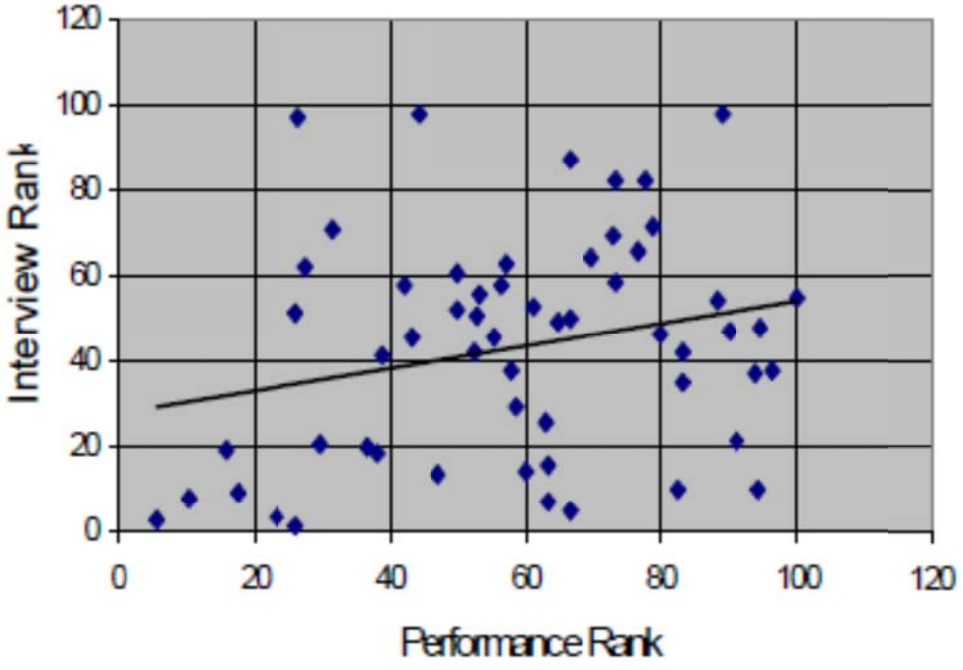

Figure 3 - Performance vs Interview (Colwell, Brown et al. 1999)

In an attempt to determine why this was the case, Intel examined further into select characteristics of the individual engineers such as their grade point average upon graduation, their level of education, and whether they were graduates of a "focus school" for Intel. Grade point average (GPA) is a measure of how well the student mastered their subjects as well as an indirect measure of excellence, discipline, and work ethic. "It seems logical that students who attain the best grades in school might be best placed to continue that trend of excellence in the industrial environment. But, Intel's recent study does not support this hypothesis. It appears that new hires with lower GPA's are as likely as the high scorers to do well at Intel. (Colwell, Brown et al. 1999)

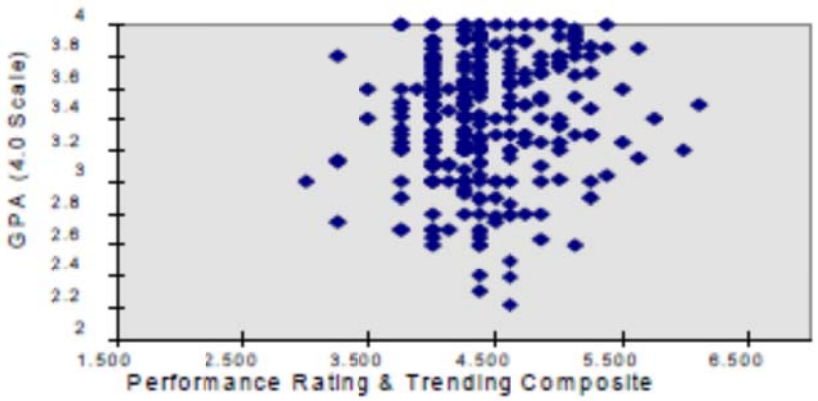

Figure 4 - Performance vs GPA (Colwell, Brown et al. 1999)

In addition, Intel noted a slight *negative* correlation between level of education and employee performance which was possibly attributed to engineers with more education being placed into positions with more direct competition with more experienced engineers. (Colwell, Brown et al. 1999)

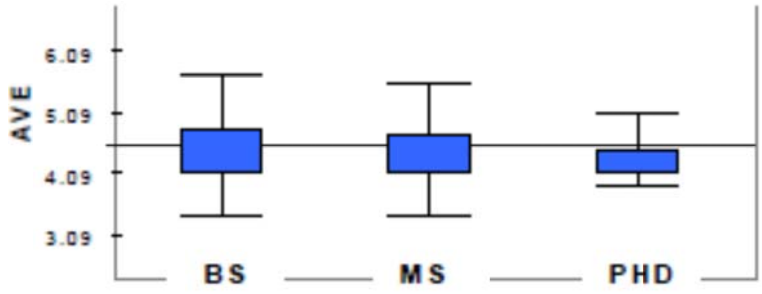

Figure 5 - Performance vs Degree (Colwell, Brown et al. 1999)

Intel has a relationship with a select number of schools that have a proven track record of academic excellence and turning out graduates who become successful Intel employees. They expected that the time and money spent on developing relationships with these schools to pay off in the quality of engineers acquired through their programs. They found this to be true but only slightly. (Colwell, Brown et al. 1999)

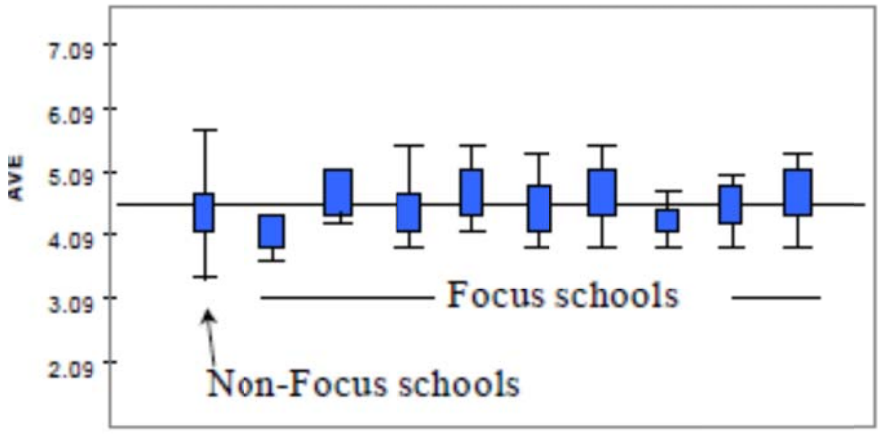

Figure 6 - Performance vs School (Colwell, Brown et al. 1999)

As a conclusion, Intel determined that there was no quantitative factor that could be used to directly assess the potential success of a collage graduate engineer prior to

being hired on by the organization. In addition, they came to the conclusion that intangibles are the strongest determinant of success once the basics of a technical education have been achieved such as: motivation, curiosity, teamwork, a competitive drive to excel, ability to solve problems independently, creativity, and communication skills. (Colwell, Brown et al. 1999)

This conclusion supports the position of other research that soft skills play the dominant role in employee success after the basic technical skills are developed. This presents a difficulty for a manager trying to select between candidates because soft skills are not readily observable from information on an application or resume. This places additional importance on the interview process because that is the only time the interviewer will have direct interaction with the candidates in order to assess their soft skills and behaviors inherent to their personality.

On a critical note, Intel chose to look for correlations between interview performance, grade point average, level of education, and location of education. Upon discovery of a lack of correlation, Intel postulated that success was the result of intangibles, otherwise known as soft skills. However, they did not attempt to isolate the most relevant soft skills for success or attempt to identify how their hiring process evaluated the candidate's level of mastery of these skills.

Procedure and Methodology

Selecting and hiring the right engineer for the job is imperative for every technical organization to succeed, so technical managers must receive all the assistance they can get to make the right decision. The purpose of this project is to analyze what characteristics technical managers have historically focused on during the candidate selection process and how well engineers at the ABC Plant have performed to these same characteristics. This information can be used to fine tune the hiring process to ensure that managers are using the right criteria to obtain critical information about each candidate and distinguish between potential candidates to select the best engineer for the position. In addition, an evaluation of the ABC Plant hiring process was performed with particular focus on the following stages of the hiring process:

- Creating job descriptions
- Screening candidate resumes
- Developing interview questions
- Evaluating interview performance
- Contacting references
- Performing candidate ranking and selection

Survey Demographics

To best ascertain how the ABC Plant selects engineers from a pool of candidates, research was conducted on the behavior of senior technical managers and technical managers at the ABC Plant. The reason for performing research on the behavior of managers was due to their involvement in the selection process as well as

the performance evaluation process. During the research, it was found to be important to be able to correlate management's evaluation of employee performance back to the employee selection process in order to evaluate the effectiveness of the hiring process.

Two questions in the survey were chosen to evaluate the demographics of the research group. Managers were asked how many years they had been in the position of selecting and hiring engineers at the ABC Plant. In addition, they were asked how many engineers they had hired during their career as a manager at the ABC Plant. The purpose of these questions was to gauge the amount of experience of the research group and determine if experience is a factor of success for an effective hiring process.

Technical Manager Survey

The Technical Manager survey questions were created as a result of information gathered during the literature review and to evaluate employee performance. The survey questions primarily focused on the following aspects of the hiring process:

- Review of candidate resumes
- Conducting the interview process
- Importance of particular skills and behaviors
- Conducting the selection process
- Evaluation of performance for engineers meeting or exceeding expectations
- Evaluation of performance for engineers not meeting expectations

In order to develop a set of questions which will determine the skills and behaviors most important to the organization and to accurately gauge employee

performance, the ACME Incorporated Performance and Development System (PDS) was reviewed. According to information retrieved from the ACME Incorporated corporate website, “ACME Incorporated encourages specific behaviors among our employees to ensure we meet our short-term and long-term commitments to solve many of the world's most complex problems. These behaviors are embodied in every project, process, and product of the company, and they are essential to the successful pursuit of our Five Initiatives - Growth, Productivity, Cash, People and the Enablers. Your performance with us will be measured according to the following Twelve Behaviors, and when you embody and develop them within yourself and in others, you will drive individual and business success.”

- **Growth and Customer Focus** recognizes that we need to think differently in order to grow. The customer is the cornerstone of our success. Effective employees do a superb job for customers every day in quality, delivery, value, and technology. They aggressively pursue new opportunities through superior sales and marketing, globalization, and technology roadmaps supported by Design for Six Sigma.
- **Leadership Impact** means thinking like a leader regardless of your job, delivering on commitments, and being a role model for others. All leaders demonstrate passion for their work and care about the people in the organization. Each employee must be able to: 1) conceptualize an issue; 2) develop an action plan to address the issue; and 3) execute the plan.

