The Informal Leader's Role on Construction Sites: A comparative analysis of formal and informal leadership structures within the construction industry

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ABSTRACT

There are numerous causes of delays in productivity and efficiency on construction job sites, many of which stem from inadequate understandings of leadership characteristics and jobsite relationships. The focus of this study is to determine who construction personnel naturally seek advice from. Additionally, this study seeks to establish a classification procedure for locating individuals who exhibit natural leadership. The characteristics used for classification include proximity, job title, experience, education, and age. It was expected that advice would be sought more often from those with various job titles who are older, have more experience, are close in proximity, and have higher education related to construction. This was often the case, except both higher titled formal leaders and informal leader had less formal education and more hands-on experience. Once the leadership structure of each jobsite had been evaluated, a comparison of the productivity of each of the companies associated with their respective jobsite was illustrated to determine whether informal or formal leadership structures were more effective in terms of the current status of product (determined by looking at the budget and schedule). Findings suggest informal leaders are less efficient due to their lack of authority to make quick decisions. It was also determined that leaders are more effective when they are in a formal position of authority. The process developed assists in discovering where leadership truly lies on construction sites, allowing one to use this information to improve productivity and efficiency by maintaining relationships and promoting where necessary.

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1.1 Problem Definition

Informal leadership has been defined in many ways. C. Dean Pielstick (2000) defines informal leaders as "those not in a formal position of leadership but recognized as leaders nevertheless." The informal leader has also been defined by Schneier and Goktepe (1983) as "one who exerts influence over other group members." For the purposes of this study, informal leadership can be defined by discovering what drives workers to follow the advice of one individual over another, regardless of title or authority. With this information one can become more able to influence how a jobsite operates and maintain the relationships necessary to ensure the successful completion of a project. This information also offers one the ability to better select influential leaders for positions that require them and can better direct one to these natural leaders when situations require their assistance.

Ineffective leadership is a common cause of employee disengagement and motivation loss (DecisionWise 2009) which often leads to poor performance and project delays in the construction industry (Ng et al. 2004). Poor site management/supervision and low speeds of decision making are two of the most common causes of project delays in the construction industry (Chan and Kumaraswamy 1997). In this industry it is common to work with different sets of workers on each project to which one is assigned. Understanding and identifying leadership qualities early in the project can help ensure that the project runs on schedule and produces quality results. In a time when work has become increasingly more difficult to find in this industry, many contractors cannot afford project delays nor can they afford to fail in their attempts to outperform their competitors in terms of quality and efficiency. According to projections made in December of 2008, roughly 50% of businesses in the United States were expected to fail by the summer of 2009; 6,400 being construction businesses, one of the most

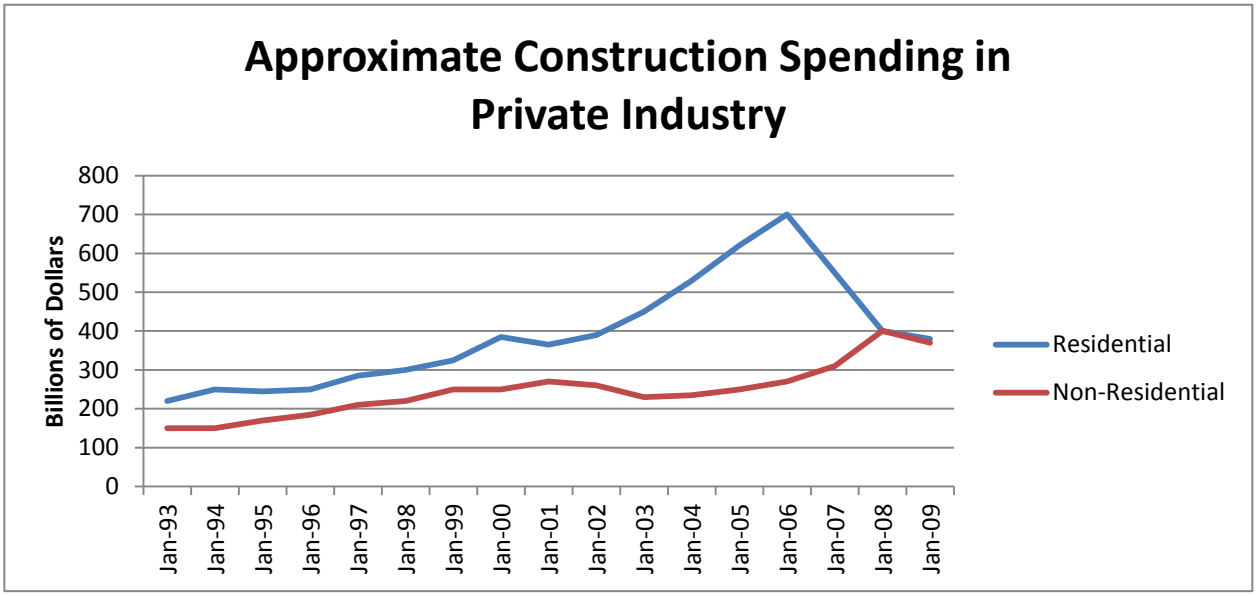


Figure 1 – Approximate Construction Spending in Private Industry (Created using data retrieved from www.calculatedriskblog.com)

affected industries by the current economic crisis (Construction 2008). Supporting these projections, it was found that spending for private construction projects was reduced by 20.6 percent from September 2008 to September 2009 (AGC 2009b). More recently, private non-residential construction has begun to decline in spending while private residential construction has been declining since 2006 (Figure 1).

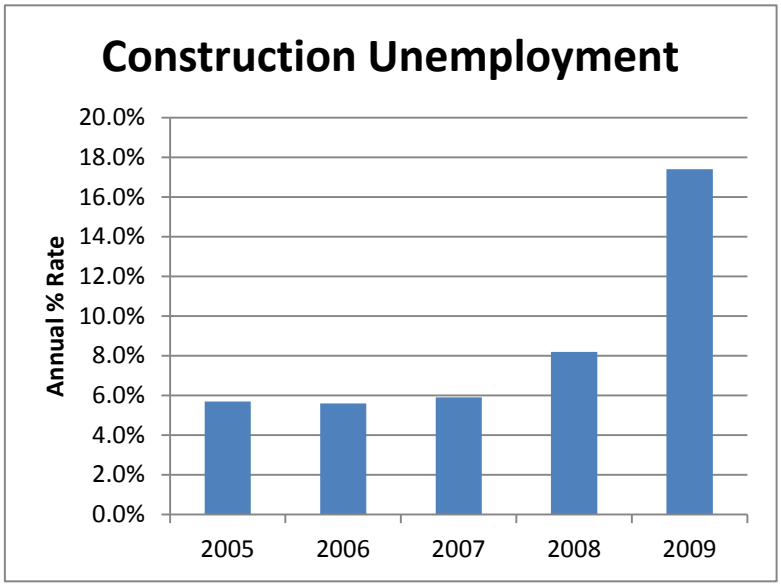


Figure 2 – Construction Unemployment from 2005 to 2009 {Chart created using data from the Engineering-News Record (ENR) and the Bureau of Labor Statistics (BLS)}

When construction companies perform poorly they tend to lose jobs and lose the need, as well as the ability, to pay as many workers as they have been; this phenomenon is often magnified during harsher economic times. In October of 2009 unemployment rose from 9.8 percent to 10.2 percent, the highest rate since 1983, with the construction industry facing one of the largest job losses over the month. Since the initial decline of the economy in December of 2007, unemployment has risen 5.3 percentage points (Figure 2), leaving 8.2 million U.S. citizens without a job (BLS 2009b). Unemployment in the Construction industry alone has risen to 17.1 percent, leaving 64,000 construction workers without a job in September of 2009. Although the residential sector of construction has been said to have taken the biggest hit by the economic downfall, in September it was non-residential construction that accounted for 80 percent of the construction workers who were laid off (AGC 2009a).

Poor leadership practices can also lead to communication failures, so it is important that proper leadership selection is established. Failure to properly communicate with coworkers can lead to problems involving safety

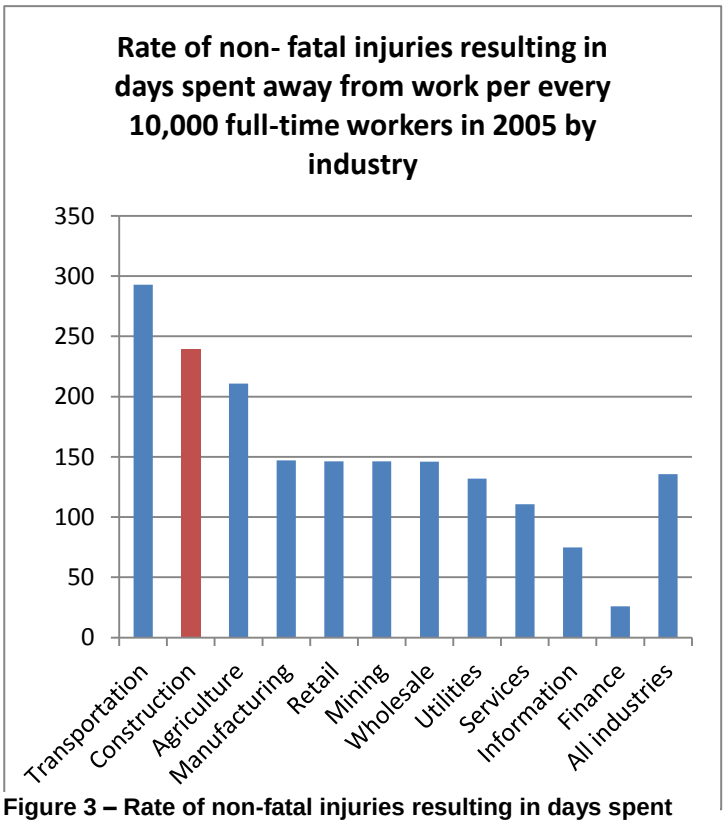


Figure 3 – Rate of non-fatal injuries resulting in days spent away from work (Chart created using data from *The Construction Chart Book, 4th Edition*)

and productivity on the jobsite. Safety is a primary concern on construction sites that can often be underestimated by laborers if their supervisors do not properly communicate safety procedures and potential risks to be aware of. Proper equipment must be provided by these leaders who must also communicate the importance of each piece of equipment. Over 135,000 cases of work related injuries or illnesses were reported for the construction industry in 2007, with an incident rate of 190 per every 10,000 workers (BLS 2009c). Construction workers suffered the greatest amount of fatalities of all other industries in the private sector last year, accounting for one fifth of the total work related fatalities in 2008 (BLS 2009a). Construction is considered to be one of the most dangerous occupations one can pursue. The construction industry accounts for only 7.7 percent of the work force in the United States and yet 22 percent of all work related fatalities are construction related (Waehrer 2007). Failure to properly communicate safety practices on construction sites also comes with financial sacrifices. The total costs for fatal and non-fatal injuries in the construction industry in 2002 were estimated to be $11.5 billion in the private sector alone (Waehrer 2007). These incidents reduce productivity by increasing costs and reducing work crew numbers on the project. In 2005, the construction industry had the second highest rate of nonfatal injuries and illnesses with days missed from work (Figure 33). One way to reduce these incidents is to inform workers properly through effective leadership practices which require adequate leadership selection.

Although there are already many excellent leaders in positions that allow them to fully utilize their leadership abilities, there are still cases where leadership abilities are either overlooked or are not characteristic of those in positions which demand them. In order to remedy these situations, one must identify leadership characteristics of naturally chosen leaders. Naturally chosen leaders are those one seeks advice from for a particular situation. Often this may in fact be the one who holds the supervisory role on the jobsite, but certainly not always. Are naturally chosen leaders more effective with or without a formal supervisory role?

1.2 Literature

There has been extensive research done that investigates leadership characteristics, effectiveness, and establishments, but very little in regards to informal leadership in construction settings. Leadership has been investigated in terms of personality traits, gender differences, leadership styles, effectiveness, and many other attributes. Yet the question has not been asked of which leadership style, formal or informal, is more effective on the construction site.

A study done by Neubert and Taggar examines gender differences in leadership selection in a team-oriented manufacturing environment. It was found that a high level of general mental ability predicted informal leadership more often for women than for men. Men were found to have emotional stability, conscientiousness, and team member network centrality as reoccurring indications of informal leadership potential (Neubert and Taggar 2004). This article suggests that gender plays a role in why leadership is naturally selected in certain individuals but does not establish which gender is more often selected to lead. In another study, Neubert analyzed informal leadership dispersion in manufacturing teams where he found a positive correlation between team cohesion and the amount of informal leaders that were identified in each team. It was also found that when a higher percentage of the informal leaders in a group were composed of female participants, supervisors generally gave higher ratings to their performance (Neubert 1999). This supports the idea that women typically can more efficiently provide informal

leadership in team settings than men, while stressing the importance of informal leadership in team settings.

At Northern Arizona University, C. Dean Pielstick (2000) conducted a comparison study between formal and informal leadership in manufacturing teams; formal leaders being those in a position of power and informal leaders being those who are not in a position of power but are still recognized as leaders. There were 161 variables used that were divided into six primary areas of interest: shared vision, communication, relationships, community, guidance, and character. The results of the study showed that informal leaders scored higher in each of the six areas than did the formal leaders, and informal leaders also received better scores on all but four of the 161 variables (Pielstick 2000). This furthers the belief that informal leaders must be identified to improve productivity and efficiency on construction sites. However this study does not directly apply informal leadership effectiveness to real situations.

James R. Barker (1993) analyzes the specifics of creating teams that could essentially "lead" themselves. This study focuses on developing culture within a real team in the industry that is driven on productivity and reward rather than simply following directions from supervisors. When there is a lack of supervision, natural leadership often arises. This study examines the formation of natural or informal leadership within industry teams that lack supervision. The current study adds components of leadership effectiveness and real situations in the construction environment.

