NORTHCENTRAL UNIVERSITY

IDENTIFYING AND ADDRESSING THE EFFECT OF MANAGEMENT TRAITS ON THE COMMITMENT OF INFORMATION TECHNOLOGY ENGINEERS

A Dissertation submitted to the Graduate Faculty

Of the Department of Business and Technology Management

In candidacy for the degree of

DOCTOR OF PHILOSOPHY

By

OLUDOTUN OLADELE ONI

Prescott, Arizona
August 2005

INFORMATION TO USERS

The quality of this reproduction is dependent upon the quality of the copy submitted. Broken or indistinct print, colored or poor quality illustrations and photographs, print bleed-through, substandard margins, and improper alignment can adversely affect reproduction.

In the unlikely event that the author did not send a complete manuscript and there are missing pages, these will be noted. Also, if unauthorized copyright material had to be removed, a note will indicate the deletion.

ProQuest Information and Learning Company
300 North Zeeb Road
P.O. Box 1346
Ann Arbor, MI 48106-1346

NORTHCENTRAL UNIVERSITY

We recommend that the dissertation prepared under our supervision by

OLUDOTUN O. ONI

entitled

Identifying and Addressing the Effect of Management Traits on the Commitment of Information Technology Engineers

be accepted in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

Richard E. Yellen, Ph.D., Committee Chair

Allen Endres, Ph.D., Committee Member

Gerald L. Collard, Ed.D., Committee Member

August 2005

ACKNOWLEDGEMENTS

To God be all the Glory. There is indeed light at the end of this long and windy tunnel. It's being a journey nurtured by persistence, commitment and determination.

I appreciate the guidance and support of my mentor and dissertation committee chair, Dr. Richard Yellen. I am also grateful to my dissertation committee members, Dr. Al Endres and Dr. Gerald Collard for their dedication and suggestions. Also, the effort of the Business Department Chair, Dr. Keith Harman, did not go unrecognized.

I cannot say enough about the sleepless nights. Special thanks to my wife, Opeyemi, for her unwavering support. Without her support, this doctoral degree would have been impossible to attain. To my daughter Toni and my son Miye, I re-affirm that you are the very best children in the world and the sky is the limit. Thank you for indulging me when I was working on this dissertation.

Dad, you showed me that it is never too late to do this, and you never relented in your inquiry about my academic progress. At last, here it is.

By the grace of God, this dissertation is dedicated to the memory of my mother who passed on to glory on February 12th, 2002. The confidence she had in me was my momentum, and her exemplary life gave me the motivation to be all that I can be. I only wish she was alive to witness this.

DISSERTATION ABSTRACT

Name: Oludotun Oladele Oni

Degree: Doctor of Philosophy

Major Field: Management Information System

Date: August, 2005

Institution: Northcentral University

Location: Prescott, Arizona

Title of Dissertation: IDENTIFYING AND ADDRESSING THE EFFECT OF MANAGEMENT TRAITS ON THE COMMITMENT OF INFORMATION TECHNOLOGY ENGINEERS

Scope of Study: The purpose of this study was to investigate the relationship between management traits and the commitment of information technology engineers to their organizations. The leadership traits or characteristics considered in this research were accountability, communication skills, courage, expertise, integrity, intellect, persistence, team building and vision. Identification, compliance and intent to leave were the commitment dimensions evaluated. The survey that was mailed out for this purpose yielded a response rate was 19%. Correlation analysis was used to explore the association between aggregate management traits and the commitment dimensions considered in this study. Same analysis was also performed to inquire about the relationships among commitment dimensions. The differences in mean scores within each of the different comparative groups were determined using multiple factor analysis of variance (ANOVA). Further analysis, when required, were carried out using the Tukey/Kramer (TK) *post hoc* multiple-comparison procedure.

Findings and Conclusions: This study investigated management traits reported by engineers and the effect on their commitment to their employing organizations. Three hypotheses were formulated to evaluate the responses of the engineers. Hypothesis 1 – Engineers whose managers possess high aggregate management traits will display high levels of identification commitment. This hypothesis held true. Hypothesis 2 – Engineers whose managers possess low aggregate management traits will display high levels of compliance commitment. Contrary to the hypothesis, there was little or no relationship between aggregate management traits scores and compliance commitment mean scores. Hypothesis 3 – The results were in agreement with this hypothesis. Respondents whose managers possess high aggregate management trait scores also reported low intention to leave scores. The study found that respondents with high levels of identification commitment have low intent to leave their respective companies. Those with high identification commitment mean scores were also found to show high levels of compliance commitment. No relationship was found between compliance commitment and intent to leave.

Chair's Approval: Richard E. Yellen Date: August 19, 2005

Richard E. Yellen, Ph.D.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

CHAPTER I

INTRODUCTION

Introduction

Management changes are bound to occur in information technology (IT) companies due to the fast-paced nature of the industry. The slow-down in the economy in the last few years has resulted in layoffs within the industry. This has limited this movement to within, rather than among, organizations.