- **Gets Results** requires consistently meeting commitments to the business and to others. Quickly translate business requirements into actions by defining "who does what by when" to ensure plans are executed.
- **Makes People Better** encourages excellence in peers, subordinates, and/or managers. Be a positive influence in the development of others.
- **Champions Change** drives continuous improvement and fosters a Six Sigma mindset to make decisions that are in the best interests of customers, shareowners, and the organization. It reflects a constant commitment to do things better. Champions Change ensures the long-term strength of the company regardless of personal impact.
- **Fosters Teamwork and Diversity** defines success in terms of the whole team. Employees must understand and capitalize on the fact that ACME Incorporated's workforce is composed of individuals who represent a great diversity of values, opinions, backgrounds, cultures, and goals. Effective team leaders not only meet the expectations of their role as leaders, but they also set and meet the expectations for team members.
- **Global Mindset** is viewing the business from all relevant perspectives and seeing the world in terms of integrated value chains.
- **Intelligent Risk Taking** recognizes that generating greater returns requires taking greater risks. An intelligent risk taker uses sound business judgment, and has the courage to take action where outcomes are uncertain but where potential rewards are great. Business decisions often need to be made based on incomplete information.

- **Self-Aware/Learner** individuals recognize their behaviors and how they affect those around them. Employees must accurately assess their own strengths and weaknesses and take action to improve.
- **Effective Communicator** means providing timely and concise information to others, and using clear and thoughtful oral and written communication to influence, negotiate, and collaborate effectively. Leaders and employees need to appreciate that effective communication is about listening and being listened to but is not always about agreeing.
- **Integrative Thinker** decides and takes action by applying intuition, experience, and judgment to the data available. They demonstrate an ability to assimilate various and conflicting information or opinions into a well-considered decision. They understand the implications of individual actions or recommendations on other systems, markets, processes, and functions.
- **Technical or Functional Excellence** means being capable and effective in a particular area of expertise. Employees must remain aware of advances and current thinking in their fields and look for ways to apply the latest technologies to their work.

As a result, the ACME Incorporated Twelve Behaviors served as a basis for many of the questions in the survey to correlate manager focus on each of the behaviors to employee performance in these behavior areas.

The survey questions were reviewed by the committee members and two additional managers prior to distribution. During the review, a question originally

formulated to request the manager to rank the Twelve Behaviors in order of importance was found to be too difficult and was transformed into a multiple choice response. After revising and tuning the survey, a trial run was performed using two managers to determine if the survey questions were properly understood and if they would generate the desired information for research purposes. The survey ultimately consisted of 52 questions with multiple choice answers. Other than the two demographic questions, the managers were given the following choice of answers with weighting factors assigned to each answer to assist with quantitative analysis of the results:

Choice	Weighting Factor
• Strongly Agree	5
• Agree	4
• Neither Agree nor Disagree	3
• Disagree	2
• Strongly Disagree	1

A complete listing of the survey questions is shown in Appendix I.

The survey was conducted electronically using the Zoomerang online survey software. This software was chosen because it is used extensively by the ABC Plant and managers are familiar with its operation. The ABC Plant also has a corporate account with the service which allowed for the use of Zoomerang tools to chart and analyze the results.

A request for completion of the survey questions was sent via e-mail to 51 Technical Managers and 11 Senior Technical Managers. The managers were given one

week to complete the survey. Of the 62 managers, 37 visited the survey webpage and 27 completed all the questions and were included in the survey results. The response rate was calculated to be 44% which is a favorable rate considering length of time allotted for responses and the general workload experienced by managers at the ABC Plant.

Results

Job Descriptions

A number of job descriptions for technical positions at the ABC Plant were reviewed against the recommendations provided by sources in the literature review. An example is noted in Appendix II. Job descriptions contain a listing of required and desired skills for the candidate, which are noted in the qualifications section. Hiring managers tend to provide somewhat ambiguous qualifications that are expected to be met by the candidate. This indicates that they expect that a candidate will be able to learn the specific systems and processes for the position. The summary of duties fulfills the role of describing the key factors of success for the position and is likely a source of behavior based interview questions. Job descriptions provide the candidate's with a good description of the mission and goals for the company. However, they tend to lack a description of the culture of the organization that can be important for a candidate to know based on their working style. The primary business for the ABC Plant is to manufacture components that have been designed by a separate entity. A candidate looking to be an engineering designer and having control over design may not be a good fit in many parts of the organization.

Survey Demographics

Question 1 asked the managers how many years they have been in the position of selecting and hiring engineers at ACME Incorporated. This question was important to determine distribution of managers that participated in the survey related to their experience. A surprising result from this question was that 66% of respondents have

been in a technical management position for less than five years. The remaining quantity decayed at approximately an exponential rate. Assuming that the survey was answered by a random distribution of managers, this result shows that technical managers at the ABC Plant are generally new and inexperienced in this role. Another potential source of this result is that younger managers participated in the survey at a higher rate than the overall population which in turn would introduce bias in the remainder of the results. However, overall manager demographics were not available to confirm this possibility.

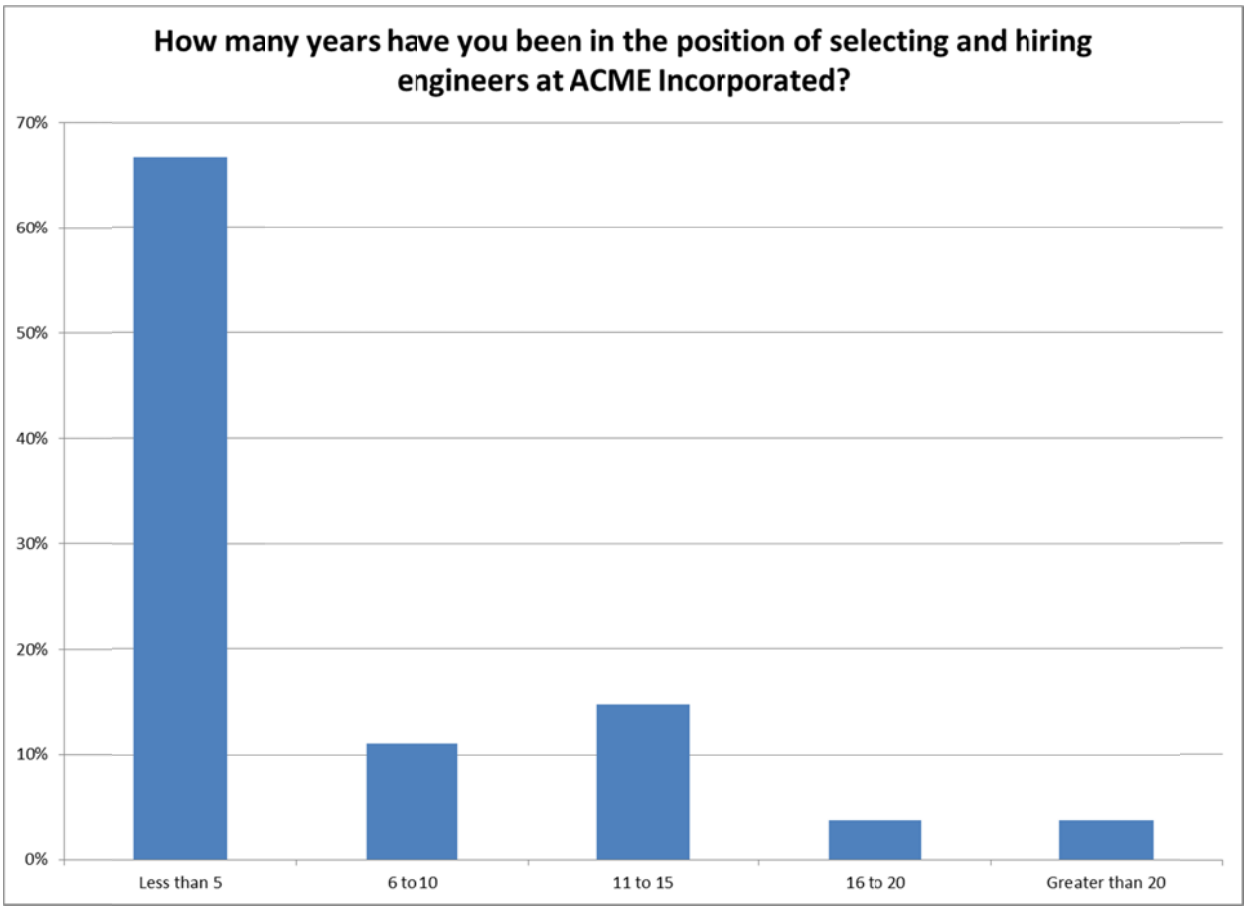

Figure 7 – Hiring Experience Question 1

To further gauge hiring experience, question 2 asked the managers how many engineers they have hired during their career as a manager at ACME Incorporated. This question was important because it interrogated experience with the process of hiring engineers which was of particular importance to this project. Another surprising result showed a binomial distribution of the responses. 51% of respondents had hired 5 or less engineers which showed consistency with the results from question 1. However, another 37% of respondents had hired 10 or more engineers during their tenure as a manager leaving only 11% in the 6 to 10 engineer range. Therefore, the population of managers at the ABC Plant appears to be split between two groups: managers with considerable experience hiring engineers and managers with little experience hiring engineers. As a result of this distribution, the remaining questions from the survey evaluating the hiring process were evaluated using both the entire manager population as well as a comparison between the populations of experienced and inexperienced hiring managers. The average weighting factor of the answers for each question are compared between populations.