In an article published by Charles Egbu (2004), the proper use of intellectual capital in the construction industry is examined. This article suggests that the intellectual capital of construction personnel is being under-utilized and further training and education is required to promote innovation and the spread of information in the construction industry. Although informal leadership is not directly referenced, the nature of the analysis targets the communication channels most frequented by those who spread the same kind of information as natural leaders, regardless of their formal titles. Leadership effectiveness however is not analyzed, leaving further research to be pursued.

William Baumol (1989) wrote a book discussing productivity and the effectiveness of leadership in the industry. His writings illustrate many ways to increase productivity and show how the American industry has already been accomplishing this in many ways. This further narrows the scope of the current study as both informal leadership and actual situations are not thoroughly tested in the construction industry in his research.

Edum-Fotwe and R McCaffer (2000) have pursued the applications of construction management and leadership in the real environment. Based on their findings and analyses, the construction industry is ever-changing with new processes, ideas, strategies, and tools and construction managers are having difficulty adapting to the changes these bring. To combat this problem, they suggest increasing training and education in order to allow them to maintain the professionalism and proficiency. Informal or natural leadership is a topic that is overlooked in this analysis and should be further pursued.

In an article titled "Level 5 Leadership" by Jim Collins (2007), leadership is looked at from the perspectives of effectiveness and real situations. Leaders in the business world are said to have more success when they have reached a "Level 5" status, rather the typical great business

leader who is often a "Level 4" leader. Level 5 leaders were found to be unique in that they showed humility and generally gave much more credit to the teams they were leading then to themselves. This leaders also were in the highest level of control within the company when their company rose to its greatest levels of success.

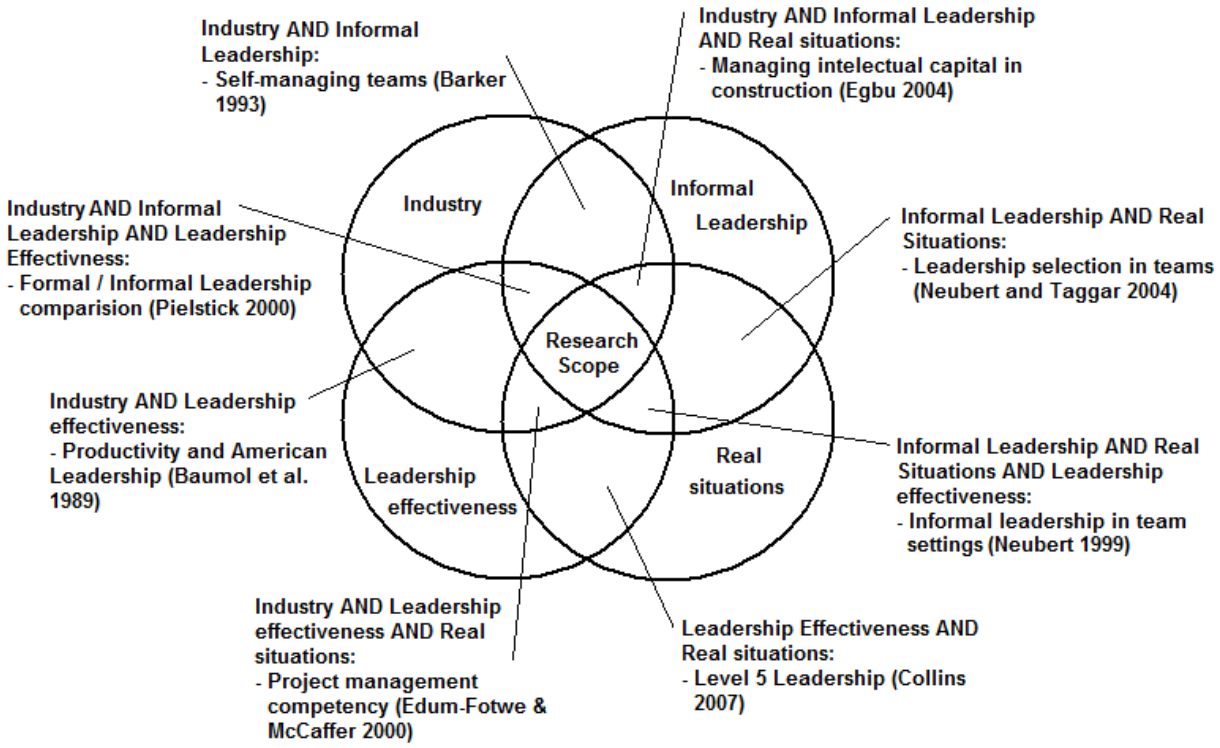


Figure 4 – Literature Review Gap Analysis Diagram

Prior research analyzes four primary constructs relating to the current study: industry, informal leadership, real situations, and leadership effectiveness (Figure 4). The significant advantages associated with informal leaders have been established by all of the previously mentioned research; however there is very little application to real situations. On a construction site, variables such as age, experience, proximity, and validity should be considered when one seeks advice and must be controlled through categorization (see *Methodology*). By direct observing this selection process for informal leaders one is enabled to more accurately identify natural or informal leadership. Prevalence and effectiveness of informal leadership on construction sites can then be evaluated through various data collection methods.

1.3 Objectives

With this research, intentions were to discover the prevalence and effectiveness of informal leadership within the construction industry in comparison to formal leadership structures, and develop a systematic process for this evaluation. Within the context of this study, informal leadership will refer to those who are sought after for advice on construction sites where they lack a formal supervisory title over those they advise. Instances where advice is sought from formal leaders, or those with formal supervisory titles over those they advise, has also been recorded for effectiveness and productivity comparison purposes. Once these

leadership roles were established, characteristics of each leader were evaluated in an attempt to establish a set of criteria for locating leadership potential and influential powers in the construction environment.

With informal and formal leadership roles established and associated characteristics defined, prevalence and effectiveness of informal leadership was then evaluated. Prevalence of informal leadership has been quantified into a comparison with leadership effectiveness. Leadership effectiveness was then determined by the corresponding project status at the time of observations. Project status has been evaluated based on two criteria: whether the project was over or under budget, and whether the project was running on, ahead of, or behind schedule. With this information conclusions were drawn to determine whether formal or informal leadership is more effective on construction sites.

If future utilization of this leadership analysis process is successful, the acquired knowledge of informal leadership should provide a better understanding of work site relationships for project managers and supervisors. By better understanding these relationships, project managers and supervisions will be more enabled to effectively communicate with their respective work crews. This communication should aid in the facilitation of improving efficiency and thereby increasing productivity (Figure 5). Efficiency within the current contexts is defined by the everlasting pursuit of minimal time and resources spent to achieve the desired outcomes. Or in other words, reducing the duration of the project schedule by completing tasks in a timely manner, while also keeping costs down, increases efficiency. When this achievement is made consistently, it can then be determined that more is being accomplished, meaning the persons involved are being more productive. Increased productivity will then enable supervisors to give back to the crew in the forms of job security, bonuses, pay raises, new hires / eased work load, more training, advancement opportunities, etc. This can all be made possible by simply knowing who, when, and how to talk to their workers.

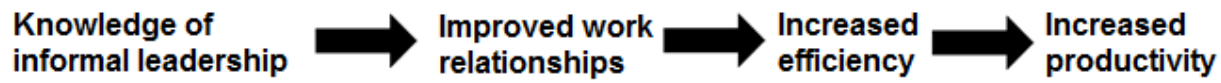


Figure 5 - Process Map of Research Objectives

1.4 Expected Outcome(s) and Impacts

The intended outcome of this study is to increase the information available to construction professionals about informal leadership prevalence in the industry and the importance of the role informal leadership plays in construction. This information can be used to improve productivity and efficiency on construction sites by improving and maintaining work relationships and promoting effective communication practices. By effectively locating and utilizing informal leadership sources to maintain relationships and ensure proper communication distribution, supervisors may be able to gain significant advantages to aid in their projects.

It also may be discovered that informal leadership demonstration serves as an exceptional indicator for promotional purposes and anticipated success rates based on jobsite efficiency and productivity. Converting informal leaders into formal leaders may prove to increase leadership effectiveness as opposed to current practices of formal leadership selection. Human Resources

departments will be consulted as to their current considerations for promotion and they may find informal leadership recognition to be helpful for promotion selection. By giving positions of authority to those who naturally have already acquired the loyalty of their coworkers, communication on the job site can be more efficient and effective. More effective communication may improve construction safety and reduce days that are taken away from work due to injuries or illnesses. So not only may workers be more productive directly from communication improvements, they may also benefit indirectly.

On a larger scale, by increasing productivity in construction, supervisors will be more enabled to "give back" to their crews in terms of pay raises, bonuses, and job security. Improved company performance will lead to more project offers and company growth. With more jobs offered with increased incentives, the construction industry may also be able to reduce the predicted shortage of skilled labor (Ireland 2007) by making construction more desirable as a career path. So it is in the best interest of all construction organizations to utilize the findings of this study.

1.5 Methodology

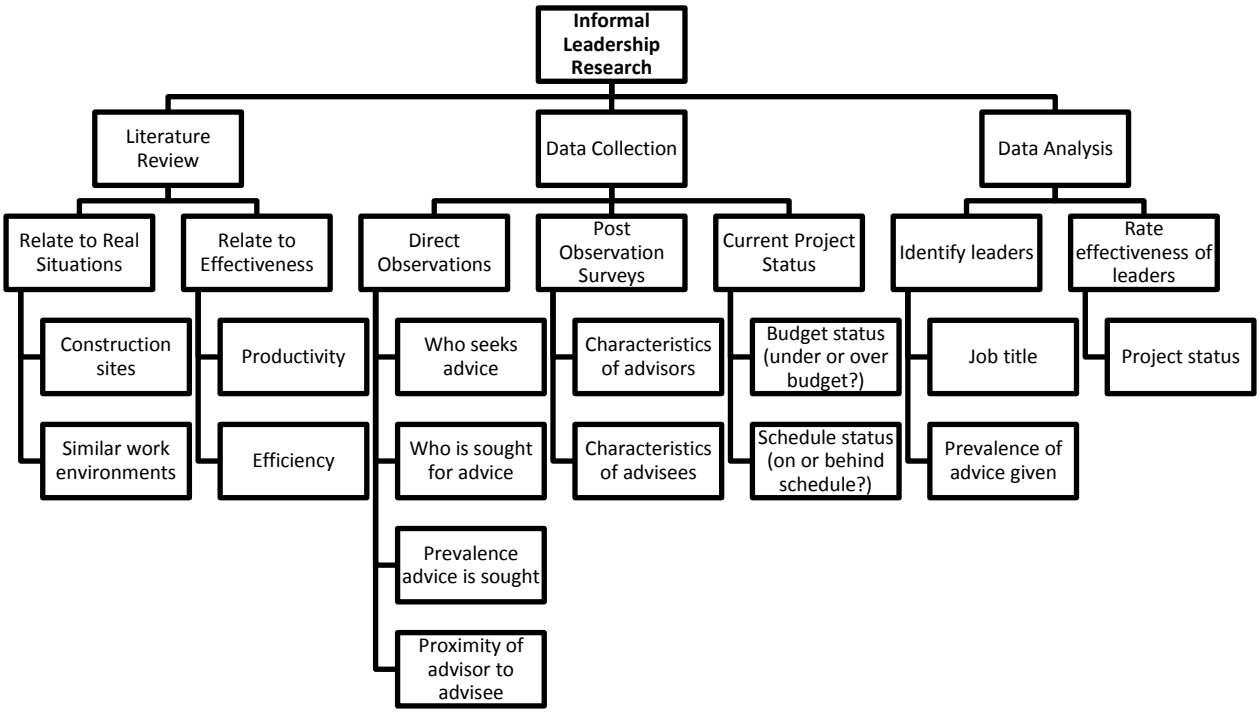


Figure 6 - Work Breakdown Structure of Originally Proposed Research Methods

The originally proposed analysis can be divided into three phases (Figure 6). The first phase has been completed in the initial review of previous literature regarding informal leadership. A gap in previous research was discovered between leadership in real situations in industry and leadership effectiveness in terms of productivity and efficiency. The next phase involves collection of the relevant data through direct observations, surveys given after

observations are made, and the current status of the relevant construction project. Before data was collected, a pilot was run by making observations in the spring of 2010 on a job site in Blacksburg, Virginia. The pilot was used to identify potential barriers to obtaining relevant data throughout the various phases of the study, and several revisions were made which are discussed in later sections. In the final phase of research the data was analyzed to identify formal and informal leaders in terms of how often they are sought after to give advice and their currently held job title. This phase also compared the effectiveness of each leader by analyzing the status of the project at the time of leadership observations.

Upon obtaining IRB approval, observations took place on four different construction sites (in addition to the pilot site) in order to increase the significance and variety of the sample size. At each site the researcher had intentions to act as a volunteer who would make periodic recordings as they arose. Construction site personnel were asked to make recordings as well by filling out a daily log in the format shown in Appendix 1. It is not possible to observe all advice exchanges simultaneously so the researcher and site personnel were only able make observations that presented themselves; this is a confound that may benefit by having more than one observer in the future. Projects chosen for observations were selected based on availability to the researcher and the cooperation of the construction firms. All projects selected were within the second half of the overall expected project duration period or neared a major project milestone (a task of noteworthy completion, crucial to the progression of the project). This was done to encourage more accurate project success rates based on project status. Site selection was based on obtaining a variety of age and experience levels of the site supervisors to control for these confounds. Other confounds were accounted for by means of randomization and increased site selections within the means of the researcher's abilities.

The researcher attempted to record who advice is sought from, how often advice was sought, who sought the advice, the relative proximity of the advisor to the advisee, the question that was asked, the answer that was given, and the experiences of each respective party. Validation of the advice provided was expected to be derived from the accuracy of the advice given to the problem that needs to be solved. If the advice given did not fully correct the problem or situation, or created a new problem that would otherwise have been avoided, the advice was recorded as invalid. Each instance required the researcher, or assisting participants, to monitor the situation to determine the outcome and the validity of the advice given.