Change, while necessary in many ways, is usually resisted and is not welcome by people because it normally means leaving their "comfort zone". Many engineers today find themselves staying with their companies because of a limited job market. The situation has presented them with the opportunity to stay long enough to assess their commitment to their respective companies. They also have a chance to observe the traits or characteristics of their managers.

Statement of the Problem

During the "dot-com boom" era, engineers and technical professionals were very much in demand, with multiple offers of lucrative salaries from competing employers trying to outdo each other. Even the most loyal professionals wavered and had their loyalty tested.

Things have changed since the demise of the boom. Engineers and technicians are now generally less secure and cautious about changing jobs when these opportunities do arise. Even in the current job climate, some engineers are dissatisfied enough with their present employment to eventually make the move to a different organization. The

sources of this frustration range from little or no salary increases to bad employment climate and poor management attitudes. Companies are also prone to treating employees with less respect than when the industry was at its best.

If these negative factors are properly explored, there are possibilities to reduce their impact. The theory is that if these factors are addressed, more people would like to stay in their current place of employment long enough to make an impact, instead of looking for new jobs when employment opportunities improve. This would also be a welcome development for employers.

This study explored some factors that impact the current trend and offers suggestions on how to rectify the situation. More specifically, this study analyzes the relationship between management traits and the commitment of information technology (IT) engineers to their organizations.

Definition of Terms

There are a number of terms used throughout this study. For a better understanding of this study, it is imperative to define some relevant terms. These terms are defined in this section.

Compliance Commitment

Compliance commitment is defined as a psychological attachment based on extrinsic rewards; individuals whose commitment is based on this exchange relationship do not display the positive, pro-social behaviors associated with high levels of internalized commitment and have a much lower intention of remaining as members of the organization (O'Reilly and Chatman, 1986).

Engineer

For this study, an engineer is defined from a job role standpoint. An engineer is defined as someone who performs an engineering duty, such as a software engineer, network engineer, computer engineer, system engineer, design engineer, hardware engineer or software architect. In this study, the person did not need to have an engineering degree to be categorized as an engineer. The work experience and job role qualified the individual to be referred to as an engineer. This approach was taken because the Internet boom of the late nineties attracted a new breed of motivated and self-trained "engineers" with a lot of "hands-on" talent with or without an engineering degree. While many in this category have engineering degrees, some do not have college degrees.

Identification Commitment

Identification commitment is the construct for the attitudes and behaviors that are adopted in order to gain association with a valued third party. It is based on a desire for affiliation (O'Reilly & Chatman, 1986), and associated with external perceptions of the organization.

Leader

A leader is someone who leads or who is in charge or in command of others. In the context of this study, anyone to whom an engineer reports was categorized as a leader.

Leadership Styles

These are the traits or characteristics of a manager as perceived by the subordinates. These may be deduced from their operational style, reaction to employees' work, general demeanor and interaction with their subordinates. They include the degree to which the supervisor is inspirational, visionary, charismatic, competent, and honest, as well as his

or her ability to model proper behavior, provide individual consideration, offer intellectual stimulation, enable action, and encourage success for those being led. These are only a few of the multitudes of behaviors that are components of a leader's managerial style (Sipes Salvato, 2001). Correlations with nine traits were used in this study to understand this relationship.

Telecommunications Companies

Telecommunications Companies are companies that manufacture and/or provide telecommunication services such as POTS (Plain Old Telephone Service) or PSTN (Public Switched Telephone Service), DSL (Digital Subscriber Line), ISDN (Integrated Services Digital Networks) and Broadband access such as T1, DS3 and T3. This category also includes companies that manufacture products and deliver services for VoIP (Voice over Internet Protocol) and wireless.

Brief Review of Related Literature

The importance of effective leadership is very well documented and cannot be overemphasized. The tremendous economic benefit of good leadership is probably the most significant reward for an organization.

Management is a very crucial aspect of any organization. Regardless of the size of the organization, "... managers are responsible for such important tasks as managing capital and financial capability, realizing growth, and recruiting the right employees" (Sipes Salvato, 2001, p. 11). Some studies have been targeted towards management of research and development (R&D) groups, while some have addressed managing engineering as a whole.

While engineers generally do not want to be part of the management team, they tend to believe they have an idea of how managers should function to help them in achieving their career goals of job satisfaction and some measure of productivity. This paradigm is probably a result of their training and background. Engineers need a change in orientation to be successful as managers. As Van Fleet (1992) suggests, professionals need to decide early on in their careers whether to be an executive and a leader of people, rather than a technician, and stick to it.

The general work climate has changed from the traditional atmosphere where leaders tend to behave like dictators. Contemporary organizations' leaders tend to be more relaxed, informal, experimental, and result oriented. As long as employees do their jobs and are productive, management really does not want to tightly control them, provided they are not engaged in any form of counterproductive activity Successful companies tend to follow this model. Mateas and Kleiner (1999) note that unlike traditional companies with rigid job assignments, slow reaction to change and the 'decision by committee' method for reacting to market changes, technology companies made decisions quickly in order to take advantage of new opportunities. According to Demarco and Lister (1999), good leaders focus their energy on promoting an atmosphere that produces a cohesive team, which has positive outcomes such as increased efficiency, a strong sense of identity, a sense of elitism and low turnover.