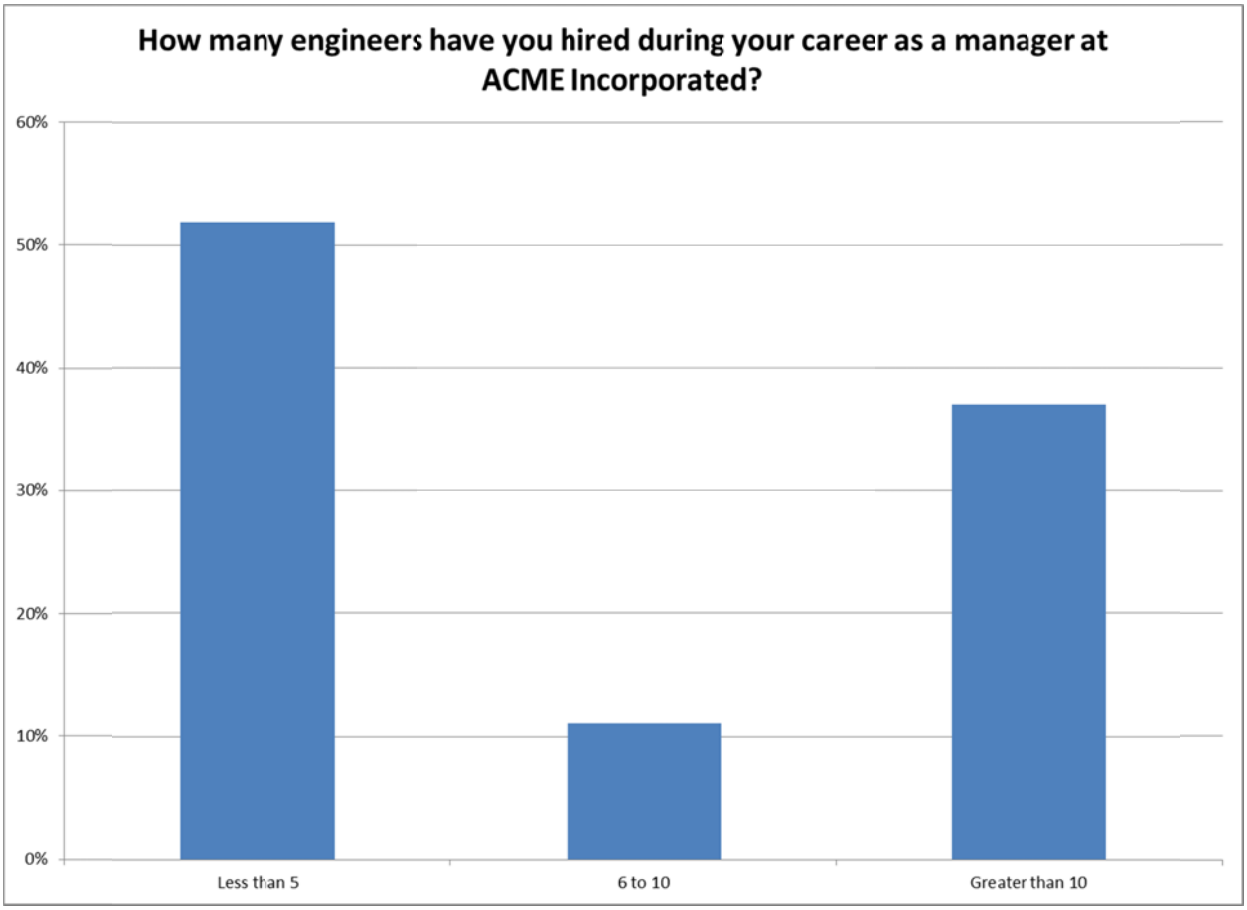

Figure 8 – Hiring Experience Question 2

Review of Resumes

Questions 3 through 7 were designed to determine how the hiring managers evaluate candidate resumes. Particular emphasis was placed on the evaluation of the soft skills and technical skills presented by the candidate's in their resumes. An interesting result from these sets of questions is that managers at the ABC Plant place more emphasis on evaluating candidate resumes for interpersonal or people skills versus technical skills. This result is counter to the information gathered in the literature review that portrayed resumes as a tool to showcase skills, accomplishments,

education, and previous job experience. Hiring managers at the ABC Plant most likely utilize interpersonal information presented in candidate resumes to augment their findings during the interview process. Hiring managers are less likely to eliminate a candidate based on their technical skills versus their soft skills during their review of resumes. This result is also counter to information gathered in the literature review that suggests that resumes are used mainly for the screening of technical skills. These findings suggest that hiring managers at the ABC Plant place a high importance on effective interpersonal skills and are looking for positive indications of teamwork, effective communication and other non-technical skills from candidates early in the hiring process.

When comparing the populations of experienced and inexperienced hiring managers, the survey results indicate that inexperienced managers are more likely to evaluate candidate resumes for technical skills related to the position versus their more experienced peers which is more in-line with research from the literature review. Inexperienced managers may be more likely to follow generally established guidelines that resumes communicate technical skills versus their more experienced peers that have realized that interpersonal skills are more important and all information about a candidate should be screened for these skills.

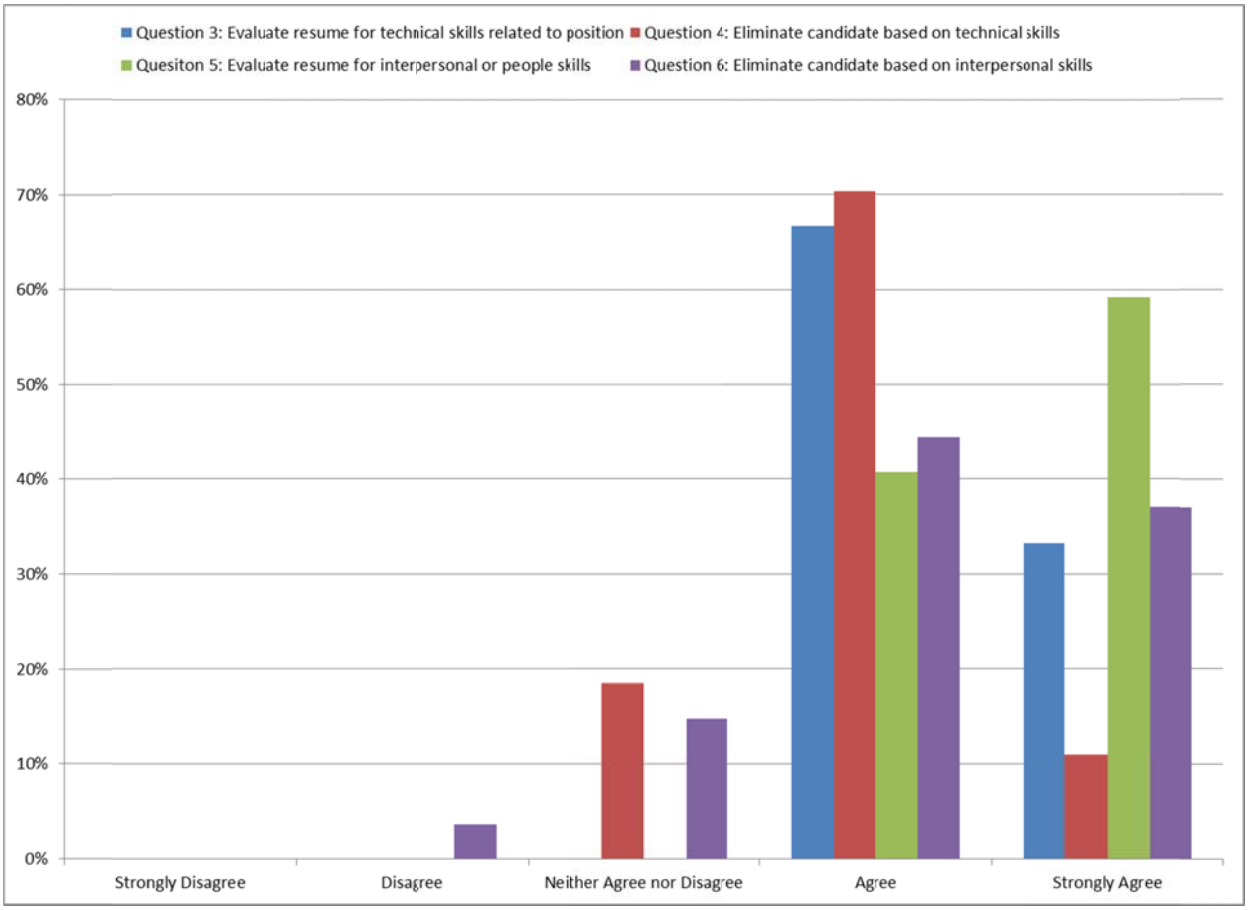

Figure 9 – Resume Evaluation

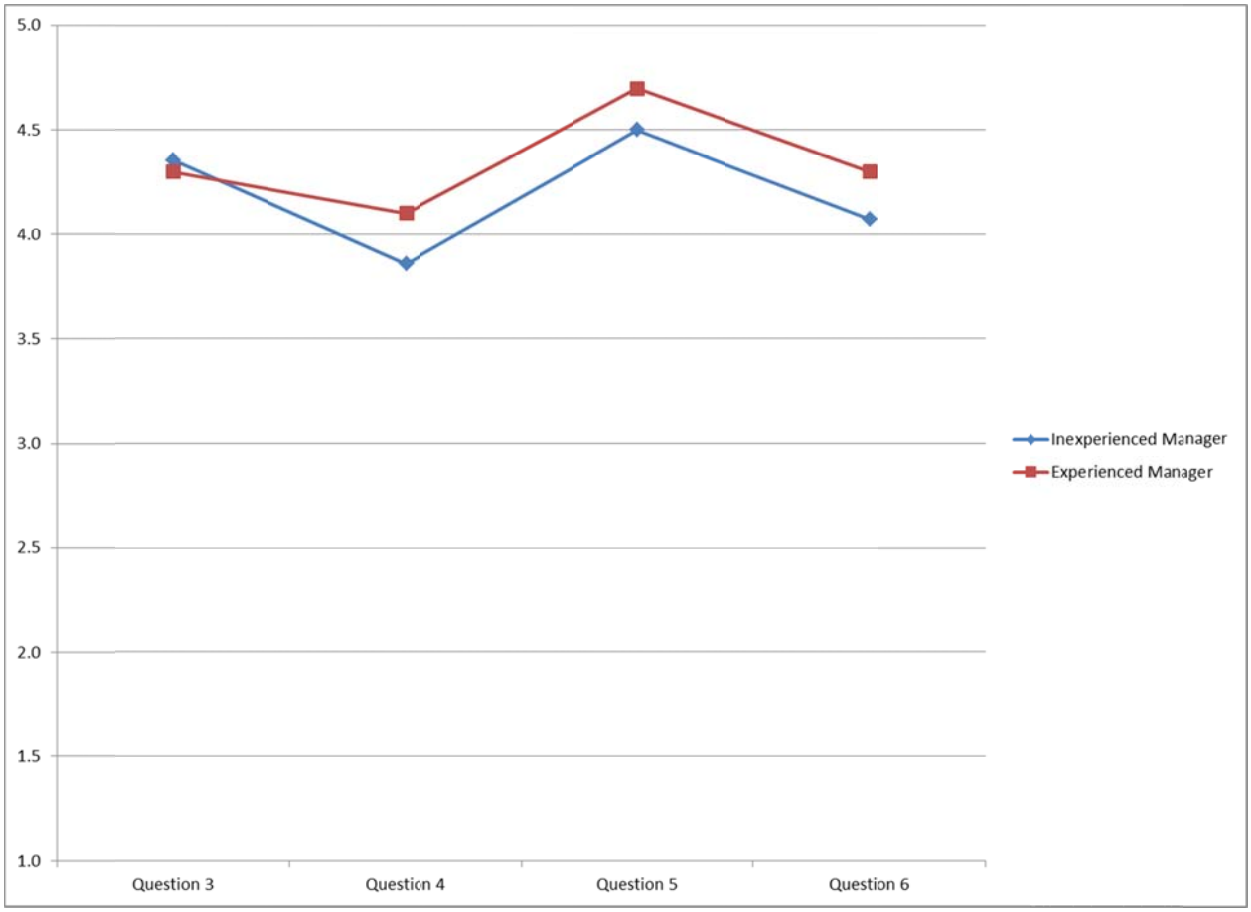

Figure 10 - Population Comparison (Resume Evaluation)

Interviews

During the interview process, ABC Plant managers spend more time evaluating interpersonal skills versus technical abilities. This result is expected given the literature review's overall emphasis of soft skill evaluation during interviews. A slight disparity is noted regarding the evaluation of a candidate's potential future behavior. Managers believe that their interview questions are effective at determining future behavior but they are less certain that a candidate's past behavior is an indicator of their future behavior. This result ultimately shows that ABC Plant managers place some critical

thought into candidate answers from interview questions and consider how a candidate might fulfill the expectations of the open position rather than outcomes from their previous positions.