Once a significant amount of observations were recorded (which was determined by the results of the pilot study), the data was then used to inquire further information from the participants. Each participant (both advisors and advisees) were asked to fill out a short survey with a deadline of two weeks and return that survey to the researcher once complete. The participants were informed that they were not required to answer any or all of the questions and that their participation is greatly appreciated. A pilot study was run in this format and was used to determine response rates, and necessary revisions. The questions asked (as a post-observation survey in the pilot, and as the primary interview questions for the final data collection) are as follows:

1. What is your age?
2. How long have you worked in the construction industry?
3. How long have you worked for the company you currently are employed with?

4. What formal training/educational programs have you completed? (Trade school, associate's degree, bachelor's degree, etc.)
5. What is your formal job title?
6. How long have you held your current job title?
7. Who do you normally seek advice from on the construction site when a problem arises relating to the task you have been assigned? If there is more than one person please list them as well.
8. Why do you generally seek advice from this person? Please list reasons for seeking advice from all persons mentioned in previous answer.
9. Do you see yourself as a leader at work?
10. Do you see yourself as a leader in other situations? If you do, what are the other situations? (Examples: sports teams, at home, volunteer work, etc.)

These questions have been designed to collect relevant data that is not directly observable. The answers to these questions could be and have been used to establish a general set of defining characteristics for informal leaders and also to eliminate confounding variables that may otherwise compromise the integrity of the analysis. After this data has been collected, individual advice exchanges can be divided into several categories (Figure 7) to control for varying age and experience levels based on their answers to the first four questions. This process is used to establish age and experience differences relative to job titles between advisors and advisees.

CONTROL FOR AGE/EXPERIENCE DIFFERENCES					
Characteristics relevant to advisor or advisee	**Category Divisions**				
	5+ years	**(5 years or less)**	**within 1 year +/-**	**5 years or less**	**5+ years**
Age	Much younger	Younger	Same Age	Older	Much older
Company Experience	Much less experience	Less experience	Same experience	More experience	Much more experience
Industry Experience	Much less experience	Less experience	Same experience	More experience	Much more experience

Figure 7 - Categorical Divisions used to Control for Age and Experience Differences

Questions five and six distinguish between formal and informal leaders (the advisors job title relative to the job title of their advisees) and allow for a comparison to be performed between them. Questions seven and eight allow the researcher to account for any potentially missed observations. The last two questions, nine and ten, give the researcher perspective as to how participants view themselves in terms of leadership. This allows for better understanding of the personality characteristics of leaders and the driving factors associated with informal leadership selection (Figure 8).

SELF PERCEPTIONS: Where leaders view themselves as leaders						
	At work	**At home**	**In School**	**Sports teams**	**Volunteer work teams**	**Other settings**
Informal leaders	%	%	%	%	%	%

Formal leaders	%	%	%	%	%	%

Figure 8 – Self-Perceptions of Formal and Informal Leaders in terms of Leadership

Once all of the data is analyzed in the above mentioned fashion, a final compilation of data is then organized to show total averages to draw conclusions from (Figure 9). This first stage of data analysis focuses on identifying common characteristics of informal leaders in comparison to formal leaders in the construction industry.

FINAL COMPILATION OF IDENTIFYING CHARACTERISTICS		
	Informal Leaders	**Formal leaders**
Advice sought from	% of instances	% of instances
Sought advice	% of instances	% of instances
Prevalence of leader	%	%
View themselves as leaders at work	%	%
View themselves as leaders elsewhere	%	%
Proximity to advisee	Most frequently (close, far, or offsite; with %)	Most frequently (close, far, or offsite; with %)
Average Age	Years	Years
Average Industry experience	Years	Years
Average Company experience	Years	Years

Figure 9 – Proposed Final Compilation of Collected Data

In order to establish a leadership structure's effectiveness on construction sites, the researcher made recordings regarding the current status of the project at the time of completing on-site interviews. A few questions were asked of the formal supervisor of each project. The first question inquires as to whether the project is over or under budget at that point in time; and the second inquired as to whether the project was on, behind, or ahead of schedule. Anonymity has been and must be ensured for the answers to these questions to encourage more honest answers and protect the rights of participants. Supervisors have also been offered feedback from the results of this study to aid them on future projects. The second stage of analysis is then run to determine if there is a relationship between the prevalence of informal leaders and project status based on the information provided below (Figure 10).

EFFECTIVENESS / PREVALENCE			
	Site One	**Site Two**	**Site Three**
Informal leaders	Percentage	Percentage	Percentage
Formal leaders	Percentage	Percentage	Percentage
Budget	Under or over	Under or over	Under or over
Schedule	On, behind, or ahead	On, behind, or ahead	On, behind, or ahead

Figure 10 – Comparison of Effectiveness on Productivity between leader types

There are several confounds that are beyond the researcher's (as well as the observed leaders') control that have an effect on the current status of the projects. Some of these variables are inclement weather, change order complications, poor contract administration, etc. Instances such as these are recorded by the researcher and this information is included in the final

conclusions of this study. If these confounds are of great enough magnitude to significantly alter the results of data collection, further observations are required at other sites.

1.6 Process Development

The methodology that was proposed above was suggested in attempts to pursue several objectives. First, the prevalence of informal leadership on construction teams must be identified. Next, common characteristics of informal and formal leaders must be established. The effectiveness of informal leadership can then be analyzed based on project status. And finally, the prevalence of informal leadership can be compared to the presence of formal leadership in terms of efficiency. With these objectives in mind, the researcher has designed and refined a systematic process for future researchers and/or construction managers to utilize and potentially improve the efficiency of their work place with their findings.

The researcher was first faced with answering the question: "What defines leadership and how can it be measured?" From that question, it was determined that leadership, whether established or natural, is the consistent provision of information to team members that is pertinent to the work at hand. This information can be in the form of instructions, requests, or general information about a topic, but the importance lies in the flow of communication a leader provides that brings the team together to accomplish a common goal.

Formal leaders have the assistance of their title for identification and the authority to make decisions, but informal or natural leaders do not have this label to rely on. So the bond that makes a leader a leader has been redefined for the purposes of this study to include advice-seeking behavior as a determinant, as this behavior is the primary avenue for work-related communication flow. "Advice-seeking behavior" refers to the act of one worker asking a work-related question to a coworker. It was now intended to discover why someone would chose to ask one person a work-related question over another.

Now that it was known what to look for, a method of observing advice-seeking behavior had to be established. At first, the researcher intended to collect this data through direct observations of the happenings on a construction site throughout the day. This would entail a great amount of time spent by the researcher on site. Not every question that was asked on site would be easily recorded or recorded at all, because the researcher was not physically able to be everywhere at once and hear every conversation. Also, there was concern of the observer bias that would be created by having the research present during the observations. For example, participants may have tended to seek advice more often from their direct supervisors, or refrain from seeking advice at all, to make it seem as though they have no need for advice. So an adjustment had to be made.

Since more man power was required in order to collect as many advice seeking behavior instances as possible, a new approach was developed. To combat both observation bias and the

lack of manpower, the researcher made attempts to enlist the assistance of the construction team members themselves. To do this, the researcher had to make the process simple and easy to record data while creating minimal disturbance to their work duties. So a data recording worksheet, as shown in Appendix 1, was created to allow workers to make their own observations as they witnessed them. This strategy was implemented in the pilot study that was run, and several unforeseen complication arose as discussed in later sections.

In order to resolve these complications, the researcher had to sacrifice the obtainable sample size by taking a more hands-on approach. At first, the researcher did this by passing out the worksheets by hand and assisting with their completion; and although this greatly increased the response rate, there was still a missing component to the process that hampered the desired pattern recognition.

Upon later reflection, the researcher realized that the method used was too sporadic to recognize a pattern. In other words, recordings of persons seeking advice from one particular person more than others was near impossible unless all team members are included in the observations. On the large site that was chosen, there were many different teams working, but not necessarily *together* in terms of advice-seeking. So to obtain more conclusive data, it became necessary to establish the roster for each team and then obtain data from each member of that team individually.

Another complication that arose was the deterioration of validity created by making observations based on recall. Respondents did not respond if the researcher was not present, and the researcher was rarely (if at all) present when questions were asked between coworkers. So this forced the observations to rely on recalling previous questions that were asked and how they were handled. The human memory, although very powerful, is less than perfect. It often fabricates new information to fill in the gaps where true information has been forgotten due to the lack of importance it had to the owner of the memory. Meaning, the longer you wait after observing advice-seeking behavior, the less detail of the occurrence you will actually remember. The fabrication of new information into these recalled instances is what introduces a bias, however slight it may be, into the data collected. This was a problem the researcher was unable to prevent, however must still be taken into account.

To ensure total involvement of all team members and that the desired information was being collected, the researcher decided to conduct one-on-one interviews and disregard the use of the advice-seeking behavior observation worksheets in the final process. By conducting these interviews, the researcher was enabled to present clearly the information being requested and subsequently received much more conclusive data. The advice-seeking behavior was recorded by simple asking the participants, “who do you normally seek advice from and why?” and other detail relating to demographics and characteristics were answered with additional questioning.

This process worked very well and seemed to capture the objectives of the researcher to a more desirable level. Once the information was compiled, the analysis outlined in the methodology section above was executed with only minor adjustments made to accommodate the nature of the data that was received (for example percentages were no longer needed due to the smaller sample size, ratios were used to represent this data instead).

1.7 Planned Schedule for Research

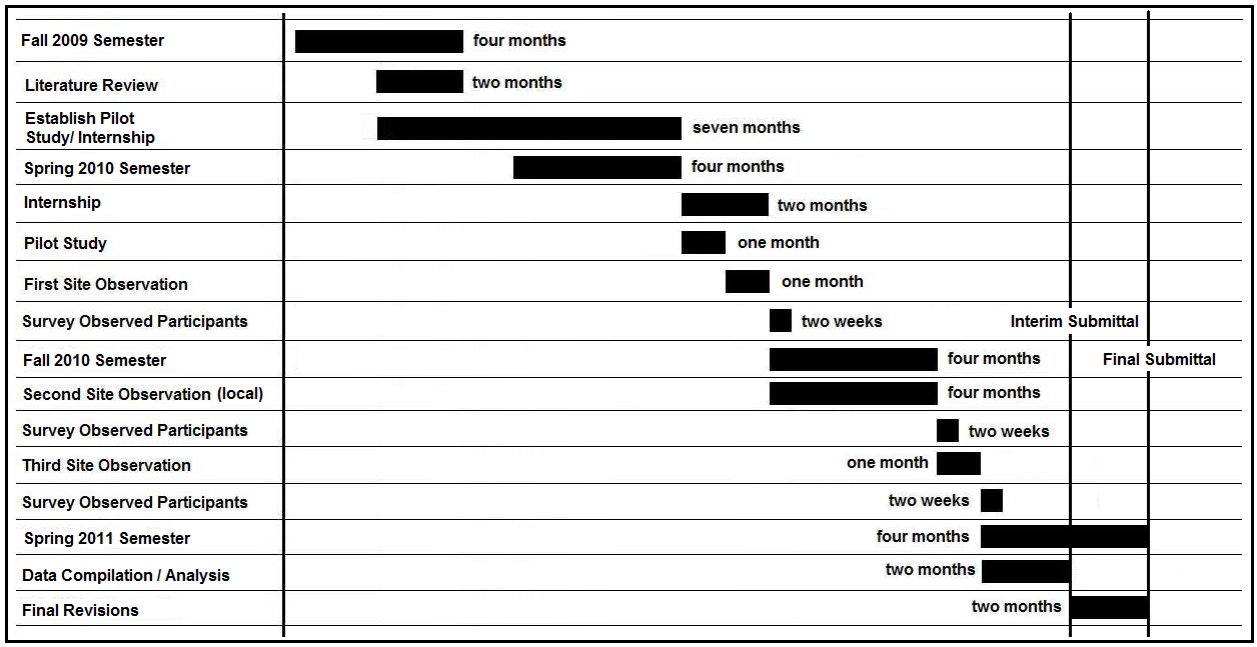


Figure 11 - Planned Research Schedule

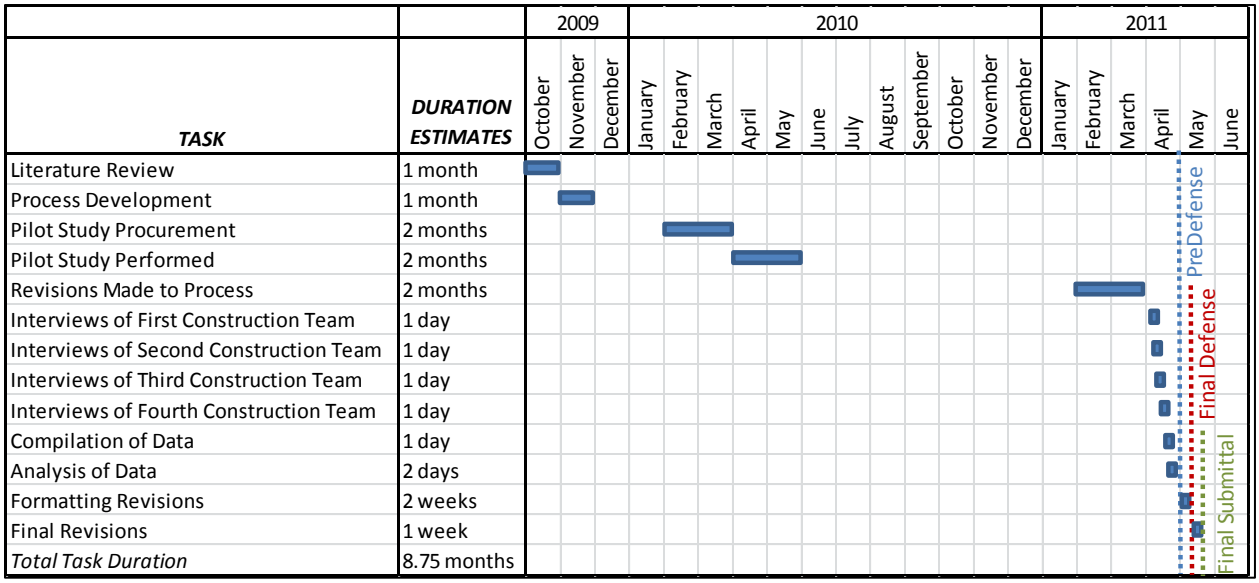
The diagram shown above (Figure 11) illustrates the planned schedule for the proposed study. It is was assumed that between one to four weeks spent at each site would allow adequate time to make significant recordings, however this was adjusted based on the results of the pilot study. Two additional weeks were assumed for collection of post observation surveys after each set of observations, however this became unnecessary upon revision of the process.