Zein and Buckler (1998), in a study of twelve highly successful companies, note a consistency in how the companies cultivate and reward innovation. The values of these companies encouraged experimentation and guarded their status as innovative companies. Successful computer and software companies also had structures in which creativity was

encouraged and flexibility was a requirement. This type of management cultivated inspirational environment and encouraged creativity (James, 1996).

Organizational cultures that nurture limitless wealth of imagination, teamwork, and individual autonomy are favored by the current marketplace (Champy, 1995). Most IT companies go as far as making this a requirement. Of course, not every company has a culture that sustains this type of creative process, and this presents an added layer of challenge to the technical manager trying to adopt this model.

Kouzes and Posner (1995) reveal that from the follower's perspective, there are four characteristics consistent with good leaders. The survey shows that good leaders are honest, forward-looking, inspiring, and competent. In another study, Boehnke, DiStefano, DiStefano, and Bontis (1999) concluded that the key dimensions of leadership are universal, and include behaviors such as visionary, inspiring, stimulating, coaching, and team building.

Some similarities exist between the qualities of a good leader and those of a good team leader. These include integrity, good judgment, courage, and commitment (Maccoby, 1995). Management interference is the leadership trait that most seemed to result in the downfall of a team (Taylor, Dahnke, Snyder, & Kuether, 1996).

Rifkin, Fineman and Ruhnke (1999) position personal attributes at the base of the hierarchical framework when developing a competency model for developing technical managers. The key personal traits include integrity, creativity, need for accomplishment and willingness to lead others. They placed the skills and knowledge required right above these traits.

According to Sipes Salvato (2001), "...one of the important qualities of a technical manager can be technical competence. Engineers may have difficulty seeing a manager as credible if he or she is not a technologist or at least somewhat technically adept. In addition, the creative engineer often needs someone as a manager who they can use to help stimulate ideas by thinking aloud" (p. 22). Rifkin et al. (1999) also affirm that the role of the technical manager is to direct and facilitate the development of new knowledge, products, or processes.

Understanding the relevant technology has been shown to influence the success of the technical group (Farris, 1988). However, Wortman (1981) states that the qualities of some technical people could hamper their ability to lead a group. The key role of the manager is not to show engineers how to do their jobs, but to provide an atmosphere that inspires creativity in them.

Farris and Cordero (2002) conclude that cross-functional teams have replaced functional groups in many applications and that some of these teams are globally distributed. According to Parker (2003), "most teams now are diverse or virtual" (p. 21). Virtual teams allow organizations to retain their valued workforce who may not want to relocate (Kerber & Buono, 2004).

These virtual teams present the challenges of managing a team with different backgrounds, cultures, languages, team player styles, training and interests (Parker, 2003). Another test for virtual cross-functional leadership is that members communicate electronically and may never meet face-to-face (Parker, 2003). Virtual teams rely heavily on telecommunications and information technologies such as conference calls, e-mail and video conferencing to leverage their expertise (Kerber & Buono, 2004).

Another sensitive, but prevalent subject in the information technology arena is that of outsourcing. The current fast-paced business environment dictates the need for external partnerships such as outsourcing to reduce cost and increase revenue (Matthews, 2004). Today, more and more organizations are interested in outsourcing their IT operations (Lee, Huynh, Kwok, & Pi, 2003; Toscano & Waddell, 2003). Outsourcing, which is often offshore, can present the same challenges as virtual teams because many outsourcing relationships span across cultural boundaries. According to Hunter (2004), the key to a successful outsourcing project is the formation of an effective team of talent across relevant areas.

While the constitution of teams is very crucial, the success of teams often depends on the leadership. "Of all the variables potentially affecting a team, few exert as strong an influence on team performance as team leadership. This is true in part because the team leader is in a position to influence so many other variables that affect performance" (Trent, 1996, p. 30).

Commitment involves the sense of attachment and loyalty by an individual (Morris, Lydka & O'Creevy, 1993). Commitment is the strength of employees' identification with and involvement in their organizations (Porter, Steers, Mowday, & Boulian, 1974). Buchanan (1974) describes commitment as "...a partisan affective attachment to the goals and values of an organization, to one's roles in relation to the goals and values, and to the organization for its own sake, apart from its purely instrumental worth" (p. 53).

O'Reilly and Chatman (1986) identify psychological attachment, which is the psychological link between the individual and the organization, as a key premise in all the various commitment approaches. O'Reilly and Chatman's bases for psychological

attachment are compliance (instrumental involvement for specific, extrinsic rewards); identification (involvement based on a desire for affiliation); and internalization (involvement predicated on congruence between individual and organizational values).

Employers can make an impact on how their employees feel by making a conscious effort to create a work environment that practically indicates that the employee is valued (Lynch et al., 1999). Lynch et al. (1999) also identify pay as only one factor, and that employers must address fairness, quality of supervision and support for the employee's life style such as flexible hours for family and time off to deal with personal interests. Good leaders focus their energy on promoting an atmosphere that produces a cohesive team, which has positive outcomes such as increased efficiency, a strong sense of identity, a sense of elitism and low turnover (Demarco & Lister, 1999).