Experienced hiring managers are more confident that they are effectively evaluating candidate interpersonal skills during the interview process than their inexperienced counterparts. In addition, they are more likely to believe that past performance is an indicator of future behavior.

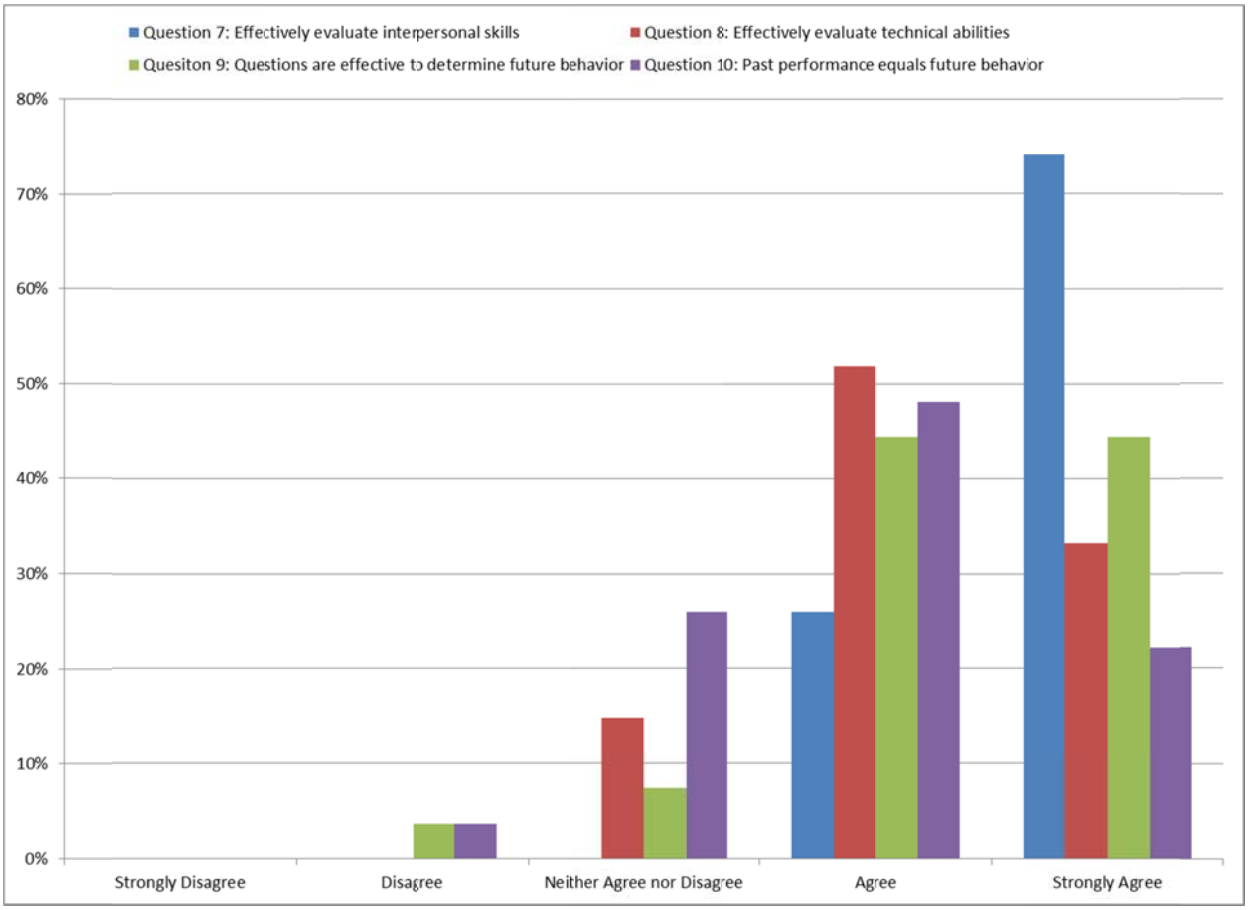

Figure 11 – Interview Evaluation

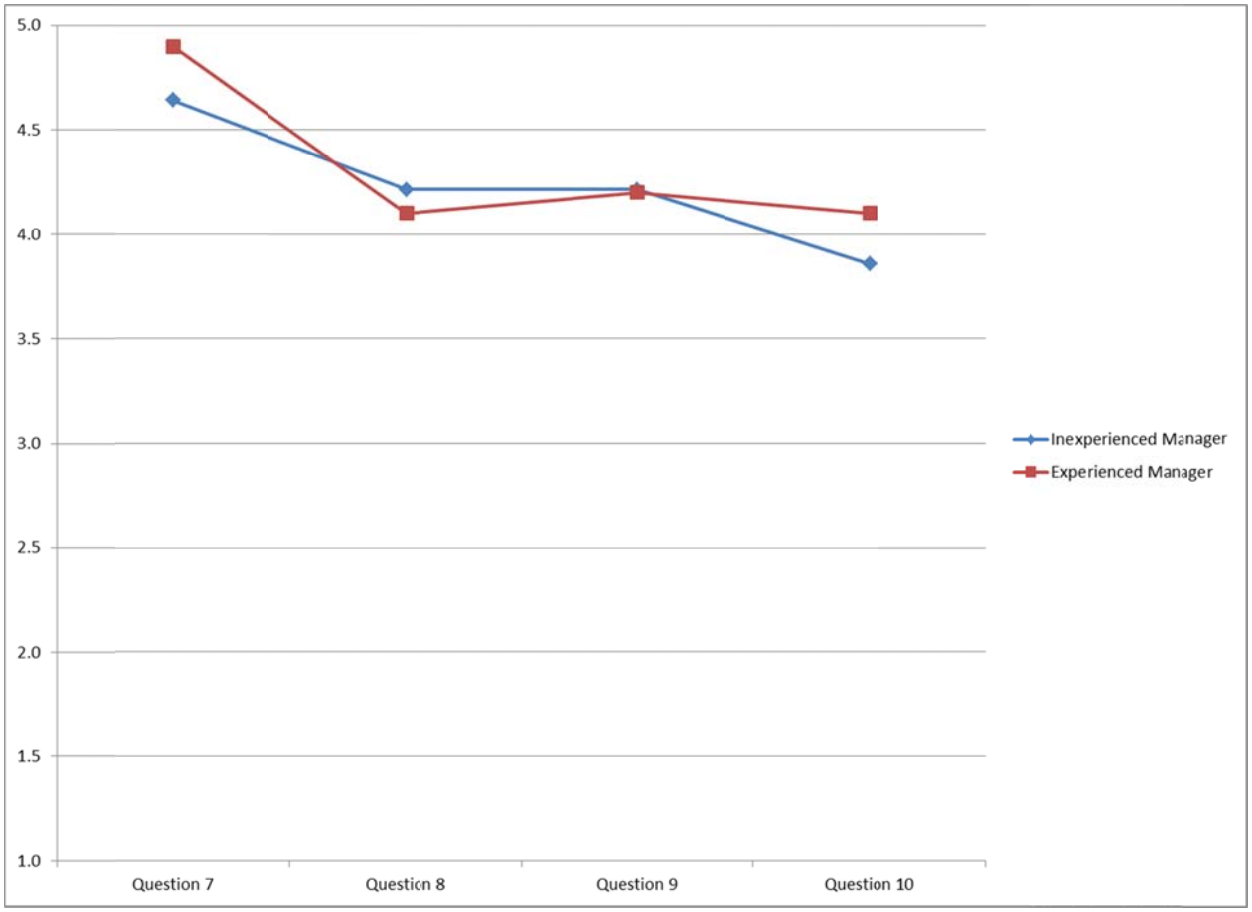

Figure 12 - Population Comparison (Interview Evaluation)

ACME Incorporated Twelve Behaviors

The following group of questions focused on the relative importance of the Twelve Behaviors as applied to the hiring process. Evaluating the average weighted result showed that the top four behaviors most important to ABC Plant managers are: Gets Results, Makes People Better, Fosters Teamwork and Diversity, and Effective Communicator. Conversely, the three least important behaviors are: Growth and Customer Focus, Leadership Impact, and Intelligent Risk Taking. Managers at the ABC Plant place more importance on skills based around making an impact, teaming, and

communicating which were identified as highly sought skills by many organizations and is consistent with the information acquired during the literature review. The relatively low importance of leadership impact is a particularly noteworthy result which is expanded upon later.

Inexperienced managers place more emphasis on growth and customer focus than experienced managers. This is an interesting result that may indicate that inexperienced managers are more likely to recognize the need to think differently in order to grow the business. Therefore, they are more likely than experienced managers to expect this behavior from their staff.