The first set of observations was originally planned during the internship scheduled for the summer of 2010, once the pilot had been completed during the first month of the internship. Site observations were then planned to continue in the fall of 2010 at various periods throughout the semester at a local construction site. This was supposed to allow the researcher to complete the third set of observations in between the fall and spring semester (2010-2011). Data would have then been compiled and analyzed during the early months of the researcher's final semester at Virginia Tech. An estimated two months were allotted for interpreting the data that was collected. After completing a final draft of the research, an interim submittal was to be given to the researcher's committee. Upon receiving feedback, the researcher would then make final revisions before submitting the final research findings.

All research tasks were over-estimated to allow ample time for the researcher to complete them while also completing the program for which he was enrolled at Virginia Tech. During the first eighteen or so months of the research, a final report was planned to be constructed for an interim submittal to the researcher's committee. As many of the firms that were originally spoken to were not local to Blacksburg, observations would have had to been scheduled during breaks in the Building Construction program of which the researcher was currently enrolled. Construction sites were selected for observations based on their availability to the researcher, cooperation from construction firms, current stages of project completion (relative to start and finish dates), and site recommendations from industry contacts.

Chapter 2: Adjustments and Discoveries

2.1 Actual Research Schedule



TASK	DURATION ESTIMATES
Literature Review	1 month
Process Development	1 month
Pilot Study Procurement	2 months
Pilot Study Performed	2 months
Revisions Made to Process	2 months
Interviews of First Construction Team	1 day
Interviews of Second Construction Team	1 day
Interviews of Third Construction Team	1 day
Interviews of Fourth Construction Team	1 day
Compilation of Data	1 day
Analysis of Data	2 days
Formatting Revisions	2 weeks
Final Revisions	1 week
Total Task Duration	8.75 months

Figure 12 - Actual Research Schedule

Characteristic of most planned projects, there was quite a bit of variation in the planned versus actual schedules. As you can see in Figure 12, once the procurement activities (literature review and process development) were completed in 2009 as originally planned, there was a two month delay until the researcher began pursuit of establishing a pilot study with a construction company. Contacts were established with a general contractor on campus through Virginia Tech's University Planning Design & Construction (UPDC) department in February of 2010. Through these contacts, the researcher obtained an invite to a prescheduled meeting of all the subcontractor representatives and managers on site. This meeting allowed the researcher to introduce the proposed methods of research and expectations. Forms were distributed and the pilot process proceeded as discussed in the following section.

During the months of April and May in 2010, the researcher made periodic visits to the site to test different data collections methods. At the end of May, the researcher became involved in other commitments which delayed further progress until February of 2011. In February, revisions were made to the data collections methods in order to better grasp the leadership structures being analyzed. The following section discusses these revisions in more detail, but in summary, the process of observing individual instances of advice seeking behavior was eliminated and one-on-one interviews were implemented using the questions established in what was formally the "post-observation survey." This allowed a much timelier turn-around as the researcher received immediate feedback and could conduct interviews of an entire construction team in only an hour or two per team, depending on the size of the team.

As shown in Figure 12, each team was interviewed within one day and all during the month of April (however not one day right after the other as the chart may be interpreted). It is suggested to allow some flexibility in scheduling these interview sessions as many construction teams are not always available. A frequently proposed time for these interview sessions (by the team supervisors) is Friday mornings between 7:00am and 11:00am. Some seemed to prefer as early as possible to conduct the interviews before work began for the day, and others preferred closer to lunch time when work typically began to slow down. You must be careful to avoid conducting interviews too close to lunch time because participants would usually rather not take away from their lunch break to answer questions. Conducting them after lunch on Friday is also difficult because many participants may leave early on Fridays.

The data from all four sites were compiled, compared, and analyzed in a span of roughly three days; however it is suggested to allow more time if possible. The researcher in this case was constrained to the availability of the construction teams; a constraint which may have been alleviated by contacting them much earlier.

The interim submittal, or pre-defense, was presented to the committee of the researcher at the end of April. A period of about two weeks was allotted for making revisions, based on the feed-back during the pre-defense, before a final defense presentation was given. Another week was given to the researcher to make final revisions.

2.2 Pilot Results

A pilot test, for the data collection methods proposed, was performed on a commercial construction site in Blacksburg, Virginia. The site superintendent was contacted by the researcher in the Spring of 2010. From there, the researcher was invited to participate in a prescheduled meeting of all of the sub-contractor representatives and managers.

The purpose and process for this study was presented at the meeting to the various subcontractors who agreed to participate. Each representative and Manager was asked to take several Data Collection Forms (Appendix A) to pass out to their team members who would then fill them out throughout the day and return completed forms to the front desk (in the main trailer

near the site entrance). The researcher then explained that he would return at a later date to retrieve the completed forms (Figure 13).

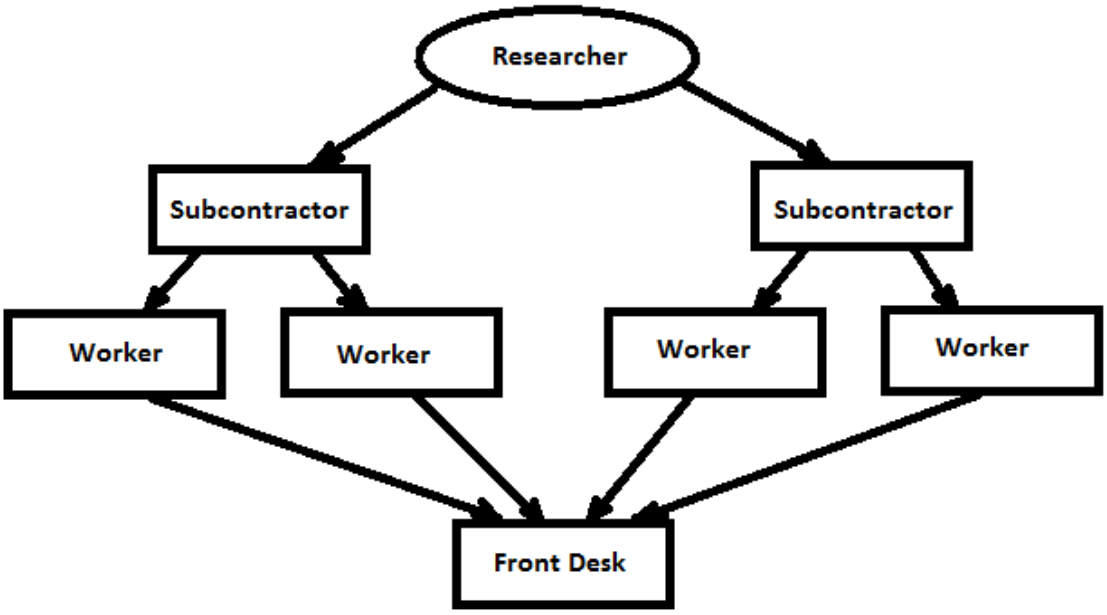


Figure 13 - Data Collection Form Distribution Process (first attempt)

The necessary forms were distributed in the fashion described above with intents to receive a large amount of responses in a short period of time. However participants seemed to be less engaged in the study this way, and did not take the extra time to complete and turn in the forms as a result (no forms were received by the front desk when the researcher returned two weeks later). So to reduce this disassociation, the researcher met again with the project superintendent to develop a new course of action.

This method of data collection (mass distribution of advice-seeking recording forms through team supervisors) was attempted in the hopes of bringing back a large amount of data in a short amount of time by utilizing the daily perspectives of first hand team members. For this method to work, it is essential to have participants:

1. Be actively engaged in making daily recordings
2. Record instances as they happen, rather than recall them later
3. Record all instances they encounter, no matter how insignificant or trivial
4. Understand what exactly the researcher is looking for in their answers
5. Include all team members in the process, both of recording data and being recorded

In a research environment, where a team is assembled specifically for the purposes of the study being conducted, these requirements would be much less difficult to control for and manage. However in real situations on construction sites, participants are much less engaged as they have more pertinent work to focus on during the day.

The second attempt at data collection took more of a hands-on approach. The site superintendent introduced the researcher to the entire work crew (all subcontractor workers included) during one of their morning meetings and explained that the researcher will be walking the site and asking to borrow a few minutes of their time to answer a few questions (Figure 14). So the researcher did this on several occasions, offering forms to workers individually and answering any questions they had while they filled them out. The researcher first asked each individual to fill out the observation collection form (Appendix 1) and then the ten question survey discussed in the earlier methodology section (Page 10).This method improved the process as responses were returned to the researcher while he was still present onsite (Appendices 2 & 3).

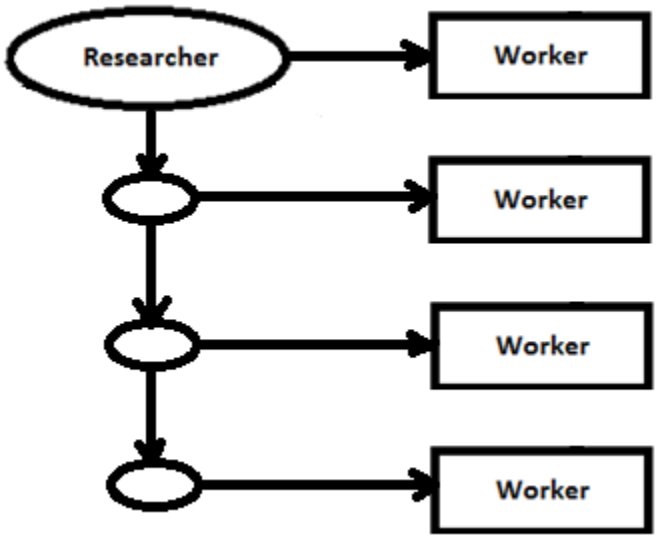


Figure 14 - Observation Form and Survey Distribution/Collection Method Diagram (second attempt)

The process used in the second attempt improved the response rate by 100% simply by making the researcher more available to answer questions and collect the forms. However this forced participants to make observations based on recalling past instances of advice-seeking behavior. Many less-significant instances of advice-seeking were most likely forgotten and observations that *were* recorded may have lost accuracy over the time that had elapsed before being recorded. It is possible that the "less-significant" instances of advice seeking may be *most* significant in determining those people are naturally, or even subconsciously, drawn to for leadership. So this could be a major confound that could not be controlled using this method.

While the method of obtaining responses had improved, the findings were not what the researcher was looking for. Since the site was very large and small teams were not identified, very few, if any, names were repeated on different form submittals. Also, team divisions (as there were many teams on the construction site contracted through the general contractor) had not been established prior to the form distribution. Without the knowledge of who was on what team, the researcher was forced to try to make conclusions with incomplete information. This made pattern identification impossible, so a different approach has been taken for the following data collection method. However this method still has potential use if several adjustments are made (see discussion under "Future Research").

2.3 Data Collection Revisions

The three primary difficulties experienced during the pilot that made the researcher unable to identify trends were:

- A disconnect or misunderstanding between the participants and what was expected for their answers
- The large size of the construction team and lack of team membership definitions greatly reducing the repetition of mentioned team members (lack of pattern recognition).
- The frequency of responses were not adequate as a 100% response rate is needed to create conclusive data

In order to combat these difficulties, the researcher decided to eliminate the collection of advice seeking instances and only use the survey questions. The researcher also decided to reduce the disconnect created between the participants and the expectations for their answers by administering the questions in short one-on-one interviews with individual team members, making sure all team members are included. Lastly, smaller and better defined teams were sought for subsequent data collection with the expectation that names were more likely to be repeated.

A team size of at least three is required to determine if advice is being sought from one person over another. The question of "how many is too many" should be determined by the researcher's availability to conduct interviews and the amount of cooperation received from construction teams. However, it must be remembered to include all participants of a defined team, no matter how many team members there may be.

In addition, and as a result of research pursued for the researcher's coursework, opinion leadership has been added to the current study. As defined by Everett M. Rogers (2003) opinion leadership is "the degree to which an individual is able informally to influence other individuals' attitudes or overt behavior in a desired way with relative frequency." This addition will help to better understand the nature of informal leaders and how they can influence the spread of innovation in the construction industry. To follow the original ten question interview/survey, the following questions have been added:

1. How likely are you to try a new product, process, or idea while working? (rank on a scale between "1" and "5", "1" being least likely and "5" being most likely)
2. How do you most often hear about a new technology or process? From who?
3. What new technologies and construction methods have you seen or heard of while working with your current team?
4. Have you changed the way you perform your work based on this new technology or process? Why or why not? (ask for each technology or process listed in previous question)
5. How long did you use this technology or process? (ask for each technology or process)

These questions are designed to identify the innovative nature of each individual and whether or not they are effective in leading opinions on new ideas or innovations, regardless of whether or not they are favorable to new technologies, processes, or ideas. With this information we may be more able to identify inefficiencies in innovation adoption within the construction industry and also how information flows through construction related social networks. This element has been

further researched and discussed in a parallel study performed by the researcher, titled "Construction Leadership and Innovation" (Pendleton 2011).

2.4 Account for Limitations

There are several limitations that must be accounted for before further discussion of the findings and potential future research. A critical component of the interview method of collecting information about leadership within small construction teams is to confirm all members of the team have, or will have, participated. Without knowing the perspectives all members in a team, crucial information leading to the identification of informal leaders may be overlooked. So it must be noted that on the general contracting team that was interviewed, two of the eight team members were not present. Significant data was collected on this site, but without the full perspective as mentioned, it is difficult to make complete and accurate conclusions.