Studies in the areas of management traits, correlated with inspiring creativity, managing technical professionals, and commitment will give the necessary foundation for grasping what characteristics of technical management affect commitment of engineers, and how they affect them.

Highlights of Methodology

This study tested for and analyzed any identified key associations between management traits and the commitment of IT engineers.

Quantitative data on management styles were collected and used for this research. The data was collected through a survey questionnaire. The subjects used in the study were engineers who worked for telecommunications companies.

A 39-item questionnaire was used in this study. The questions were designed to inquire about specific areas of management that represent management styles and traits. The leadership traits or characteristics considered in this research were: accountability, communication skills, courage, expertise, integrity, intellect, persistence, team building and vision. The commitment dimensions considered were identification, compliance and intent to leave. A five-point Likert scale was developed to obtain responses. Responses were grouped based on common trends or demographics in order to test the research hypotheses.

The management/leadership traits section of the questionnaire was adapted from the GE Leadership Effectiveness Survey (LES) (1000ventures, n.d.). The GE Leadership Effectiveness Survey (LES) was designed to address GE values in terms of management behavior, with the purpose of measuring how GE leaders conformed to these values (Ulrich, 1997). Since the reliability of the original instrument could not be obtained, Cronbach's alpha was calculated for the items in each of the nine management traits considered in this study. The resulting alphas are: team building (0.85); expertise (0.76); initiative (0.86); persistence (0.78); integrity (0.83); vision (0.83); communication (0.78); accountability (0.66); and courage (0.85). The alpha for the aggregate traits is 0.95. These estimates indicate strong internal consistency of the items, and, therefore, the suitability of the questionnaire for use.

The six-item identification and compliance commitment section of the questionnaire was based on the scale used by Bennett and Durkin (2000). Bennett and Durkin (2000) derived their 12-item questionnaire from the items that loaded most highly after factor analysis in a 21-item scale originally developed by O'Reilly and Chatman

(1986). Three items in this study each measured identification and compliance commitment. Bennett and Durkin (2000) used Cronbach's alpha to calculate the reliability. The resulting alpha for identification commitment was determined to be 0.73, confirming its fitness for use. The compliance commitment yielded a lower alpha (0.49). The four-item section on intent to leave one's employing organization was also based on the O'Reilly and Chatman (1986) instrument. In this research, the Cronbach alpha for the items in the intent to leave dimension was confirmed to be acceptable (0.87).

The responses were categorized into the nine management traits considered in the study, and statistical methods were used to analyze the collated data. The mean scores were plotted to represent the engineers' opinions about the nine traits in the study. The responses from the commitment questionnaire were also categorized and analyzed in the same manner. Descriptive statistics such as means and standard deviations were calculated from the data. Correlation analyses were performed to estimate the types and significance of correlations between managerial traits and engineers' commitment. Analysis of variance (ANOVA) was utilized to test for the difference in populations' means.

The following hypotheses were tested in this study:

Hypothesis 1– Identification commitment

Engineers whose managers demonstrate high aggregate management traits will display high levels of identification commitment.

Hypothesis 2 – Compliance commitment

Engineers whose managers demonstrate low aggregate management traits will display high levels of compliance commitment.

Hypothesis 3 – Intent to leave

Engineers whose managers demonstrate high aggregate management traits will show low levels of intent to leave.

Limitations of the Study

This study specifically focused on 57 subjects in the telecommunications industry. Apart from being an engineer in a telecommunications company, effort was made to assure a diversified sample in terms of age, experience and educational background. The subjects used in this study were Institute of Electrical and Electronics Engineers (IEEE) members. More specifically, they represent design engineers, hardware engineers, and software engineers who work in the Telecommunications Services and Telephone line of business. The study assumed that this sample would give an insight into the perspective of the general population of engineers across the IT industry.

The exposure to human error or bias due to the human subjective nature should also be considered as a limitation in the research. These occur because when the engineers were asked about their views based on their personal experiences, they provided information and responses from their own point of view. Since this is inherent in human nature and cannot be avoided, it is being recorded as a limitation.

The results of the correlation tests only indicate an *association* between two variables and do not suggest that the scores of one variable are *caused* by the other.

Research Expectations

This study focused on 57 subjects in the telecommunications industry with the hope that it would give an insight into the perspective of the general population of engineers across the IT industry.

The expectation of this research was to find out if any correlation exists between management traits of information technology engineering managers and commitment of engineers. The result of this study would allow organizations to focus on developing managerial skills that were positively correlated with employee commitment. Another potential benefit is to encourage engineers who might want to transition into management to start preparing themselves for the journey. The three organizational commitment dimensions used in this study were compliance commitment, which was based on extrinsic rewards; identification commitment, which is characterized by the desire for affiliation; and intent to leave.

CHAPTER II

REVIEW OF RELATED LITERATURE

Introduction

A plethora of previous research has focused on managing and leading in general. Numerous works have also been targeted towards technical and engineering leadership. This chapter organizes the literature into four categories: engineers and management; professional and engineering leadership; leadership and management traits; and commitment.