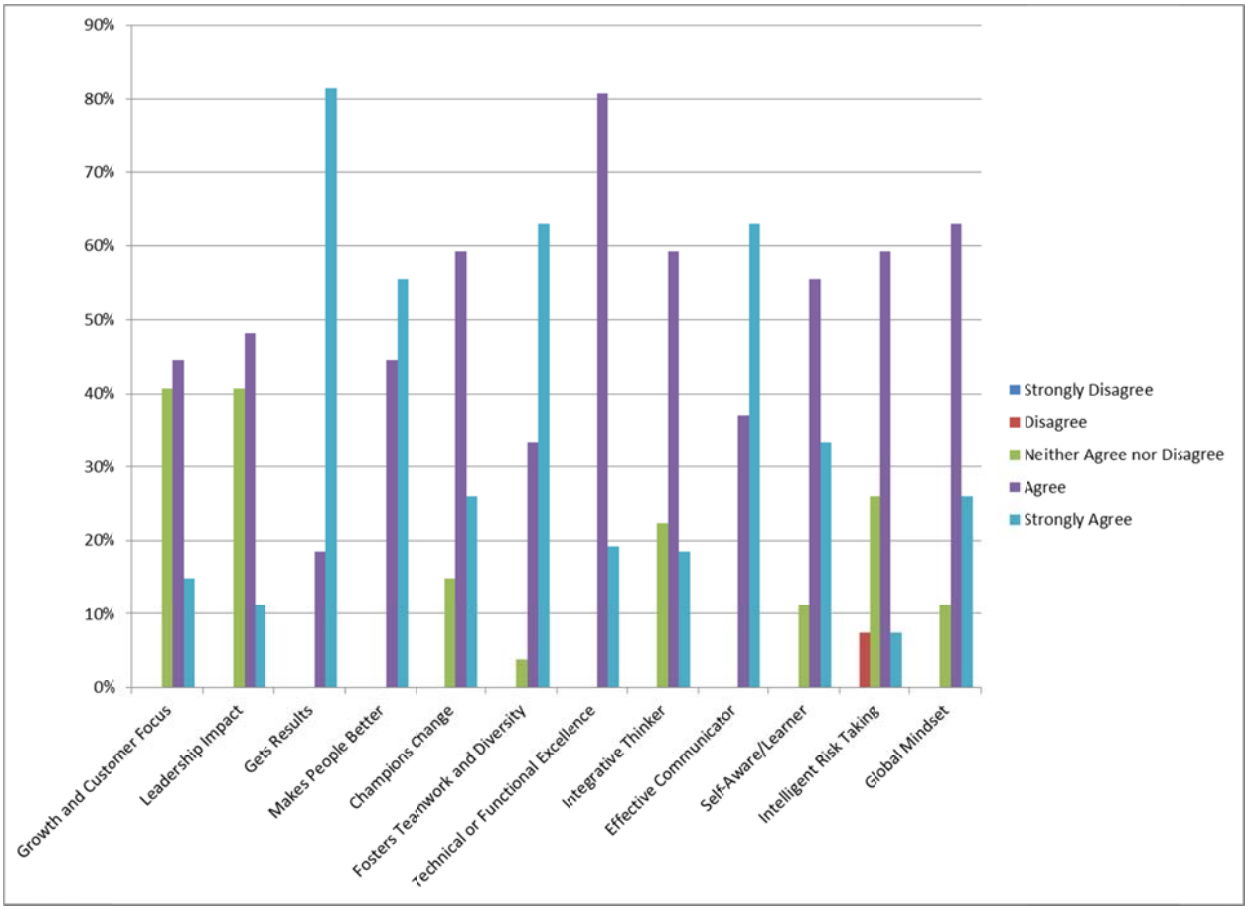

Figure 13 - Relative Importance of Twelve Behaviors

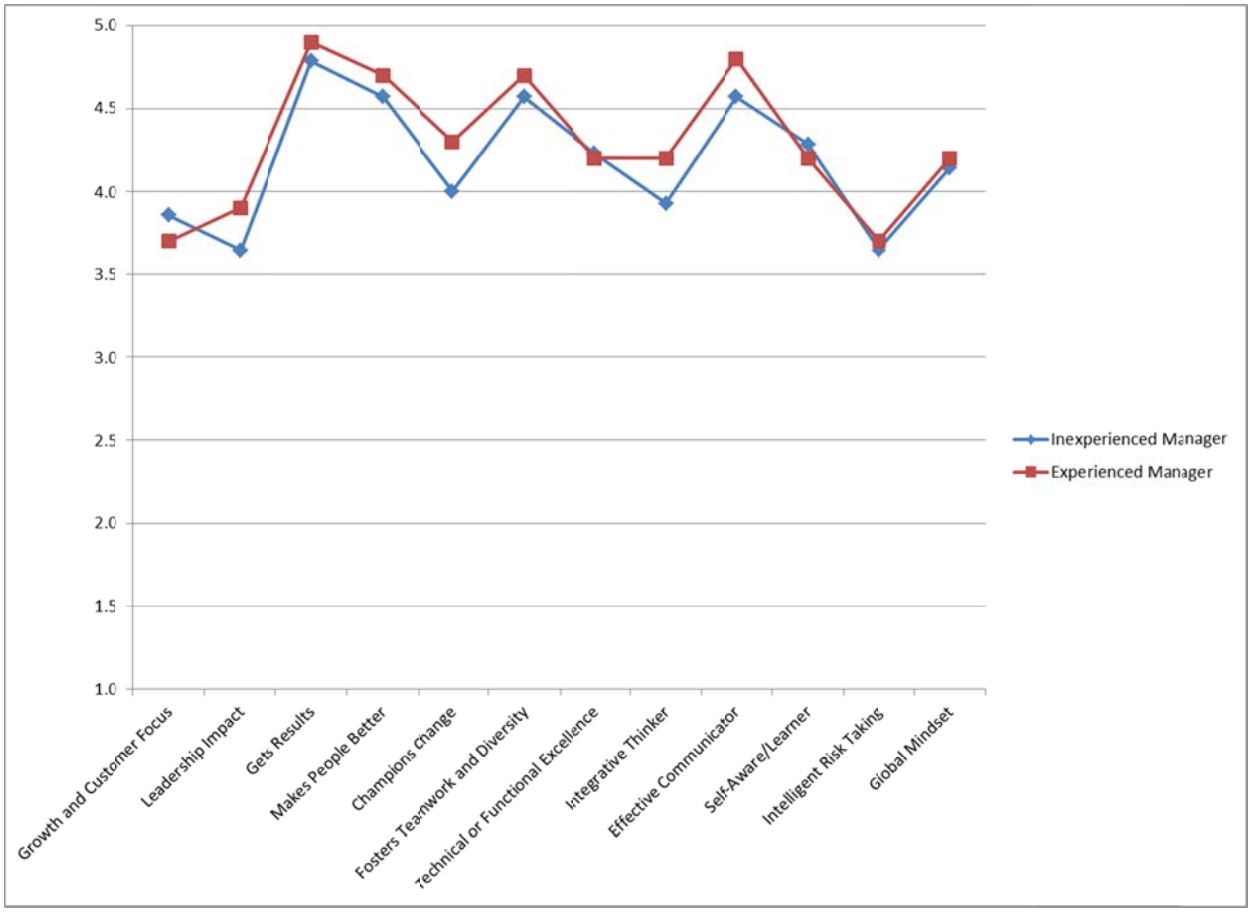

Figure 14 - Population Comparison (Twelve Behaviors)

References

The ABC Plant requests references from each candidate during the application process. These references are screened by human resources personnel to determine if there are any reasons why the candidate should not be hired. In addition, a preliminary clearance investigation is performed prior to an offer being extended to a candidate selected by the hiring manager. This investigation also gives the ABC Plant the opportunity to identify any barriers to employment before time and effort is expended in the full security clearance investigation. The human resources organization often finds

that references do not give much detail regarding the candidate's previous employment and often only confirm that the candidate was employed during the time stated on their resume. As expected, this is a result of a concern over litigation by a former employee if they discover that information provided to their prospective employer is not accurate.

Selection

The results from survey questions regarding the selection process show that managers at the ABC Plant are most confident in their ability to evaluate the fit of a candidate in the position and the organization with 93% indicating that they agree or strongly agree. Managers at the ABC Plant are marginally confident that they have the tools for selecting the best candidate and they have devised their own tools to help with the process as shown with 63% indicating agreement and 30% giving a neutral response to the questions. 54% of the managers surveyed neither agreed nor disagreed that they will select a candidate that meets their expectations. This indicates a measurable level of uncertainty about the result of the hiring process and correlates with the level of inexperience in the hiring process noted by hiring managers in question 2. A large majority of managers indicate that they have improved in their ability to select high performing engineers with experience. This result shows promise for the population of managers less experienced with the hiring process.

Experienced managers are generally more confident in their execution of the selection process with particular confidence in their ability to evaluate fit for the position and organization as well as having improved in their ability to select high performing engineers. They are very much in agreement with inexperienced managers regarding their feelings about the tools provided to select candidates.