At the time of the interviews with team members of the general contractor, information received regarding the two missing team members was mistakenly overlooked by the researcher. Upon further reflection, this information should have been recorded and further pursued during the interview sessions with other participants. This would have given the researcher a better perspective of the involvement of the missing team members in the leadership structure of the team. Of the two missing team members, one seemed to be more involved in offering advice as a formal leader (based on recollecting the references made by the present team members) and the other missing team member seemed less involved due to preoccupations with administrative formalities and monitoring as part of their responsibilities. A closer look into the leadership positions of these missing team members may have established more conclusive data.

To combat this limitation in the future, the researcher must ask all team members to list their coworkers. This provides a more accurate description of the persons on the team and will show if there are any discrepancies between perspectives. Also, if there are members who are not present during the interviews, the research can allow more ample time to reach those individuals at a later date, or attempt to receive the necessary information about those individuals through the participants that are present at the time.

Team definitions are not always easy to determine. On larger sites, there may be a team of ten electricians where only six are working together consistently. The other four may be working with two drywall installers on a daily basis. So to avoid overlooking what the boundaries of the real teams are, it should be asked not "who do you work for" but "who do you work with," making sure to specify that these coworkers may not be on the same payroll or work for the same company, but they are who you consult with on a day to day basis.

Additional limitations include the small sample size available to the researcher and the bias associated with interviews rather than first-hand observations. A larger sample size, or even simply participation of larger teams, would most likely increase the identification of leadership roles. More conclusive information may be derived by interviewing much larger teams if it is within the researcher's abilities to define the team members well and complete thorough interviews with all team members. As another option, first-hand observations, such as on-site video/audio equipment, or the immersion of the researcher into construction team(s) as a case study, would reduce the possibility of missed instances of advice seeking due to the imperfect

memory we all have. Events are much easier to recall when they are of greater significance to the observer. So routine instances of advice seeking behavior may often be overlooked or forgotten by the participants and might also be the most crucial observations to the researcher. By taking these and the formerly mentioned adjustments into account in future endeavors, it is hoped to obtain a more complete perspective of the leadership structures on construction teams than the current study has to offer.

2.5 Findings

Four different teams were interviewed which totaled at 19 participants. Of the 19 participants, there were seven identified formal leaders, one identified informal leader, and four identified opinion leaders (Figure 15). Leadership status assignments have been made by the researcher based first hand observations as well as the answers obtained during the interview process.

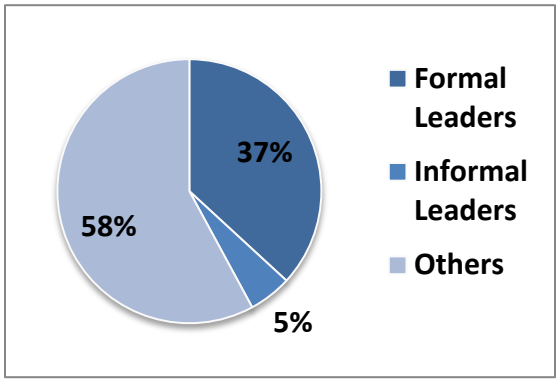


Figure 15 - Leadership Distribution

The first construction site the researcher went to was run by a small residential construction crew assigned to build a custom home in Blacksburg. The crew consisted of four workers, one of which owns the company. To ensure anonymity, designations of "A1 through A4" were used to replace names of those who were interviewed on the interview results chart (Appendix 4). An informal leader, a formal leader, and an opinion leader were all identified based on the observations of the interviewer and the answers given by the participants. In this case, each leader type was a separate person and the leadership structure had enabled the project to be on schedule and on budget. It is interesting to note that the informal leader does not see their self as a leader at work or elsewhere, and in fact they normally turn to the opinion leader or the formal leader for help when needed. It should also be noted that the formal leader is not always on site; so when the formal leader is not available, the informal leader is turned to for advice by the others (Figure 16).

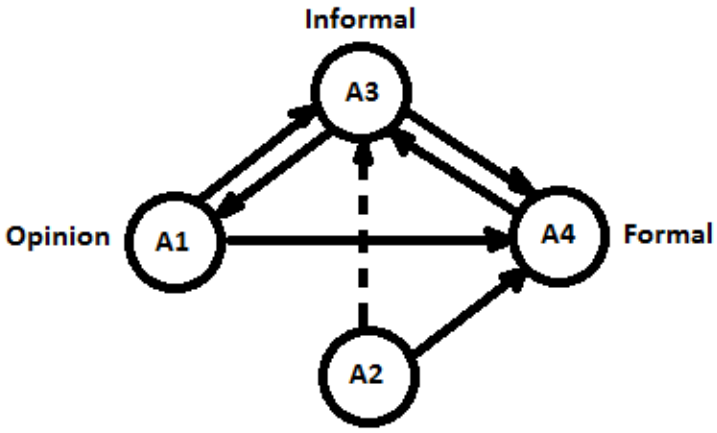


Figure 16 - Advice seeking behavior diagram for first site

On the second site, the team was composed of five members performing electrical work for a general contractor. This site did not appear to have any informal leadership or opinion leadership. There was one identified formal leader who was very efficient in making quick decisions and moving the process along (Figure 17). The efficiency and constant availability of the formal leader may have made it unnecessary to have an informal leader provide advice in the absence of the informal leader. All team members seemed very knowledgeable about the work they were performing which may have reduced the need to seek advice from others. It is also important to note that the team members had been brought together to assist each other on this particular job, but most had not worked together consistently in the past. When asked about the overall status of the project, the formal leader responded that the project is currently on budget and on schedule.

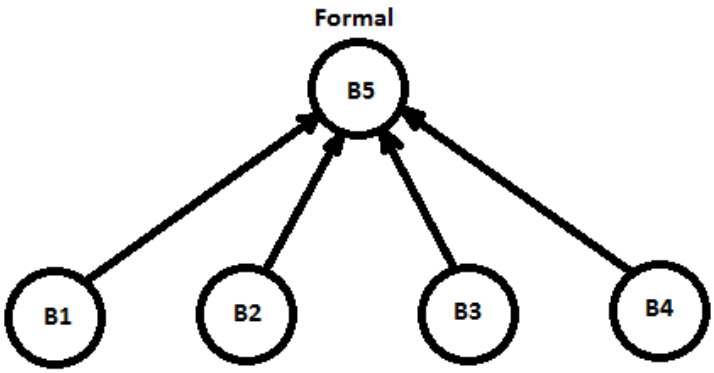


Figure 17 - Advice seeking behavior for the second site

The third site, composed of a subcontracted team assigned to complete the exterior work of several residential homes, also lacked informal and opinion leadership. The formal leader was one of four workers on the team and was also the company owner. What was different about the way this formal leader led is that he seemed much more open to new ideas and getting feedback or advice from his team members (Figure 18). So while technically the formal leader, he also exhibited qualities you might expect to find in an informal leader. This project was said to be ahead of schedule and either on, or possibly under, budget.

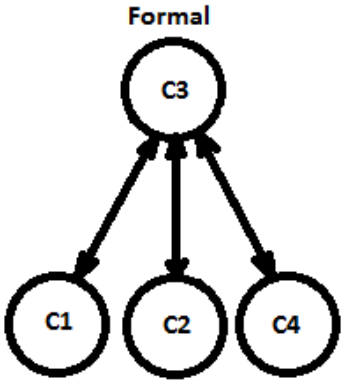


Figure 3 - Advice seeking behavior for the third site

The fourth and last site that was interviewed was a general contracting team providing general management for a commercial project. Of the six total team members that were interviewed, three were identified as opinion leaders, four as formal leaders, and one of the formal leaders (the one with the highest formal title) exhibited characteristics often found in informal leaders. The formal/informal leader was sought after for advice by most other team members due to his extensive experience in construction, rather than just due to his formal title. Other team members were consulted by each other for their particular expertise rather than just their title, but seemingly not to the extent of the formally mentioned leader. This team placed a very high emphasis on innovation and using new processes, tools, or ideas to run their operations more efficiently. All team members exhibited leadership in one form or another as they were assigned the task of managing the site operations of the site (Figure 19). This project was said to be ahead of schedule and on budget, with plenty of remaining opportunity to improve their status as it was still early in the project.

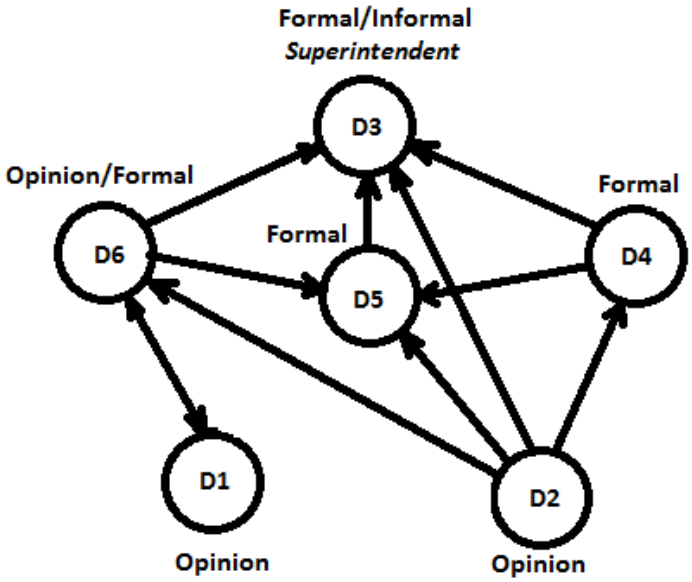


Figure 19 - Advice seeking behavior for the fourth site

Each site had very unique leadership structures and all four projects appeared to be running very smoothly. Two of the sites were actually ahead of schedule and they did not have the presence of informal leadership. There was however more unity among the team members and more idea exchanges between formal leaders and other team members. The interview question answers for each site are listed for comparison in Appendix 4.

2.6 Analysis

Once the answers from the interview questions had been compiled, further comparisons were made as illustrated in Tables 1 and 2. Table 1 compares the differences found between formal and informal leaders. Table 2 shows a comparison of the effectiveness and prevalence of the two types of leadership between all four sites.

Table 1 – Informal and Formal leadership Characteristics Comparison

FINAL COMPILATION OF IDENTIFYING CHARACTERISTICS		
	Informal Leaders	*Formal leaders*
Prevalence of leader	1 out of 19 participants	7 out of 19 participants
View themselves as leaders at work	None	All 7
View themselves as leaders elsewhere	None	All 7
Proximity to advisee	Always on site	Usually on site, further away
Training/Education	Hands-on only	3 out of 7 have BS degrees
Average Age	54	42
Average Industry experience	40	23
Average Company experience	30	14

Table 2 - Effectiveness and Prevalence of Leadership Types on Each Site

EFFECTIVENESS / PREVALENCE				
	Site One: Home Builder	*Site Two: Electrical Sub*	*Site Three: Exterior Sub*	*Site Four: General Contractor*
Informal leaders	1 out of 4	0 out of 5	0 out of 4	O out 6
Formal leaders	1 out of 4	1 out of 5	1 out of 4	4 out of 6
Budget	On budget	On budget	On or under budget	On or under budget
Schedule	On schedule	On schedule	Ahead of Schedule	Ahead of Schedule

Based on these results, it appears that sites without informal leadership identified were often more efficient, yet all sites were still at least on budget and on schedule. Age and hands-on experience seem to be somewhat less important for formal leaders and more important for informal leaders. It should also be noted that higher education was common among most formal leaders, but hands-on experience was more important for those with higher formal titles. Those with the highest formal titles had little or no formal education in construction, only hands-on

experience, much like the informal leaders. Self-perception differed between formal and informal leaders, as the informal leader who was interviewed stated that they do not see themself as a leader either at work or other situations (Appendix 4).

Chapter 3: Discussion and Conclusions

3.1 Observations

From this study, several interesting observations were made. First, it appears that although informal leadership is indeed effective and prevalent on some construction teams, formal leadership seems to be more efficient. This is most likely due to the authority associated with their title and how it allows them to make decisions quickly without hesitation or debate. This suggests that giving an informal leader a formal title may be one way to empower them to be more efficient. Teams where informal leaders were not present appeared to be typically more efficient than those with only formal leaders (however all sites maintained at least a satisfactory status). The informal leader that *was* identified surprisingly did not see himself as a leader at all.

Additionally, more importance seems to be placed on hands-on experience rather than formal education or certifications in terms of leadership effectiveness. Both the informal leader and the formal leaders with the highest titles shared the common characteristic of not going through a formal educating process and, instead, having an extensive background of first-hand construction experience. This suggests that informal leaders may in fact make great candidates for the highest levels of management, even more so than some of the formal leaders who are closer in status.

From the leadership structure identification process standpoint, several methods were implemented creating a variety of both desirable and undesirable results. Making personal observations out on the construction site is very cumbersome, time-consuming, and may not produce the desired results in the end. Utilizing field personnel, or the actual construction team members, to assist the collection of observations is difficult at best. Rather than asking for their assistance, it proved to be a much more efficient method to conduct one-on-one interviews. However when conducting these interviews, it is essential that certain guidelines are followed as outlined in the next section.

3.2 Conclusions

To conclude the information discovered by the research outlined in this paper, several comparisons have been made. Informal leaders was found to be present and effective (meaning it really does exist and work) but formal leadership appeared to more efficient in terms of reduced time spent on decision making. It appeared that having the formal title was an essential tool to make quick and unchallenged decisions. So the informal leader was found to have the desirable characteristics and effectiveness necessary to perform well as a leader, they were only missing a formal title as tool to be enabled to be more efficient.

Although formal leaders often had both formal education and hands-on experience, higher managers typically had less formal education and more hands-on experience than other managers did. This may suggest that although both education and first-hand experiences are important, first-hand experience may be *more* important from a management standpoint. This finding may have a drastic effect on training and hiring programs in the future.

In terms of experience and education, the informal leader and the highest level leaders had a lot in common. Both were generally older than some of the participants, they had more company and industry experience, and they had not pursued degrees at a university level. They also both seemed very much attuned to the idea and contributions of their coworkers and held a mutual respect for what others had to offer to the project at hand. Making this comparison may suggest that informal leaders could perform exceptionally well in the highest positions of management.