Engineers and Management

Engineers are technical personnel and are generally "hands-on" in their chosen field. They are typically not trained managers and avoid changing to a management role if they can. Allen and Katz (1986) show that many technical people are not interested in being promoted to either a technical or a managerial ladder.

Finn (1989), Gomez-Mejia, Balkin, and Milkovitch, (1990); and Hesketh, Gardner, and Lissner, (1992) suggest that because engineering requires a large amount of technical training, engineers might see a transition into management as a waste of their personal potential. In addition, many who choose science or engineering as a discipline are inherently oriented more toward technical and professional objectives than organizational goals and therefore prefer technical jobs (Shapira & Griffith, 1990). Lea (1991) shows that technically oriented education and training means that engineers who move into management may lack the skills to be effective managers and therefore may wish to remain technical. Rosenbaum (1990) points out that engineers are likely to possess

sophisticated technical problem-solving skills, which may not translate well to management where human relationships are often more likely to be the source of the problem issues. Even those with broad business and management training can find their first leadership experience difficult. Little about the professional experience prepares the professional for management (Glen, 2003).

Engineers still move to management for a number of reasons. According to Jones (1983), engineers may have little choice but to move to the management cadre if they wish to receive higher salaries. Vitton (1991) also notes that few engineers backtrack once they decide to move into management positions. "Clearly those that do make the transition into management attain the rewards that they were seeking from the position, even if their promotion was not necessarily optimal from the organization's perspective" (Johnson & Sargeant, 1998, p. 44). According to Johnson and Sargeant (1998), those that make this transition have different motives of making the move and it appears that distinct groupings of motives might exist within the same sample. According to Glen (2004), the natural need to be in charge does not necessarily suggest good technical leadership.

While engineers generally demand more independence from their managers, studies show that the typical engineer is not a good manager. Most engineers go into the field for the love of the engineering profession and most of their training is geared towards improving their productivity, which is an entirely different path from the management career path. The notion that the technically adept is the best suited to be in charge is wrong as they require a very different set of skills (Glen, 2004). Van Fleet (1992)

suggests that professionals need to decide earlier on in their careers whether to be an executive and a leader of people, rather than a technician, and stick to it.

Clarke (2002) suggests that some factors prevent the application of the knowledge about managing scientists and engineers. These are: (1) determining an individual's managerial potential much more by technical skills than his or her potential to develop leadership skills; and (2) once managerial potentials have been discovered, promoting an individual into a management position before developing the skills.

Professional and Engineering Leadership

Chen, Ford, and Farris (1999) report that scientists and engineers believe organizations benefit by providing them with intrinsic rewards and salary increases. According to Miller (1988), professionals expect to be able to make decisions about how to manage their work. Glen (2003) suggests that when managing professionals, the position of authority offers relatively little power compared with traditional practice.

Engineers and scientists can be demanding in terms of the degree of freedom they demand. This makes managing these groups of professionals different from managing other groups of employees. "Even if a team is comprised entirely of engineers, and led by an engineer, challenges are many" (Sipes Salvato, 2001, p. 25).

Engineers usually work on teams; in fact, working on teams has become the norm (Bozionelos & Lusher, 2002). According to Trent (2003), a team is a popular and growing option among organizations. Seitz (1997) points out that engineers frequently work in multiple teams and projects simultaneously. These teams can have members entirely within a company or have members from within a strategic coalition or even

customers or suppliers of the company. Bellinger (1997), in an annual survey of engineers, also reports that 75 percent of the respondents were members of at least one team. Sixty-seven percent of the subjects indicated that they had been team leaders at some time.

Farris and Cordero (2002) conclude that cross-functional teams have replaced functional groups in many applications and that some of these teams are globally distributed. According to Parker (2003), "most teams now are diverse or virtual" (p. 21). Virtual teams allow organizations to retain their valued workforce who may not want to relocate (Kerber & Buono, 2004). Unlike conventional teams, virtual teams function across space, time, and organizational and geographic zones (Lipnack & Stamps, 1997; Moyntoya-Weiss, Massey, & Song, 2001). Virtual team challenges include time and distance (Bell & Kozlowski, 2002; Cascio, 2000; Henry & Hartzler, 1998).

These virtual teams present the challenges of managing a team with different backgrounds, cultures, languages, team player styles, training and interests (Parker, 2003). Another test for virtual cross-functional leadership is that members communicate electronically and may never meet face-to-face (Parker, 2003). Virtual teams rely heavily on telecommunications and information technologies such as conference calls, e-mail and video conferencing to leverage their expertise (Kerber & Buono, 2004).

Another sensitive but prevalent subject in the information technology arena is that of outsourcing. The current fast-paced business environment dictates the need for an external partnership such as outsourcing to reduce cost and increase revenue (Matthews, 2004). Today, more and more organizations are interested in outsourcing their IT operations (Lee, Huynh, Kwok, & Pi, 2003; Toscano & Waddell, 2003). Outsourcing,

which is often offshore, can present the same challenges as virtual teams because many outsourcing relationships span across geographical boundaries. According to Hunter (2004), the key to a successful outsourcing project is the formation of an effective team of talent across relevant areas.