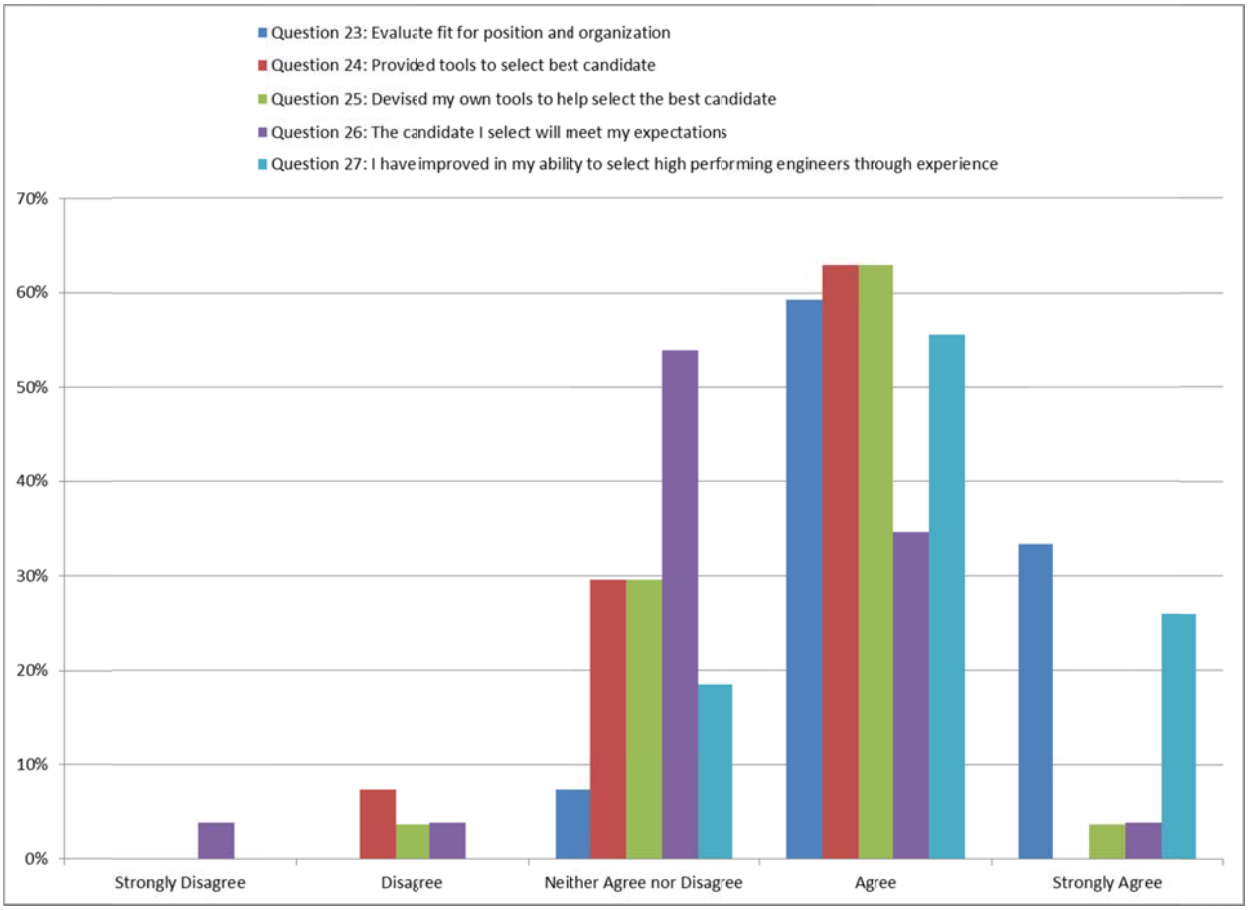

Figure 15 – Candidate Selection

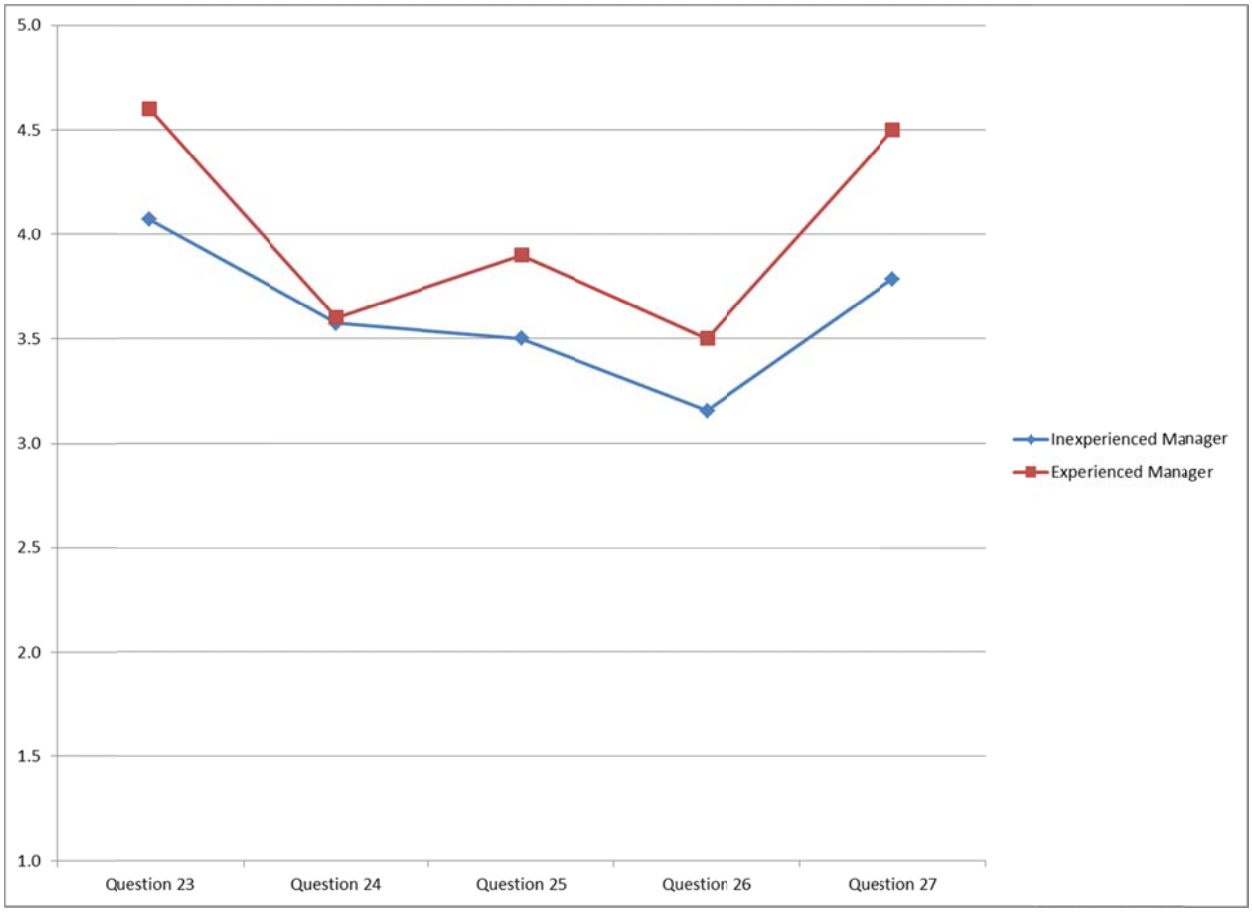

Figure 16 – Population Comparison (Candidate Selection)

Engineers Meeting or Exceeding Expectations

Successful engineers at the ABC Plant: Get Results and Foster Teamwork and Diversity. These results match up with two of the four most important behaviors identified by managers during the hiring process as noted above. Makes People Better and Effective Communicator were also indicated as measures of an engineer meeting or exceeding the expectations of management.

A correlation of performance against expectations was performed by comparing the differences in weighted averages of each behavior. The behavior with the largest difference between management emphasis and employee results was leadership impact. The survey results show that mid to high performing engineers are better leaders than what is expected from behaviors are evaluated during the hiring process to fill an open position at the ABC Plant. A possible reason for this outcome is that hiring managers expect engineers to grow their leadership skills as they develop in their careers at the ABC Plant. Another possibility is that strong leadership skills is the behavior that is the real differentiator of success for an engineer at the ABC Plant.