The process developed to make the discussed conclusions above was refined more and more as the study progressed. To pursue information from construction field personnel it is recommended you cautious in how you perform your study. First, know as much as possible about the team you are interviewing. This means knowing how many are on the team, how many are there on the day of interviews, what titles they hold, what their experiences are, and even how they perceive themselves. Be meticulous in your questioning to gain this information and any other information essential to the results of your study. If you do not conduct interviews and you decide to take the worksheet approach, make sure all team members are accounted for, they understand how to fill out the worksheets, and they *are* filling out the worksheets. It is suggested to ask the formal leader of the team to present you with a list of all team members to easily have the team mapped out ahead of time (especially if you are collected data on a large site with multiple teams.

You also want make sure the team is defined properly for the purposes of the study. There could be 15 people working for a masonry subcontractor, but only seven are working together in one area, four in the next area, and 4 in the remaining section of the building. So they may not even know the names of everyone who is supposedly "on their team." Teams may also form inadvertently between different trades who are working in the same section of a building but on different components, such as electricians and plumbers. Make sure this is accounted for when establishing the boundaries of your teams, because it may have a significant effect on the data.

If definitive team boundaries are established, the worksheet method still may work. Responses were received when this method was attempted, they just weren't complete enough to make adequate conclusions. Do not rush into this strategy by passing forms out to everyone on the site because most will not have the time and the patience to fill them out immediately. Be more systematic by speaking with one subcontractor at a time. Establish the team and seek out

each member specifically. Once your observations are complete for that team, you can then move on to another team or subcontractor.

With either method, whether you use worksheets or interviews, make sure you allow adequate time to follow up with loose ends such as missing participants or revisions that must be made. If using a case study method or audio visual equipment, make sure you set clear guidelines for yourself for making observations and allow yourself time to practice making these observations. You can be assured that these methods will be very time-consuming.

3.3 Contributions

The results and findings of this study have contributed to the general knowledge of construction and leadership practices in several ways. A systematic process for identifying informal leaders has been provided, allowing construction teams to identify and empower informal leaders to make decisions on the job site more efficiently. Basic guidelines for using the developed process are listed as follows:

1. Conduct one-on-one interviews so as to gain individualistic perspectives rather than potentially biased group perspectives
2. Use a short and simple question format as shown in the example in Appendix 3, using questions regarding advice-seeking as leadership determinants and the other questions to further characterize the participants for comparison
3. Number both your questions and your written answers from your interviews so they are easily referenced to each other
4. Include names in your notes to allow participants to reference each other by name while they are being interviewed; this is crucial for you to see the underlying leadership structures in terms of advice seeking, but you must be sure not to reference anyone by name in your published material
5. Do not hesitate to stray from the questioning format during interviews if it is relevant to the information that is sought or will provide more accuracy to your results
6. Identify all team members throughout the interview process, asking each participant who they normally work with to identify any discrepancies
7. Collect answers from all participants, allowing amply time after initial interviews to follow up with absent team members; do not allow yourself to miss important information by excluding absent team members from your observations
8. Team size but be at least 3 participants to establish leadership structure; if there are only two team members then they will not have the opportunity to choose one person over another to seek advice from (because there will only be one choice)
9. Keep the team size manageable. It is suggested to seek interviews with teams that are within the abilities of the researcher(s) to properly interview all team members; if the team is too large and the interviews too timely, the information gathering may be rushed or incomplete

Before you can conduct these interviews, you must also take the proper steps and obtain the proper approvals. These steps and approvals are outlined below:

1. Approval from the Institutional Review Board (IRB) from your respective university must be obtained as you will be conducting research with human subjects
2. A letter of request must be formalized for contacting construction organizations to arrange times and obtain their approval to conduct your interviews
3. Participants must be assured anonymity it the final publications of your material
4. It is highly suggested to offer each organization a final copy of your findings as they may find them to be useful in refining their management processes; they may request you do so even if you do not initially offer, so be prepared to provide it for them

The findings discovered through testing this process, however limited, suggest that more emphasis should be placed on first-hand or hands-on experience, rather than formal education, for hiring, training, and development processes. Many larger construction companies seem to place more emphasis on offering classroom based training. What was found in this study suggests that it may be better to offer more opportunities for their employees to learn this information while out on the job; whether this is through a mentoring program or just by the old-fashioned method of trial and error. Hiring and promoting also should place more emphasis on first-hand or work experience rather than how long someone has sat in a classroom. This is not to say that formal education is not important or beneficial, because it certainly is, but without extensive experiences with real applications, management may not be as enabled as they need to be to perform at the top of their game. In fact, many of the highest managers were able to gain more extensive experience as they entered the work force earlier, as they were not delayed by formal education.

It is also important to note that increasing the availability of formal leaders, either by empowering informal leaders with formal titles or by allowing formal leaders to be closer in proximity more often, may improve efficiency on job sites. Each time a decision must be made, and the formal leader is not there to make it, someone still needs to make the decision. This is often where the informal leader takes their role. Since the informal leader has no authority to enforce their decisions, a consulting process with other team members may slow the decision making process. If the identified informal leader is placed in a position of formal leadership, the consulting process can be skipped and decisions can be made much more quickly. If the existing formal leader is always available when decisions need to be made, then the decision making process should continue at an efficient pace without a problem.

The contributions of this study greatly add to the useable tools and knowledge available to construction managers to improve the communication and efficiency of their work environments. By utilizing these tools and findings for evaluating and revising your management or leadership structures, work sites can become safer, more productive, and more stable. This will promote the construction industry as whole, creating more job opportunities both on a corporate and an individual level by excelling in team performance and establishing remarkable reputations.

3.4 Future Research

Further research into the effectiveness and prevalence of informal leadership on construction sites can be performed in several ways. By collecting a larger sample size, more definitive conclusions may be drawn. To accomplish this, construction site activity could be

monitored using audio and visual equipment. Another way to draw more conclusive data would be to perform a case study by working within an organization and witnessing advice seeking behavior first-hand over a longer period of time. For both of these methods, the researcher(s) may find the "data collection form" format (Appendix 1) useful in making such recordings.

The data collection form may produce more significant findings if monitored properly. If the researcher(s) compile a list of team members and control the distribution of the form to only those team members (rather than sporadically throughout a site composed of many teams) pattern recognition may be more probable. This process would require several visits to collect as much data as possible, and the researcher(s) must be diligent in assisting the participants in form completion. Advantages to this method would be the large increase in data, the reduced opportunity for recall bias, and the availability of multiple teams per site location. Disadvantages would be the increased time and diligence required, and the likelihood of companies being hesitant to allow such a prolonged disturbance to their project.

To further test the differences between formal and informal leaders, informal leaders can be identified and promoted using the systematic approach outlined in this study. Then the previously informal leaders could be more directly compared, in terms of effectiveness and efficiency, to formal leaders who have obtained their title due to other qualifications. This process could also be reversed by seeing how well a formal leader performs as a leader without their formal title.

Another step that could be taken would be to see how well an identified informal leader performs when leading a company in a position of higher management. As discussed earlier, formal leaders with the highest formal titles had near identical characteristics in terms of lacking formal education and having an extensive background of first-hand construction knowledge. Another common characteristic was their willingness to hear new ideas and try new processes at the suggestion of others on their team.

A study discussed by Jim Collins, titled "Level 5 Leadership" (2001), suggests the highest level leaders in organizations bring the greatest results for their company when they are what Collins refers to as a "Level 5 Leader." In contrast to the persona of many leaders of organizations, these level 5 leaders show extreme modesty and humility, often giving more credit to those they are leading than to themselves. Although this contrasts many formal leaders of organizations, it seems to be apparent in informal leaders based on the results and findings formally discussed. This leads us to believe that informal leaders can be greater leaders if or when they are given the opportunity.

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This study found gender differences among informal leaders in manufacturing settings. This study however did not establish how informal leaders are established or which gender is generally more effective in an informal leadership position. Available online at http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6W5N-4C2FKNK-1&_user=10&_rdoc=1&_fmt=&_orig=search&_sort=d&_docanchor=&view=c&_searchStrId=1096197648&_rerunOrigin=google&_acct=C000050221&_version=1&_urlVersion=0&_userid=10&md5=1158335b3c516914f85169027e956ef1.

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This article provides a several definitions of informal leadership that have been collected from prior research. The study confirms a relationship between group efficacy and the dispersion of informal leaders. The results suggest that group efficacy (the confidence a group has in its abilities to complete the task assigned to them) is increased when informal leadership is more prevalent. Available online at http://www.unh.edu/management/faculty/ob/tp/Informal%20Leaders%20and%20the%20Development%20of%20Group%20Efficacy.pdf.

Appendices

Appendix A - Data Collection Log Format

All names listed on this form will remain anonymous in all published or otherwise publicly submitted material.

Today's Date: ____________________

Advice asked by:			**Approximate Time:**
Advice asked from:			
Proximity to one another:	☐ In eye-sight/ear-shot	☐ On the job site	☐ Off-site (call/email)
Purpose of question:	☐ To seek direction	☐ To seek information	☐ To seek guidance
Question Description:			
Validity of advice:	☐ Problem solved	☐ Situation improved	☐ Problem unsolved

Advice asked by:			**Approximate Time:**
Advice asked from:			
Proximity to one another:	☐ In eye-sight/ear-shot	☐ On the job site	☐ Off-site (call/email)
Purpose of question:	☐ To seek direction	☐ To seek information	☐ To seek guidance
Question Description:			
Validity of advice:	☐ Problem solved	☐ Situation improved	☐ Problem unsolved

Advice asked by:			**Approximate Time:**
Advice asked from:			
Proximity to one another:	☐ In eye-sight/ear-shot	☐ On the job site	☐ Off-site (call/email)
Purpose of question:	☐ To seek direction	☐ To seek information	☐ To seek guidance
Question Description:			
Validity of advice:	☐ Problem solved	☐ Situation improved	☐ Problem unsolved

Advice asked by:			**Approximate Time:**
Advice asked from:			
Proximity to one another:	☐ In eye-sight/ear-shot	☐ On the job site	☐ Off-site (call/email)
Purpose of question:	☐ To seek direction	☐ To seek information	☐ To seek guidance
Question Description:			
Validity of advice:	☐ Problem solved	☐ Situation improved	☐ Problem unsolved

Appendix B - Completed Observation Collection Forms (Pilot)

Advice asked by:	LABORER		**Approximate Time:**
Advice asked from	[redacted]		
Proximity to one another:	☑ In eye-sight/ear-shot	☐ On the job site	☐ Off-site (call/email)
Purpose of question:	☑ To seek direction	☐ To seek information	☐ To seek guidance
Question Description:	Screw went through AIR on 2nd Floor		
Validity of advice:	☑ Problem solved	☐ Situation improved	☐ Problem unsolved

Advice asked by:	PLUMBERS		**Approximate Time:**
Advice asked from:	me		8 30
Proximity to one another:	☐ In eye-sight/ear-shot	☑ On the job site	☐ Off-site (call/email)
Purpose of question:	☐ To seek direction	☐ To seek information	☑ To seek guidance
Question Description:	Replace Insulation on Pipe		
Validity of advice:	☑ Problem solved	☐ Situation improved	☐ Problem unsolved

Advice asked by:			**Approximate Time:**
Advice asked from:			
Proximity to one another:	☐ In eye-sight/ear-shot	☐ On the job site	☐ Off-site (call/email)
Purpose of question:	☐ To seek direction	☐ To seek information	☐ To seek guidance
Question Description:			
Validity of advice:	☐ Problem solved	☐ Situation improved	☐ Problem unsolved

Advice asked by:			**Approximate Time:**
Advice asked from:			
Proximity to one another:	☐ In eye-sight/ear-shot	☐ On the job site	☐ Off-site (call/email)
Purpose of question:	☐ To seek direction	☐ To seek information	☐ To seek guidance
Question Description:			
Validity of advice:	☐ Problem solved	☐ Situation improved	☐ Problem unsolved

Advice asked by:	[redacted]		**Approximate Time:**
Advice asked from:	[redacted]		5 MIN
Proximity to one another:	☐ In eye-sight/ear-shot	☒ On the job site	☐ Off-site (call/email)
Purpose of question:	☒ To seek direction	☒ To seek information	☐ To seek guidance
Question Description:	AN OOPS Needs fixed		
Validity of advice:	☐ Problem solved	☐ Situation improved	☒ Problem unsolved

Advice asked by:			**Approximate Time:**
Advice asked from:			
Proximity to one another:	☐ In eye-sight/ear-shot	☐ On the job site	☐ Off-site (call/email)
Purpose of question:	☐ To seek direction	☐ To seek information	☐ To seek guidance
Question Description:			
Validity of advice:	☐ Problem solved	☐ Situation improved	☐ Problem unsolved

Advice asked by:			**Approximate Time:**
Advice asked from:			
Proximity to one another:	☐ In eye-sight/ear-shot	☐ On the job site	☐ Off-site (call/email)
Purpose of question:	☐ To seek direction	☐ To seek information	☐ To seek guidance
Question Description:			
Validity of advice:	☐ Problem solved	☐ Situation improved	☐ Problem unsolved

Advice asked by:			**Approximate Time:**
Advice asked from:			
Proximity to one another:	☐ In eye-sight/ear-shot	☐ On the job site	☐ Off-site (call/email)
Purpose of question:	☐ To seek direction	☐ To seek information	☐ To seek guidance
Question Description:			
Validity of advice:	☐ Problem solved	☐ Situation improved	☐ Problem unsolved

All names listed on this form will remain anonymous in all published or otherwise publicly submitted material.