Although the constitution of teams is very crucial, the success of teams often depends on the leadership. "Of all the variables potentially affecting a team, few exert as strong an influence on team performance as team leadership. This is true in part because the team leader is in a position to influence so many other variables that affect performance" (Trent, 1996, p. 30). Farris (1988) suggests that technical supervisors and managers could exert technical leadership by influencing the characteristics of productive climates for R&D. Team leadership can be in the form of engineering lead, project lead or even managing engineers. Team leaders should have the ability to communicate a clear goal for the team and provide guidance towards accomplishing it. According to Maccoby (1995), among the foundation blocks of teamwork are openness and conflict resolution. Antonioni (1996) notes that team leaders are also required to conduct productive meetings where they encourage participation of all members, exert influence, and manage conflicts among members.

Because the demands of technical teams are different from those of other corporate employees, technical team leadership requires a slightly different approach (Grossman, 1997). Successful team leaders must have the flexibility of choosing team members with diverse orientation because it promotes creativity (Leonard-Barton, 1995). According to Bellinger (1997), effective leaders must also be able to perform such tasks as encourage participation, resolve conflicts and motivate team members.

Diverse expertise is therefore required for leading a team due to the varied skills that are required for a team to function properly. Team leadership calls for facilitation of team members rather than task distribution. As a result, a leader must be a facilitator for members of their team (Sipes Salvato, 2001). Scientists and engineers need leadership, marketing and manufacturing skills to work in cross-functional teams (Cordero, 1999; Pelled & Adler, 1994; Rosenbaum, 1990). Gwynne (1997) also pointed out that in addition to academic and technical competence, recruiters also look for attributes such as interpersonal skills and job flexibility.

Scientists and engineers generally expect more autonomy and flexibility than management is willing to give them. Another difficulty may arise since engineers also tend to trivialize management's role in an organization, and that is definitely counterproductive (Sipes Salvato, 2001). The idea that the creative-innovative process needs protection from prevailing schedules and budgets, and that they are not easily planned, managed, or measured, is another potential problem source (Miller, 1986).

According to Zein and Buckler (1998), another requirement for engineering leaders is that their actions and decisions must be justified by creativity and innovation. Leaders also need to have the ability to encourage experimentation and intelligent failure, without departing from established corporate guidelines.

There are also problems that arise with managing professionals in general that also apply to managing engineers. For example, because of the relatively short product cycle from development to production, professionals expect success more quickly than in past years. "In the late 1960s, the crucial time for the professional to review his or her relationship to the organization and choose to grow or leave was around five to seven

years out of formal education" (Miller, 1988, p. 43). Similar review and measurement of progress and attachment have since reduced this to about two years after graduation (Miller, 1988). This assessment period has a downward trend and is probably less than two years by now. This gives the manager a narrowing time window to make a positive impression on the employee.

Certain employee expectations can also be a source of problems for engineering managers. These may include promotions and more freedom. Professionals also believe they should manage their own work, and feel obligated to follow their principles, even when it contradicts management's direction. Professionals also tend to be critical about any "unnecessary" management (Miller, 1988).

Using metrics in evaluating researchers and development individuals is often counterproductive, and doing so might jeopardize innovation and creativity. "Performance evaluation has never done well. Individuals should be seen as assets, and the point is how to lead people to use their minds" (Santo, 1997, p. 116). Successful companies are able to manage both projects and the people without negative effects on the innovative process.

According to Farris and Cordero (2002), priority must be given to the integration of technical goals with financial and business goals and equipping scientists and engineers to achieve them. They further suggested that this could be accomplished in most cases by leaders being a *catalyst,* which means, "creating a working environment with clear objectives, challenging work, collaboration in teams, full communications opportunities, opportunities to grow and develop new skills, and a fair reward system linked to performance" (Farris & Cordero, 2002, p. 16).

Leadership and Management Traits

"Leadership is an elusive skill, but most workers seem to agree that there are certain traits that characterize an effective leader and distinguish him or her from a regular manager" (Sipes Salvato, 2001, p. 18). Numerous research works have focused on different managerial practices, aimed at establishing which are the most valuable and which are associated with differentiating good leadership from basic management (Keller, 1995; Hooijberg, 1996; Tracey & Hinkin, 1998; Nemeth, 1998; Zein & Buckler, 1998; Leavy, 2003).

For leadership traits to be established, it is imperative to explore the connection between managers and subordinates or team leaders and members. Certain management behaviors or styles have historically been grouped together. For example, Wortman (1981) uses a behavior-based approach to define twelve groups of managerial styles, namely: conservative, captain, avoider, ambivalent, structured, motivator, empathetic, driver, laissez -faire, achiever, dictator, and supporter.

Wortman (1981) further suggests that none of the styles considered in the study is perfect, and that a variety of behaviors may be appropriate for any particular situation. The study also noted that effective leaders often combine multiple styles effectively.

Different researchers have also defined transformational leadership and transactional leadership. Pawar and Eastman (1997) define transformational leaders as those who create a dynamic organizational vision that often demands a change in cultural values to reflect greater innovation.