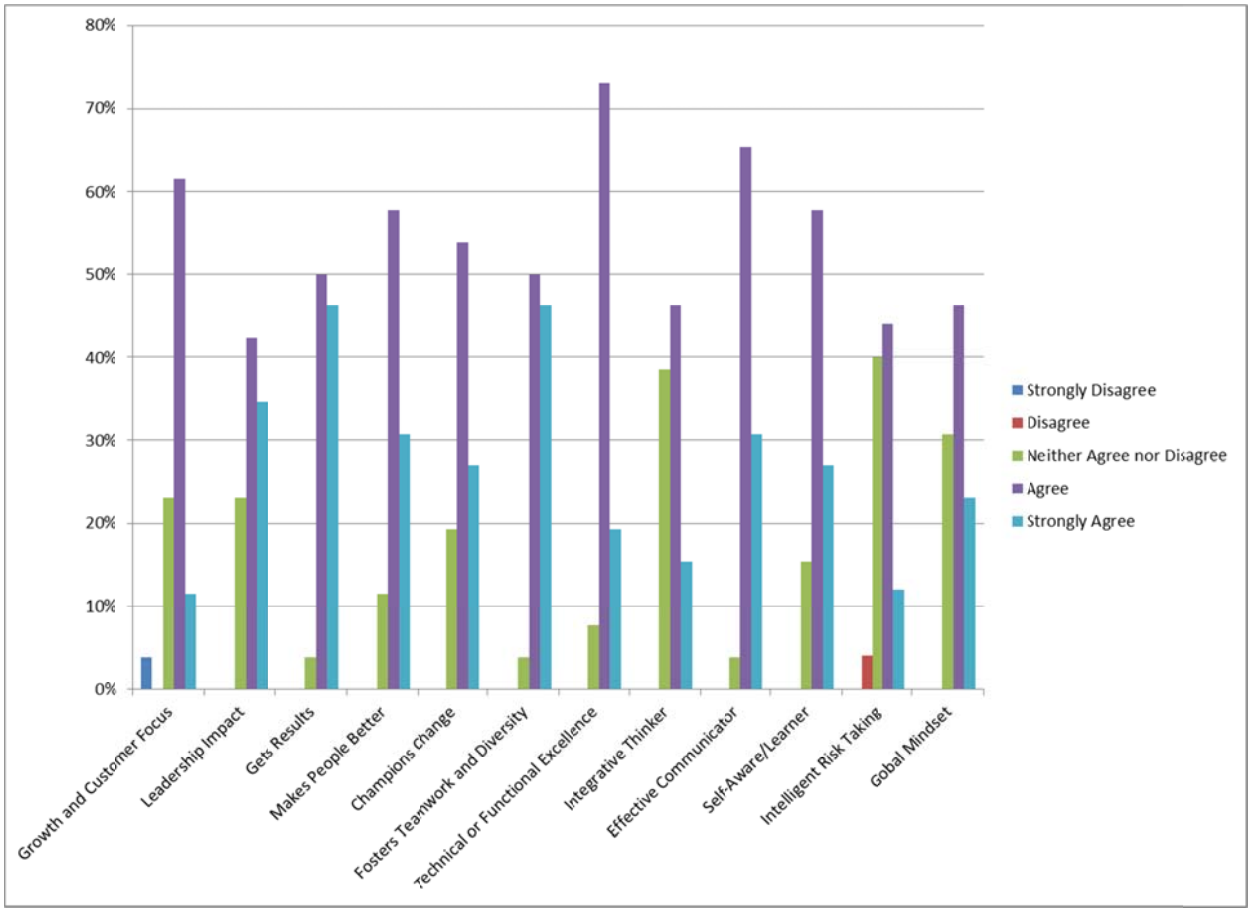

Figure 17 - Twelve Behaviors of Engineers Meeting or Exceeding Expectations

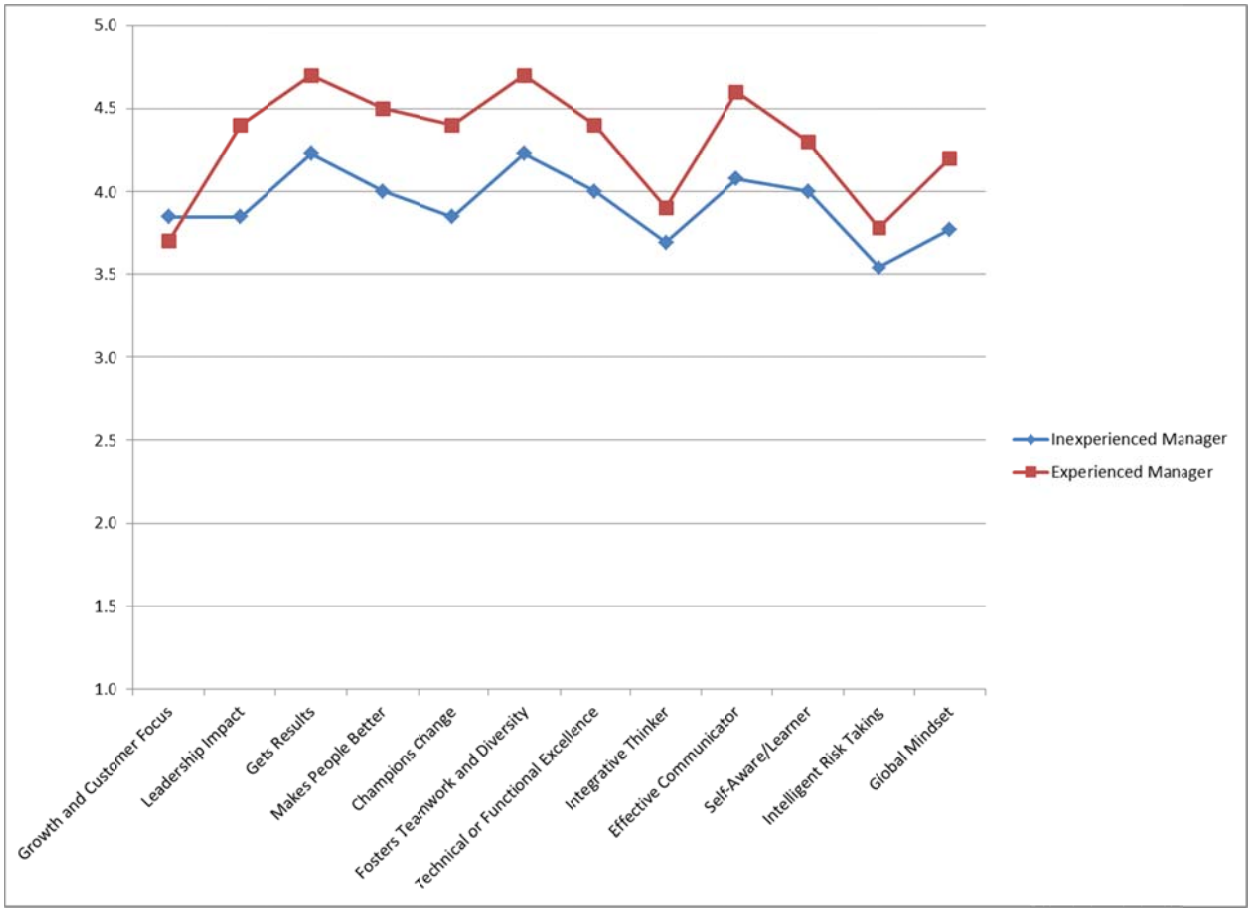

Figure 18 - Population Comparison (Meeting or Exceeding Expectations)

Engineers Below Expectations

As a whole, engineers at the ABC Plant that don't meet expectations score lowest in Leadership Impact. This result further supports that managers do not place enough emphasis on this behavior and that it potentially is the single most differentiator of success. A correlation of performance against expectations was performed by comparing the differences in weighted averages of each behavior. The behaviors with the largest difference between management emphasis and employee results were Gets Results, Makes People Better, and Effective Communicator. This result is effectively the

inverse of high performing engineers which would be expected. The survey results show that low performing engineers score highest in technical and functional excellence. This further supports evidence from the literature review that success is determined from soft skills after necessary technical skills are mastered.

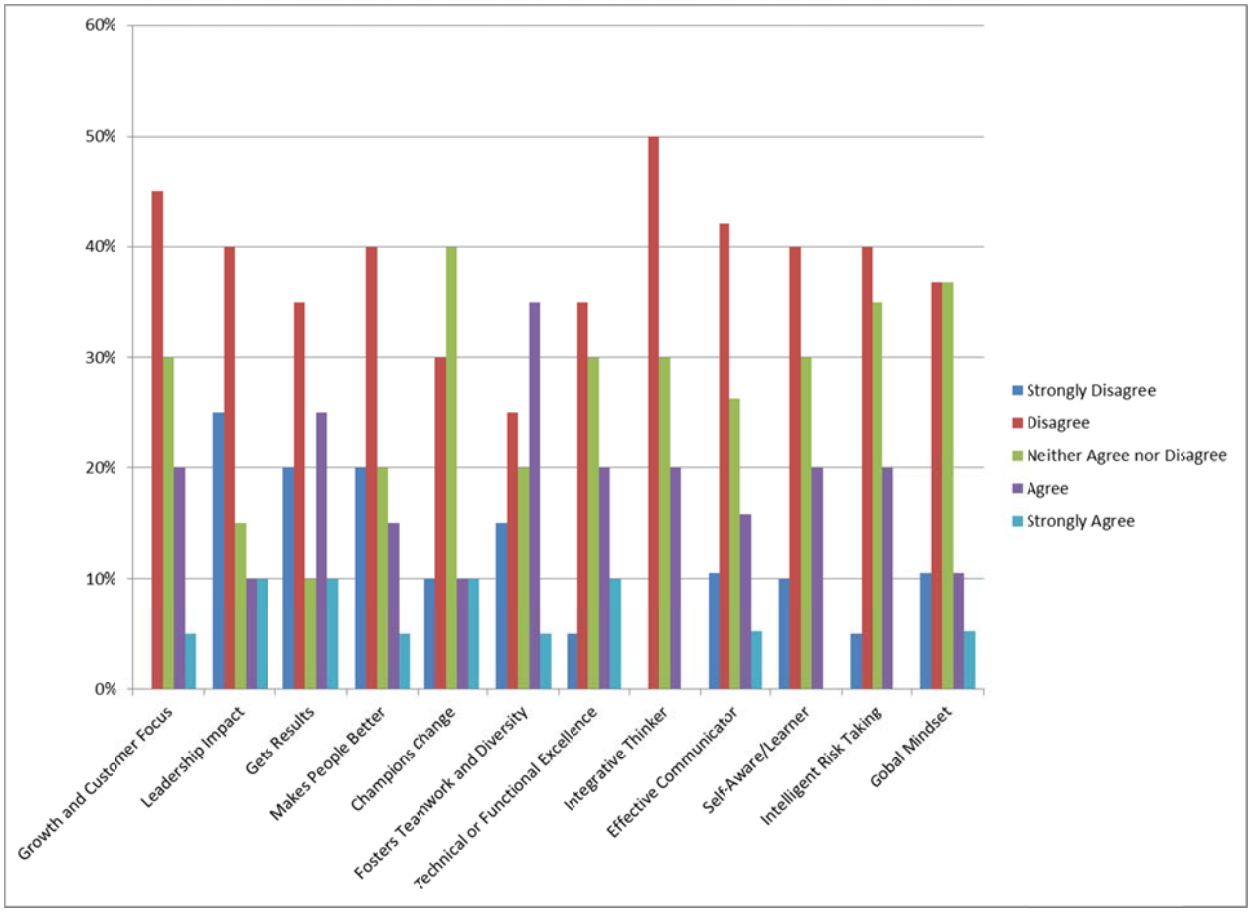

Figure 19 - Twelve Behaviors of Engineers Below Expectations

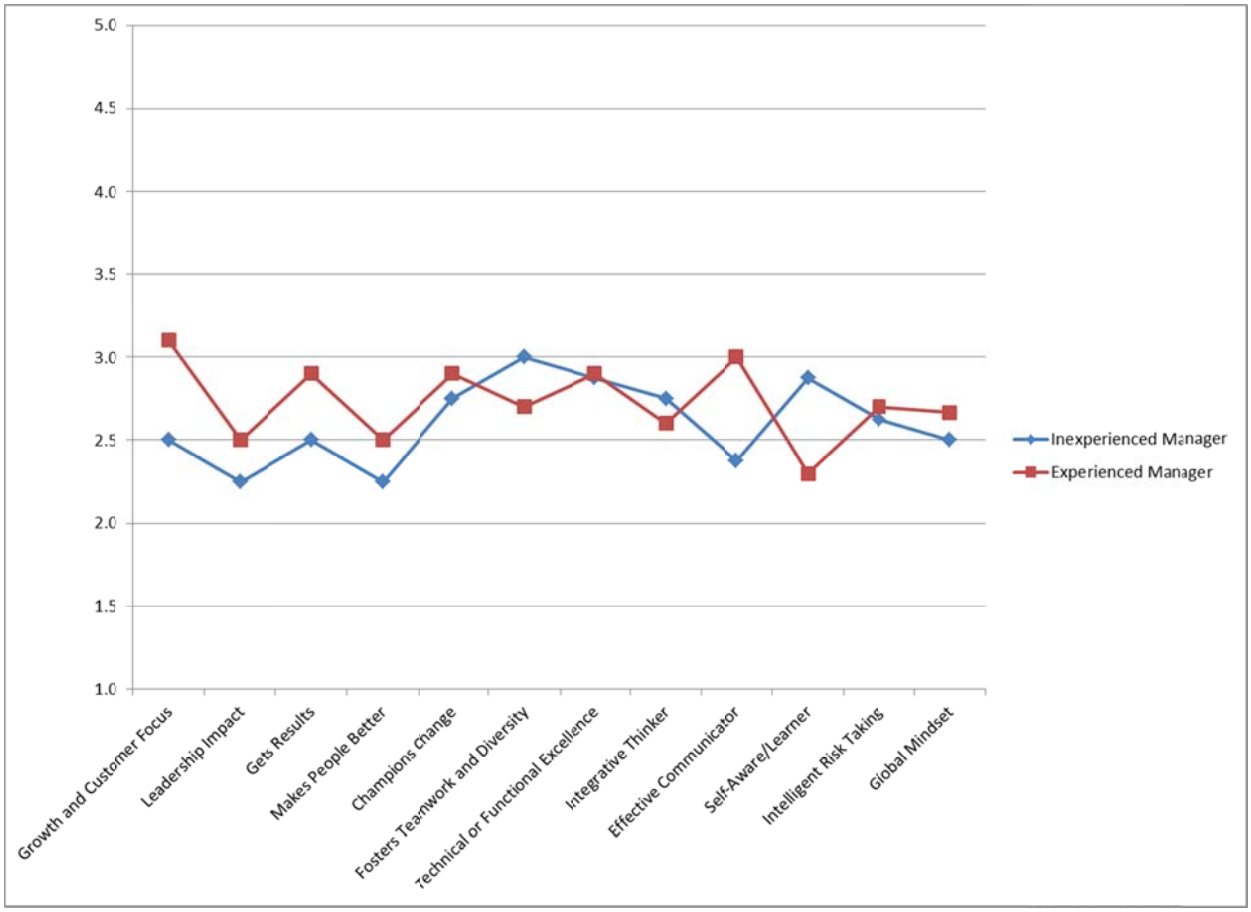

Figure 20 - Population Comparison (Below Expectations)

Conclusions

The results from the survey of technical managers and senior technical managers at the ABC Plant as well as the evaluation of the hiring process show that there are opportunities for improvement. The primary areas of improvement suggested are to increase the importance of leadership skills, provide more training in the hiring process to improve manager confidence, and provide details of the organization's culture in job descriptions.