Completed By: [redacted] **Today's Date:** 5-18-10

Prefered Method of Contact (phone # or email address): _____

Advice asked by: [redacted]			**Approximate Time:** 10:00 AM
Advice asked from: [redacted]			
Proximity to one another:	☑ In eye-sight/ear-shot	☑ On the job site	☐ Off-site (call/email)
Purpose of question:	☑ To seek direction	☐ To seek information	☐ To seek guidance
Question Description:	Can you change this Pipe?		
Validity of advice:	☑ Problem solved	☐ Situation improved	☐ Problem unsolved

Advice asked by:	My Dad		**Approximate Time:** 6:00 AM
Advice asked from:	[redacted]		
Proximity to one another:	☑ In eye-sight/ear-shot	☐ On the job site	☑ Off-site (call/email)
Purpose of question:	☐ To seek direction	☑ To seek information	☐ To seek guidance
Question Description:	How are you doing		
Validity of advice:	☐ Problem solved	☑ Situation improved	☐ Problem unsolved

Advice asked by:	[redacted]		**Approximate Time:** 11:05 AM
Advice asked from:			
Proximity to one another:	☑ In eye-sight/ear-shot	☑ On the job site	☐ Off-site (call/email)
Purpose of question:	☐ To seek direction	☐ To seek information	☐ To seek guidance
Question Description:	What are you doing?		
Validity of advice:	☑ Problem solved	☐ Situation improved	☐ Problem unsolved

Advice asked by:	Dad		**Approximate Time:** 11:06 A.M
Advice asked from:	[redacted]		
Proximity to one another:	☑ In eye-sight/ear-shot	☑ On the job site	☐ Off-site (call/email)
Purpose of question:	☐ To seek direction	☑ To seek information	☐ To seek guidance
Question Description:	Why did I have to go get a latter?		
Validity of advice:	☑ Problem solved	☐ Situation improved	☐ Problem unsolved

All names listed on this form will remain anonymous in all published or otherwise publicly submitted material.

Completed By: [redacted] **Today's Date:** 5:22:10

Prefered Method of Contact (phone # or email address): _____

Advice asked by:	[redacted]		**Approximate Time:** 10:30
Advice asked from:			
Proximity to one another:	☒ In eye-sight/ear-shot	☐ On the job site	☐ Off-site (call/email)
Purpose of question:	☐ To seek direction	☒ To seek information	☐ To seek guidance
Question Description:	LOCATION OF ACESS DOOR		
Validity of advice:	☒ Problem solved	☐ Situation improved	☐ Problem unsolved

Advice asked by:	[redacted]		**Approximate Time:** 11:00
Advice asked from:			
Proximity to one another:	☒ In eye-sight/ear-shot	☐ On the job site	☐ Off-site (call/email)
Purpose of question:	☐ To seek direction	☒ To seek information	☐ To seek guidance
Question Description:	TO MOVE WATER PIPE		
Validity of advice:	☒ Problem solved	☐ Situation improved	☐ Problem unsolved

Advice asked by:			**Approximate Time:**
Advice asked from:			
Proximity to one another:	☐ In eye-sight/ear-shot	☐ On the job site	☐ Off-site (call/email)
Purpose of question:	☐ To seek direction	☐ To seek information	☐ To seek guidance
Question Description:			
Validity of advice:	☐ Problem solved	☐ Situation improved	☐ Problem unsolved

Advice asked by:			**Approximate Time:**
Advice asked from:			
Proximity to one another:	☐ In eye-sight/ear-shot	☐ On the job site	☐ Off-site (call/email)
Purpose of question:	☐ To seek direction	☐ To seek information	☐ To seek guidance
Question Description:			
Validity of advice:	☐ Problem solved	☐ Situation improved	☐ Problem unsolved

All names listed on this form will remain anonymous in all published or otherwise publicly submitted material.

Completed By: [redacted] **Today's Date:** 5-18-10

Prefered Method of Contact (phone # or email address): 540-357-1378

Advice asked by: [redacted]			**Approximate Time:** 8:00 AM
Advice asked from: [redacted]			
Proximity to one another:	☑ In eye-sight/ear-shot	☐ On the job site	☐ Off-site (call/email)
Purpose of question:	☐ To seek direction	☑ To seek information	☐ To seek guidance
Question Description:	WHERE CAN I FIND DRIVE KEYS		
Validity of advice:	☑ Problem solved	☐ Situation improved	☐ Problem unsolved

Advice asked by: [redacted]			**Approximate Time:** 8:30 AM
Advice asked from: [redacted]			
Proximity to one another:	☑ In eye-sight/ear-shot	☐ On the job site	☐ Off-site (call/email)
Purpose of question:	☐ To seek direction	☑ To seek information	☐ To seek guidance
Question Description:	WHERE DO I TURN THIS ELBOW DOWN		
Validity of advice:	☑ Problem solved	☐ Situation improved	☐ Problem unsolved

Advice asked by: [redacted]			**Approximate Time:** 10:00 AM
Advice asked from: [redacted]			
Proximity to one another:	☑ In eye-sight/ear-shot	☐ On the job site	☐ Off-site (call/email)
Purpose of question:	☐ To seek direction	☑ To seek information	☐ To seek guidance
Question Description:	HOW MUCH DO I CUT THIS OFF (DUCT)		
Validity of advice:	☑ Problem solved	☐ Situation improved	☐ Problem unsolved

Advice asked by: [redacted]			**Approximate Time:** 11:00 AM
Advice asked from: [redacted]			
Proximity to one another:	☑ In eye-sight/ear-shot	☐ On the job site	☐ Off-site (call/email)
Purpose of question:	☐ To seek direction	☑ To seek information	☐ To seek guidance
Question Description:	HOW MUCH PIPE DO I CUT OFF		
Validity of advice:	☑ Problem solved	☐ Situation improved	☐ Problem unsolved

All names listed on this form will remain anonymous in all published or otherwise publicly submitted material.

Completed By: [redacted] **Today's Date:** 5-18-10

Prefered Method of Contact (phone # or email address): _____

Advice asked by:	[redacted]		**Approximate Time:**
Advice asked from:			11:00 a.m.
Proximity to one another:	☐ In eye-sight/ear-shot	☑ On the job site	☐ Off-site (call/email)
Purpose of question:	☐ To seek direction	☑ To seek information	☑ To seek guidance
Question Description:	I needed to know where the self-drilling drywall screws were.		
Validity of advice:	☑ Problem solved	☐ Situation improved	☐ Problem unsolved

Advice asked by:	[redacted]		**Approximate Time:**
Advice asked from:			7:00 a.m.
Proximity to one another:	☑ In eye-sight/ear-shot	☐ On the job site	☐ Off-site (call/email)
Purpose of question:	☑ To seek direction	☐ To seek information	☐ To seek guidance
Question Description:	I needed a new assignment this morning.		
Validity of advice:	☑ Problem solved	☐ Situation improved	☐ Problem unsolved

Advice asked by:	[redacted]		**Approximate Time:**
Advice asked from:			9:00 a.m.
Proximity to one another:	☑ In eye-sight/ear-shot	☐ On the job site	☐ Off-site (call/email)
Purpose of question:	☐ To seek direction	☐ To seek information	☑ To seek guidance
Question Description:	I wanted to know if I was properly installing rearview head.		
Validity of advice:	☐ Problem solved	☑ Situation improved	☐ Problem unsolved

Advice asked by:			**Approximate Time:**
Advice asked from:			
Proximity to one another:	☐ In eye-sight/ear-shot	☐ On the job site	☐ Off-site (call/email)
Purpose of question:	☐ To seek direction	☐ To seek information	☐ To seek guidance
Question Description:			
Validity of advice:	☐ Problem solved	☐ Situation improved	☐ Problem unsolved

All names listed on this form will remain anonymous in all published or otherwise publicly submitted material.

Completed By:_____ **Today's Date:** _____

Prefered Method of Contact (phone # or email address):_____

Advice asked by:	[redacted]		**Approximate Time:**
Advice asked from:	[redacted]		8:50
Proximity to one another:	☐ In eye-sight/ear-shot	☒ On the job site	☐ Off-site (call/email)
Purpose of question:	☐ To seek direction	☒ To seek information	☐ To seek guidance
Question Description:	Removal of Decks		
Validity of advice:	☐ Problem solved	☐ Situation improved	☒ Problem unsolved

Advice asked by:	[redacted]		**Approximate Time:**
Advice asked from:	[redacted]		10:50
Proximity to one another:	☐ In eye-sight/ear-shot	☒ On the job site	☐ Off-site (call/email)
Purpose of question:	☒ To seek direction	☐ To seek information	☐ To seek guidance
Question Description:	Clean out Units		
Validity of advice:	☐ Problem solved	☒ Situation improved	☐ Problem unsolved

Advice asked by:			**Approximate Time:**
Advice asked from:			
Proximity to one another:	☐ In eye-sight/ear-shot	☐ On the job site	☐ Off-site (call/email)
Purpose of question:	☐ To seek direction	☐ To seek information	☐ To seek guidance
Question Description:			
Validity of advice:	☐ Problem solved	☐ Situation improved	☐ Problem unsolved

Advice asked by:			**Approximate Time:**
Advice asked from:			
Proximity to one another:	☐ In eye-sight/ear-shot	☐ On the job site	☐ Off-site (call/email)
Purpose of question:	☐ To seek direction	☐ To seek information	☐ To seek guidance
Question Description:			
Validity of advice:	☐ Problem solved	☐ Situation improved	☐ Problem unsolved

All names listed on this form will remain anonymous in all published or otherwise publicly submitted material.

Completed By: [redacted] **Today's Date:** 5/20/10

Prefered Method of Contact (phone # or email address): [redacted]

Advice asked by:	[redacted]		**Approximate Time:** 8:30 AM
Advice asked from:	ME		
Proximity to one another:	☐ In eye-sight/ear-shot	☐ On the job site	☒ Off-site (call/email)
Purpose of question:	☐ To seek direction	☒ To seek information	☐ To seek guidance
Question Description:	About MATERIALS on another JOB		
Validity of advice:	☒ Problem solved	☐ Situation improved	☐ Problem unsolved

Advice asked by:	ME		**Approximate Time:** 10:00
Advice asked from:	[redacted]		
Proximity to one another:	☐ In eye-sight/ear-shot	☒ On the job site	☐ Off-site (call/email)
Purpose of question:	☒ To seek direction	☐ To seek information	☐ To seek guidance
Question Description:	week end over time		
Validity of advice:	☐ Problem solved	☒ Situation improved	☐ Problem unsolved

Advice asked by:			**Approximate Time:**
Advice asked from:			
Proximity to one another:	☐ In eye-sight/ear-shot	☐ On the job site	☐ Off-site (call/email)
Purpose of question:	☐ To seek direction	☐ To seek information	☐ To seek guidance
Question Description:			
Validity of advice:	☐ Problem solved	☐ Situation improved	☐ Problem unsolved

Advice asked by:			**Approximate Time:**
Advice asked from:			
Proximity to one another:	☐ In eye-sight/ear-shot	☐ On the job site	☐ Off-site (call/email)
Purpose of question:	☐ To seek direction	☐ To seek information	☐ To seek guidance
Question Description:			
Validity of advice:	☐ Problem solved	☐ Situation improved	☐ Problem unsolved

Appendix C - Post Observation Survey Responses (Pilot)

All names listed [redacted] or otherwise publicly submitted material.

Completed By: [redacted] **Date:** 5/19/10

1. What is your age? 46

2. How long have you worked in the construction industry?

8 YEARS

3. How long have you worked for the company you currently are employed with?

8 YEARS

4. What formal training/educational programs have you completed? (Trade school, associate's degree, bachelor's degree, etc.)

TRADE

5. What is your formal job title?

INSULATION MECH.

6. How long have you held your current job title?

5 YEARS

7. Who do you normally seek advice from on the construction site when a problem arises relating to the task you have been assigned? If there is more than one person please list them as well.

[redacted]

8. Why do you generally seek advice from this person? Please list reasons for seeking advice from all persons mentioned in previous answer.

MATERIALS

JOB PERFORMANCE

9. Do you see yourself as a leader at work? Circle one: **YES** / **NO**

10. Do you see yourself as a leader in other situations? If you do, what are the other situations? (Examples: sports teams, at home, volunteer work, etc.)

YES

FRIENDSHIPS RELATIONSHIPS SAFE ON MY time OFF

All names listed on this form will remain anonymous in all published or otherwise publicly submitted material.

Completed By: [redacted] **Date:** 5-18-10

1. What is your age? 38

2. How long have you worked in the construction industry?

19 years

3. How long have you worked for the company you currently are employed with?

9 yrs

4. What formal training/educational programs have you completed? (Trade school, associate's degree, bachelor's degree, etc.)

Medical gas certified

5. What is your formal job title?

Plumber

6. How long have you held your current job title?

9 yrs

7. Who do you normally seek advice from on the construction site when a problem arises relating to the task you have been assigned? If there is more than one person please list them as well.

My Boss

8. Why do you generally seek advice from this person? Please list reasons for seeking advice from all persons mentioned in previous answer.

He ~~Boss~~ has a task for each of us to complete each day

9. Do you see yourself as a leader at work? Circle one: (YES) / NO

10. Do you see yourself as a leader in other situations? If you do, what are the other situations? (Examples: sports teams, at home, volunteer work, etc.)

Yes. I am also a father of three.

All names listed on this form will remain anonymous in all published or otherwise publicly submitted material.

Completed By: [redacted] **Date:** 5·22·10

1. What is your age? 53

2. How long have you worked in the construction industry?

35 YRS

3. How long have you worked for the company you currently are employed with?

18 YRS

4. What formal training/educational programs have you completed? (Trade school, associate's degree, bachelor's degree, etc.)

GRADUATED HIGH SCHOOL

5. What is your formal job title?

SHEETMETAL FOREMAN

6. How long have you held your current job title?

10 YRS

7. Who do you normally seek advice from on the construction site when a problem arises relating to the task you have been assigned? If there is more than one person please list them as well.

FROM JOB SUPER

8. Why do you generally seek advice from this person? Please list reasons for seeking advice from all persons mentioned in previous answer.

FOR INFORMATION OR DIRECTION

9. Do you see yourself as a leader at work? Circle one: **YES** / **NO**

10. Do you see yourself as a leader in other situations? If you do, what are the other situations? (Examples: sports teams, at home, volunteer work, etc.)