According to Boehnke, DiStefano, DiStefano, and Bontis (1999), transactional leadership is based upon rewards and punishments. "This leader recognizes and rewards employees in response to their meeting previously agreed-to standards. In classic management-by-objectives procedures, they communicate performance expectations clearly and recognize people for their achievements. These behaviors result in performance consistent with what was expected" (Boehnke et al., 1999, p. 59).

Other studies on transactional and transformational leadership have addressed effectiveness and productivity. Jung and Avolio (1999) demonstrate that transactional leadership increased performance on a test where creative and innovative solutions were a requirement, while Pfeffer and Veiga (1999) show that employees were more willing to work when transactional leadership was in place, and thus increased their productivity. On the other hand, transformational leadership increased subordinate job satisfaction, but had no effect on their productivity (Ross & Offerman, 1997).

Both transactional and transformational leadership are often combined by managers when interacting with members of their group. The resulting interactions culminate in some group members being given more independence. This development occurs intuitively, as some subordinates are perceived to be more reliable or competent (Basu & Green, 1997).

Kouzes and Posner (1995) reveal that from the follower's perspective, there are four characteristics consistent with good leaders. The research showed that good leaders are honest, forward-looking, inspiring, and competent. Over 90 percent of participants in the study chose honesty as the most important characteristic desired in a leader above all others. Being forward-looking rated among the most important traits by 75 percent of the

subjects. Ranking third and fourth were inspiring and competent with 68 percent and 63 percent, respectively. Kouzes and Posner (1995) further state that these characteristics combine to produce a credible individual, which is of great importance, especially in uncertain times. Results of another survey by Boehnke et al. (1999) revealed that the main leadership traits are widely accepted to include behaviors such as visionary, inspiring, stimulating, coaching, and team building.

High commitment or high performance management practices have been studied for their economic returns. These methods attempt to offer employees more responsibility and control over their work; they also encourage them into developing their expertise, thus increasing the level of employee participation. "... people work harder because of the increased involvement and commitment that comes from having more control and say in their work; people work smarter because they are encouraged to build skills and competence; and people work more responsibly because more responsibility is placed in the hands of employees farther down in the organization" (Pfeffer & Veiga, 1999, p. 40).

As expected, similarities exist between the basic qualities of a good leader and those of a good team leader. These include integrity, good judgment, courage, and commitment (Maccoby, 1995). Glen (2004) lists emotional flexibility, comfort with ambiguity and ability to communicate as predictive traits of a great leader. According to Taylor, Dahnke, Snyder, and Kuether (1996), management interference is the leadership trait that most seemed to result in the downfall of a team.

Rifkin, Fineman and Ruhnke (1999) position personal attributes at the base of the hierarchical framework when developing a competency model for training technical

managers. The key personal attributes include integrity, creativity, need for accomplishment and willingness to lead others. They place the skills and knowledge required right above these traits. The skills and knowledge considered include bridging organizational cultures between the technical and business workers, building collaborative relationships, communicating technical information, consulting and advising, integrating technical and business knowledge, and project management.

According to Sipes Salvato (2001), "...one of the important qualities of a technical manager can be technical competence. Engineers may have difficulty seeing a manager as credible if he or she is not a technologist or at least somewhat technically adept. In addition, the creative engineer often needs someone as a manager whom they can use to help stimulate ideas by thinking aloud" (p. 22). Rifkin et al. (1999) also affirm that the role of the technical manager is to direct and facilitate the development of new knowledge, products, or processes.

Understanding the relevant technology has been shown to influence the success of the technical group (Farris, 1988). However, Wortman (1981) states that the qualities of some technical people could hamper their ability to lead a group. The key role of the manager is not to show engineers how to do their jobs, but to provide an atmosphere that motivates and stimulates the creative process (Wortman, 1981).

An aggregate of factors is therefore responsible for effective leadership, and they vary dramatically from one job function to another. "Effective leadership is not simply a matter of certain traits or behaviors. Rather, it is a complex interaction of traits, leader behavior, and group, task, and organizational characteristics" (Farris, 1988, p. 13).

Commitment

Previous researchers have stressed the need for high quality, flexibility, and employee commitment (Guest, 1987; 1989). The current marketplace, which is rife with restructuring, downsizing and delayering in many organizations, has however advanced the drive for these goals (Yates, 2002).

Commitment has to do with the sense of attachment and loyalty by an individual (Morris, Lydka & O'Creevy, 1993). Porter et al. (1974) define commitment as "the strength of an employee's personal identification with and involvement in a particular organization" (p. 604). Buchanan (1974) describes commitment as "...a partisan affective attachment to the goals and values of an organization, to one's roles in relation to the goals and values, and to the organization for its own sake, apart from its purely instrumental worth" (p. 53). Buchanan (1974) also made a distinction between exchange-based attachment, which is based on return for extrinsic reward; and moral-based attachment, where involvement is based on similarities in values between the individual and the organization.