Hiring managers place a great deal of importance on the soft skills of candidates and based on information from literature sources and this is the correct approach because soft skills pay the dominant role in employee success after the basic technical skills are developed. However, managers at the ABC Plant do not place enough emphasis on leadership impact as an important behavior for a candidate to possess prior to employment. Engineers that meet or exceed expectations have a higher rating in this behavior than what is expected of a candidate during the hiring process. In addition, engineers that have not met expectation have the lowest rating in this behavior. As a result, the organization should consider a requirement to evaluate this behavior during the entire hiring process in order to increase focus on leadership until the aggregate engineering population is more adept at this behavior. The ABC Plant should also look at ways to increase the leadership impact of existing employees by finding opportunities for them to develop this behavior such as leading small projects with team members and becoming mentors for less experienced engineers.

Managers at the ABC Plant do not have a large amount of experience with the hiring process. This shows based on the lack of confidence in their ability to hire an engineer and know that said engineer will perform to their expectations. However, given the significant amount of difficulty in executing the hiring process, this lack of confidence would be expected. The human resources organization at the ABC Plant should consider providing additional training and opportunities to hiring managers to become more familiar with the hiring process to build confidence in their success.

The ABC Plant is a unique engineering organization because component designs are typically not produced at the facility. Engineers that have a desire to be involved in design may be disappointed to discover limited opportunities at the ABC Plant. Conversely, engineers with a desire to be involved in manufacturing and producing components based on established designs will likely succeed in the organization. The culture of the organization requires that teamwork be achieved with the design agency to

Overall, the ABC Plant has an effective process for hiring engineers into the organization that will be successful and provide for sustained growth and competitiveness. Hiring managers have a limited amount of interaction with each candidate and thus are at a disadvantage by not having comprehensive detail of every strength and weakness. This disadvantage is shared by every hiring manager in every organization. However, with an increased focus on leadership and training of hiring managers, the ABC Plant can improve their hiring process and increase the odds of success.

Bibliography

Barber, D. (1999). "Star techs." Inc **21**(13): 42.

Charles, R. L., P. A. Kirk, et al. (2004). "THE PARADOX OF SOFT SKILLS VERSUS TECHNICAL SKILLS IN IS HIRING." The Journal of Computer Information Systems **45**(1): 69.

Colwell, R. P., G. Brown, et al. (1999). Intel's college hiring methods and recent results. Microelectronic Systems Education, 1999. MSE '99. IEEE International Conference on.

Grigoryev, P. (2006). "Hiring by Competency Models." The Journal for Quality and Participation **29**(4): 16.

Haas, I. M. (1997). "Hiring the best." Computer **30**(5): 100-101.

Henderson, W. (2010) How Long Does It Take To Get Security Clearance? ClearanceJobs.com

Herrera, F. (2001). "Demystifying hiring and retention." Employment Relations Today **28**(2): 87.

Kanouse, D. (1981). "Programming Success into Employee Hiring." Engineering Management Review, IEEE **9**(4): 87-93.

Kariya, S. (2001). "The how-tos of hiring." Spectrum, IEEE **38**(12): 55-56.

Melymuka, K. (2004). "Hiring Nerds." Computerworld **38**(45): 58.

NNSA (2012, 1/7/2012). "Our History | National Nuclear Security Administration." Retrieved 1/7/2012, 2012, from http://www.nnsa.energy.gov/aboutus/ourhistory.

Noggle, L. H. (1959). "Criteria for the Selection of Engineers for Employment." Education, IRE Transactions on **2**(3): 78-81.

Riehl, H. (1998). "Managing with skills." Ivey Business Quarterly **62**(4): 50.

Rogge, M. A. (1989). "Locate And Hire Technical Employees." Personnel Journal **68**(11): 68.

Rorrer, R. A. L. (2003). "Credentials for the job." Mechanical Engineering **125**(8): 50.

Venturato, T. (1979). "Hiring Techniques: It's What's up Front That Counts!" Engineering Management Review, IEEE **7**(1): 33-38.

Appendix I

Question 1: How many years have you been in the position of selecting and hiring engineers at ACME Incorporated?

Question 2: How many engineers have you hired during your career as a manager at ACME Incorporated?

Please indicate how much you agree or disagree with each of the following statements regarding your review of candidate's resumes:

Question 3: I specifically look for technical skills related to the open position.

Question 4: I will eliminate a candidate from further consideration based on an assessment of their technical skills.

Question 5: I specifically look for indications of the candidate's interpersonal or people skills.

Question 6: I will eliminate a candidate from further consideration based on indications of their interpersonal skills.

Please indicate how much you agree or disagree with each of the following statements regarding how you conduct the interview process:

Question 7: I ask questions that help me assess the candidate's interpersonal skills.

Question 8: I ask questions that help me assess the candidate's technical abilities in relation to the open position.

Question 9: I ask questions that are effective in helping me determine the candidate’s future behavior.

Question 10: Past performance as indicated through the answers to interview questions indicate the future behavior of the candidate.

Please indicate how much you agree or disagree with each of the following statements regarding the importance of a candidate's skills and behaviors:

Question 11: They will bring growth to the department.

Question 12: They will become a leader in the department.

Question 13: They will be self-motivated to get the job done.

Question 14: They will create a positive impact on others in the department.

Question 15: They will strive to establish positive change in the department.

Question 16: They will work well in a team.

Question 17: They will bring technical experience and/or excellence.

Question 18: They will be able to devise win-win situations to problems.

Question 19: They will communicate well with others.

Question 20: They will continually learn and increase their competencies.

Question 21: They will identify and pursue opportunities with low risk and high reward.

Question 22: They will think about how decisions can impact beyond the department.

Please indicate how much you agree or disagree with each of the following statements regarding the selection process:

Question 23: I evaluate not only a candidate's fit for the particular open position but potential fit in other positions in the organization.

Question 24: I have been provided the tools to select the best candidate for the position.

Question 25: I have devised my own tools that help me select the best candidate for the position.

Question 26: I am certain the candidate I select will meet my expectations.

Question 27: I have improved in my ability to select high performing engineers over my years as a manager.

Please indicate how much you agree or disagree with each of the following statements regarding engineers you have hired that have met or exceeded expectations:

Question 28: They bring growth to their department.

Question 29: They are leaders in their department.

Question 30: They are self-motivated and get the job done.

Question 31: They create a positive impact on others in their department.

Question 32: They strive to make positive changes in their department.

Question 33: They work well in teams.

Question 34: They bring technical experience and excellence to their department.

Question 35: They devise win-win solutions to problems.

Question 36: They communicate well with others in the organization.

Question 37: They continue to learn and increase their competencies.

Question 38: They identify and pursue opportunities with low risk and high reward.

Question 39: They think about how decisions can impact beyond the department level.

Please indicate how much you agree or disagree with each of the following statements regarding engineers you have hired that HAVE NOT met expectations:

Question 40: They bring growth to their department.

Question 41: They are leaders in their department.

Question 42: They are self-motivated and get the job done.

Question 43: They create a positive impact on others in their department.

Question 44: They strive to make positive changes in their department.

Question 45: They work well in teams.

Question 46: They bring technical experience and excellence to their department.

Question 47: They devise win-win solutions to problems.

Question 48: They communicate well with others in the organization.

Question 49: They continue to learn and increase their competencies.

Question 50: They identify and pursue opportunities with low risk and high reward.

Question 51: They think about how decisions can impact beyond the department level.

Appendix II

Job Description – Engineer Senior Electrical

Description

ACME Incorporated is a $10B+ SBG (Strategic Business Group) with 40,000 employees in over 125 domestic and international locations. We are a leading global aviation supplier designing, manufacturing, and distributing advanced electronic systems, products, and services to commercial, defense and space industries. The ABC Plant is a U.S. Department of Energy, National Nuclear Security Administration facility managed and operated by ACME Incorporated. Our primary business is to manufacture sophisticated mechanical, electronic and engineered-material components for our nation's defense system. Our goal is to seek innovative solutions that surpass our customers' expectations. To accomplish this, we research, develop and deploy some of the most advanced design and manufacturing technologies in use in the United States today.

This position is seeking an individual with a BS Degree in Electrical Engineering and with extensive course work in Radio Frequency (RF) /Communications. Experience in system level radar packaging, digital signal processing (DSP), as well as testing and analysis. Experience working with RF simulation and other software packages such as ADS, Microwave Office, HFSS, and MatLab/Simulink are also desirable. This individual will collaborate with customers, design laboratory personnel, manufacturing and production support personnel including management on development and improvement

of RF Antenna product designs and manufacturing processes. Demonstrated experience in project management and leadership is preferred.

Summary of Duties:

- Interfaces with customers, design agency personnel, suppliers, and internal organizations to resolve design, development, production and acceptance issues.

- Performs engineering evaluation and troubleshooting tests, product and process capability studies, product data reviews, and other engineering evaluation work to assure product functionality and manufacturability.

- Leads, directs, influences and/or coordinates the work of major projects, or products with responsibility for overall department and project objectives.

- Provides technical assistance to support advance development for RF Antenna Designs.

- Executes projects by interacting with customers, suppliers, and internal organizations. Resolves (directly or through direction) design, development, production, and acceptance issues.

- Provides regular project status updates for customer and management review.

As an Equal Opportunity Employer, ACME Incorporated is committed to a diverse workforce.

Qualifications

Basic Qualifications:

- Must be a U.S. citizen and capable of obtaining and maintaining a government security clearance.

- Bachelor's of Science Degree in Electrical Engineering.

- At least 5 years of experience in the engineering of manufactured products or comparable related technical activity (including university research), including the application of advanced engineering principles and technology.

Additional Qualifications:

- MS Degree in Electrical Engineering with an emphasis in Radio Frequency (RF) / Communications is preferred.

- 5 or more years of experience leading technical teams and initiatives.