COACH REC BALL

BOGS AT HOME

All names listed on this form will remain anonymous in all published or otherwise publicly submitted material.

Completed By: [redacted] **Date:** 5-18-10

1. What is your age? 39

2. How long have you worked in the construction industry?

22 YRS

3. How long have you worked for the company you currently are employed with?

16 YRS

4. What formal training/educational programs have you completed? (Trade school, associate's degree, bachelor's degree, etc.)

SUPERVISOR TRAINING ON THE JOB, SAFTEY TRAINING

5. What is your formal job title?

SHEETMETAL MECHANIC / WELDER

6. How long have you held your current job title?

14 YRS

7. Who do you normally seek advice from on the construction site when a problem arises relating to the task you have been assigned? If there is more than one person please list them as well.

[redacted]

8. Why do you generally seek advice from this person? Please list reasons for seeking advice from all persons mentioned in previous answer.

JOB SUPERVISOR, HE OVERSEES ALL THE DAY TO DAY FUNCTIONS

9. Do you see yourself as a leader at work? Circle one: (YES) / NO

10. Do you see yourself as a leader in other situations? If you do, what are the other situations? (Examples: sports teams, at home, volunteer work, etc.)

HOME, SCV / SONS OF CONFEDERATE VETERANS

All names listed on this form will remain anonymous in all published or otherwise publicly submitted material.

Completed B [redacted] **Date:** 5-18-10

1. What is your age? 26

2. How long have you worked in the construction industry?

9 years

3. How long have you worked for the company you currently are employed with?

8 years

4. What formal training/educational programs have you completed? (Trade school, associate's degree, bachelor's degree, etc.)

Carpenter's Apprenticeship School

5. What is your formal job title?

Union Carpenter

6. How long have you held your current job title?

5 years

7. Who do you normally seek advice from on the construction site when a problem arises relating to the task you have been assigned? If there is more than one person please list them as well.

Our Job Superintendant or Foreman.

8. Why do you generally seek advice from this person? Please list reasons for seeking advice from all persons mentioned in previous answer.

They are held responsible for the finished product of what we are building or installing.

9. Do you see yourself as a leader at work? Circle one: **(YES)** / **NO**

10. Do you see yourself as a leader in other situations? If you do, what are the other situations? (Examples: sports teams, at home, volunteer work, etc.)

At home, church, or when I am helping friends or family

Appendix D – Site interview answer comparisons

DATA FROM FIRST SITE					
		A1	**A2**	**A3**	**A4**
1	**Age**	28	52	60	54
2	**Construction Experience**	12	30	42	40
3	**Experience with Company**	6	15	34	30
4	**Formal training/education**	Some College	Hands on	BS in Architecture	Hands on
5	**Job Title**	Carpenter	Carpenter/Painter	Company Owner	Carpenter
6	**How long title has been held**	6 years	15 years	34 years	30 years
7	**Advice usuaully sought from**	A3 or A4	A3	A4	A3
8	**Why sought from this person**	position/experience	position (he's the boss)	experience	position (boss)
9	**Leader at work?**	No	No	Yes	No
10	**Where else?**	At home, w/ friends	At home	Yes, in general	No
11	**How likely to try new things**	5 at home, 2 at work	3	3	5
12a	**How do you hear about it**	magazines, reading	from boss	word of mouth, magazines	word of mouth
12b	**Who do you hear it from**	trade magazines	boss	no one in particular	From A1
13	**What new things have you used A)**	New roofing membrane	Water-base stain	nothing in particular	new roofing material
	B)	Water-base stain			
	C)	New wood epoxy			
14	**How/if changed work style A)**	Applied same as before	must be more careful	some things differently	put on the same way
	B)	Must be more careful			
	C)	More repairs, less replace			
15	**how long new idea/process used**	Only 1 job, will use again	1 job so far	N/A	1 job so far
	Perceived Leadership Status:	Opinion	None	Formal	Informal

DATA FROM SECOND SITE						
		B1	**B2**	**B3**	**B4**	**B5**
1	**Age**	47	21	49	42	32
2	**Construction Experience**	29	2.5	30	24	19
3	**Experience with Company**	7	2.5	6	18	2
4	**Formal training/education**	Class B Contractor's Lic.	Apprenticeship	Master Electrician	Hands on	Master Electrician
		Traffic Control Lic.			Classes/Films	OSHA/Traffic
		Flagger Operations Lic.			Certifications	VDOT Traffic Control
						BS Engineering
5	**Job Title**	Foreman	Laborer	Project Foreman	Foreman	Project Manager
6	**How long title has been held**	5 years	2.5 years	2 years	17 years	2 years
7	**Advice usuaully sought from**	B5	B1 or B5	B1	B5	no one
8	**Why sought from this person**	position (he's the boss)	They're the boss	Boss	Boss (solves issues)	N/A
9	**Leader at work?**	Yes	Yes	Yes	Yes	Yes
10	**Where else?**	Coaching, others	Motorcycle racing	Several places	At home	Outfitters (Outdoor)
11	**How likely to try new things**	2.5 (anything if beneficial)	5	4	5	4
12a	**How do you hear about it**	magazines, postings, demos	Commercials, magazines	Product Suppliers	Word of mouth	Classes, Training
12b	**Who do you hear it from**	spokes persons	anybody	anybody	Project Manager (offsite)	In house programs
13	**What new things have you used**	Keyed recepticle	none specific	Not many recently	none in particular	Several
14	**How/if changed work style**	Not yet, but same principle	not usually	N/A	N/A	Sometimes different
15	**how long new idea/process used**	Not used yet	none specific	N/A	N/A	Often times easier
	Perceived Leadership Status:					Formal

DATA FROM THIRD SITE					
		C1	C2	C3	C4
1	Age	29	57	49	40
2	Construction Experience	12	10	35	25
3	Experience with Company	12	3	15	14
4	Formal training/education	On the job / hands-on	Hands-on	Hands-on	Job Core
5	Job Title	Carpenter/Installer	Laborer/Installer	Company Owner	Cut man/Installer
6	How long title has been held	12 years	3 years	15	14
7	Advice usuaully sought from	C3	C3	Contractors, Everyone	C3
8	Why sought from this person	position (he's the boss)	Experience (he knows everything)	Promote Collaboration	He's the boss
9	Leader at work?	No	No	Yes	Yes
10	Where else?	At home	At home, Cooking	At home	At home
11	How likely to try new things	5	2	4	4.5
12a	How do you hear about it	Suppliers, Contractors	Internet	Lumber companies	See it in stores
12b	Who do you hear it from	Who we build for	Internet	Lumber companies	Anyone
13	What new things have you used	Prefinshed Hardiboard	New hardiboard System	Hardiboard and new saw	Hardiboard
14	How/if changed work style	Process similar, more careful	Same process, so no	more demanding, no paint, pays more	Cleaner cuts, more careful
15	how long new idea/process used	Only this job so far	4 days, just this job	Have used before this job	Two other houses prev.
	Perceived Leadership Status:			Formal	

DATA FROM FOURTH SITE							
		D1	D2	D3	D4	D5	D6
1	Age	25	24	56	27	43	29
2	Construction Experience	2	4	29	7	16	13
3	Experience with Company	0.75	1	29	7	7	6
4	Formal training/education	BS Architecture	BS Civil Engineering	Hands-on	Hands-on	LEED AP, Hands-on	BS Construction Manag.
							LEED AP, Company Training
5	Job Title	Office Engineer	Project Engineer	Superintendent	Assitant Superintendent	Project Manager	Project Manager
6	How long title has been held	0.75 years	0.5 years	20 years	2 years	7 years	0.25 years
7	Advice usuaully sought from	D6	D5, D6, D3, D4	Usually come to me, idea exchange	D3 or D5	D3	D1, D3, D5
8	Why sought from this person	Supervisor / Proximity	experience/knowledge	Rely on experience of others	Experience for both	A lot of Experience	Experts in Fields
9	Leader at work?	Yes w/ BIM	Yes	Yes	Yes	Yes	Yes
10	Where else?	At home	Habitat for Humanity	Everywhere	At home, Softball	In general	Coach of Softball Team
11	How likely to try new things	5 on a daily basis	5	4	4	3.5	5
12a	How do you hear about it	Corp. BIM, Meetings	Meetings, Conferences	Meetings, classes, other jobs	From Subcontractors	Research, Trade publications	Conferences, Managers
12b	Who do you hear it from	Corporate BIM	Managers	Other sites or entities of company	From Subcontractors	Company, Subcontractors	Fresh-out-of-school Associates
13	What new things have you used	New BIM Processes	Blue Beam Software	Not many b/c foundation is standard	Caissons/drilling processes	Soil Improvement	Lean Scheduling
			Lean Construction Tracking	BIM			Higher Detail BIM
			Buzz Saw Program				"Agilia" self-leveling concrete
14	How/if changed work style	Constantly learning	All done much differently	Used to much higher magnitude	Learning everyday	Managed same way	Value added, less labor req.
15	how long new idea/process used	Throughout the project	6 months	Used for 5 years, but not this much	On this job, based on site condition	On this site	BIM - progressive, Conc. 0.25 yrs
	Perceived Leadership Status:	Opinion Leader	Opinion Leader	Formal/Informal Leader	Formal Leader	Formal Leader	Opionion/Formal Leader

Appendix E - IRB Approval letter 1

VirginiaTech

Office of Research Compliance
Institutional Review Board
2000 Kraft Drive, Suite 2000 (0497)
Blacksburg, Virginia 24060
540/231-4606 Fax 540/231-0959
e-mail irb@vt.edu
Website: www.irb.vt.edu

MEMORANDUM

DATE: January 28, 2011

TO: Christine Fiori, Annie Pearce, Michael Garvin, Glen Pendleton

FROM: Virginia Tech Institutional Review Board (FWA00000572, expires October 26, 2013)

PROTOCOL TITLE: The Informal Leader's Role on Construction Sites: A Comparative Analysis of Formal and Informal Leadership Structures Within the Construction Industry

IRB NUMBER: 10-004

Effective February 26, 2011, the Virginia Tech IRB Chair, Dr. David M. Moore, approved the continuation request for the above-mentioned research protocol.

This approval provides permission to begin the human subject activities outlined in the IRB-approved protocol and supporting documents.

Plans to deviate from the approved protocol and/or supporting documents must be submitted to the IRB as an amendment request and approved by the IRB prior to the implementation of any changes, regardless of how minor, except where necessary to eliminate apparent immediate hazards to the subjects. Report promptly to the IRB any injuries or other unanticipated or adverse events involving risks or harms to human research subjects or others.

All investigators (listed above) are required to comply with the researcher requirements outlined at http://www.irb.vt.edu/pages/responsibilities.htm (please review before the commencement of your research).

PROTOCOL INFORMATION:
Approved as: **Expedited, under 45 CFR 46.110 category(ies) 7**
Protocol Approval Date: **2/26/2011 (protocol's initial approval date: 2/26/2010)**
Protocol Expiration Date: **2/25/2012**
Continuing Review Due Date*: **2/11/2012**
*Date a Continuing Review application is due to the IRB office if human subject activities covered under this protocol, including data analysis, are to continue beyond the Protocol Expiration Date.

FEDERALLY FUNDED RESEARCH REQUIREMENTS:
Per federally regulations, 45 CFR 46.103(f), the IRB is required to compare all federally funded grant proposals / work statements to the IRB protocol(s) which cover the human research activities included in the proposal / work statement before funds are released. Note that this requirement does not apply to Exempt and Interim IRB protocols, or grants for which VT is not the primary awardee.

The table on the following page indicates whether grant proposals are related to this IRB protocol, and which of the listed proposals, if any, have been compared to this IRB protocol, if required.

Appendix F - IRB Approval letter 2

VirginiaTech

Office of Research Compliance
Institutional Review Board
2000 Kraft Drive, Suite 2000 (0497)
Blacksburg, Virginia 24060
540/231-4606 Fax 540/231-0959
e-mail irb@vt.edu
Website: www.irb.vt.edu

MEMORANDUM

DATE: April 1, 2011

TO: Christine Fiori, Annie Pearce, Michael Garvin, Glen Pendleton

FROM: Virginia Tech Institutional Review Board (FWA00000572, expires October 26, 2013)

PROTOCOL TITLE: The Informal Leader's Role on Construction Sites: A Comparative Analysis of Formal and Informal Leadership Structures Within the Construction Industry

IRB NUMBER: 10-004

Effective April 1, 2011, the Virginia Tech IRB Chair, Dr. David M. Moore, approved the amendment request for the above-mentioned research protocol.

This approval provides permission to begin the human subject activities outlined in the IRB-approved protocol and supporting documents.

Plans to deviate from the approved protocol and/or supporting documents must be submitted to the IRB as an amendment request and approved by the IRB prior to the implementation of any changes, regardless of how minor, except where necessary to eliminate apparent immediate hazards to the subjects. Report promptly to the IRB any injuries or other unanticipated or adverse events involving risks or harms to human research subjects or others.

All investigators (listed above) are required to comply with the researcher requirements outlined at http://www.irb.vt.edu/pages/responsibilities.htm (please review before the commencement of your research).

PROTOCOL INFORMATION:
Approved as: **Expedited, under 45 CFR 46.110 category(ies) 7**
Protocol Approval Date: **2/26/2011 (protocol's initial approval date: 2/26/2010)**
Protocol Expiration Date: **2/25/2012**
Continuing Review Due Date*: **2/11/2012**
*Date a Continuing Review application is due to the IRB office if human subject activities covered under this protocol, including data analysis, are to continue beyond the Protocol Expiration Date.

FEDERALLY FUNDED RESEARCH REQUIREMENTS:
Per federally regulations, 45 CFR 46.103(f), the IRB is required to compare all federally funded grant proposals / work statements to the IRB protocol(s) which cover the human research activities included in the proposal / work statement before funds are released. Note that this requirement does not apply to Exempt and Interim IRB protocols, or grants for which VT is not the primary awardee.

The table on the following page indicates whether grant proposals are related to this IRB protocol, and which of the listed proposals, if any, have been compared to this IRB protocol, if required.