O'Reilly and Chatman (1986) identify psychological attachment, which is the psychological link between the individual and the organization, as a key premise in all the various commitment approaches. Psychological attachment "reflects the degree to which the individual internalizes or adopts characteristics or perspectives of the organization" (O'Reilly & Chatman, 1986, p. 493). O'Reilly and Chatman's bases for psychological attachment are compliance (instrumental involvement for specific, extrinsic rewards), identification (involvement based on a desire for affiliation), and internalization (involvement predicated on congruence between individual and

organizational values). Similar approaches to employee commitment have been used in subsequent studies (Durkin & Bennett, 1999; Bennett & Durkin, 2000).

Price (1997) defines organizational commitment as the extent of employee loyalty to an organization. Meyer and Allen (1990) see organizational commitment as an affective form of commitment based on sense of loyalty toward an organization. Becker (1992), Becker and Billings (1992), and Reichers (1985) focus their studies on commitment to the organizational unit, rather than different teams or departments within the organization.

Mathieu and Zajac (1990) explore two forms of organizational commitment: affective commitment and continuance commitment. Employees who possess affective commitment to their organization remain with them because they want to, while those with high levels of continuance commitment might remain because they have to (Mathieu & Zajac, 1990).

Positive correlation has been demonstrated between commitment to organizations and such parameters as job satisfaction (Bateman & Strasser, 1984; Mowday, Porter & Steers, 1982), attendance (Mathieu & Zajac, 1990; Steers & Rhodes, 1978) and motivation (Mowday, Porter & Steers, 1979). On the other side of the scale, low commitment has been associated with outcomes such as absenteeism and labor turnover (Cotton & Tuttle, 1986; Clegg, 1983). According to Mowday et al. (1982), highly committed employees wish to remain with their employing organizations.

Organizations can positively influence how their employees feel by making a conscious effort to create a work environment that practically indicates that the employee is valued (Lynch et al., 1999). Lynch et al.(1999) also identify pay as only one factor and

that employers must address fairness, quality of supervision and support for employee lifestyle such as flexible hours for family and time off to deal with personal interests. Good leaders focus their energy on promoting an atmosphere that produces a cohesive team, which has positive outcomes such as increased efficiency, a strong sense of identity, a sense of elitism and low turnover (Demarco & Lister, 1999).

Summary of Related Literature

The literature reviewed in this chapter provides background information about technical leadership, management traits and employee commitment. Many researchers emphasize the challenges in managing technical professionals. From the review of literature, one of the reasons engineers avoid management positions is the thought of losing their technical skills and dealing with bureaucracy.

Because management requires a different set of skills than technical ability, when technical professionals are placed in management positions, they might not be prepared, and end up being poor managers. Clarke (2002) highlights two factors preventing the application of the knowledge about managing scientists and engineers. These are: (1) determining an individual's managerial potential much more by technical skills than his or her potential to develop leadership skills; and (2) once managerial potentials have been discovered, promoting individuals into management position before developing the skills.

The fact that engineers usually work in cross-functional teams is another consistent theme in the review of literature. The team atmosphere can span geographical and cultural boundaries, which may be a result of outsourcing. These "virtual" teams usually communicate using latest advancements in information technology. Apart from the core

leadership skills necessary to manage, the engineering manager also needs to be able to coordinate engineers across these boundaries. The challenge of virtual team leaders in this dynamic market is achieving the level of productivity comparable to those in a collocated environment (Kerber, & Buono, 2003).

Numerous research studies have focused on different leadership and managerial traits. Rifkin, Fineman and Ruhnke (1999) position personal attributes at the base of the hierarchical framework when developing a competency model for developing technical managers. The key personal attributes include integrity, creativity, need for accomplishment and willingness to lead others. They place required skills and knowledge directly above these traits. The skills and knowledge include bridging organizational cultures between the technical and business workers, building collaborative relationships, communicating technical information, consulting and advising, integrating technical and business knowledge, and project management. They also affirm that the role of the technical manager is to guide and facilitate the development of new knowledge, products, or processes.

Previous researchers have stressed the need for high quality, productivity, flexibility, and employee commitment (Guest, 1987; 1989). The drive to secure these goals has been accelerated alongside organizational change through restructuring, involving significant downsizing and de-layering in many organizations (Yates, 2002).

Organizations can positively influence how their employees feel by making a focused effort to create a work environment that practically indicates that the employee is valued (Lynch et al., 1999). Good leaders focus their energy on promoting an atmosphere that produces a cohesive team, which has positive outcomes such as

increased efficiency, a strong sense of identity, a sense of elitism and low turnover (Demarco & Lister, 1999).

The literature has addressed key issues about engineering leadership, management traits and commitment. This research explores how these variables interact with each other to find the right balance of management traits and engineers' commitment to their employing organization. If these factors are identified and addressed, employees may be motivated to stay in their current place of employment long enough to make an impact. It will also reduce the possible exodus of engineers out of their current employment if and when employment opportunities improve.

CHAPTER III

METHODOLOGY

Overview

This chapter describes the methodology that was used in investigating the associations between management traits and the commitment of IT engineers. It includes a problem restatement, statement of hypotheses, description of the research design, operational definition of variables, description of materials and instruments, selection of subjects, procedures, discussion of data processing, methodological assumptions and limitations and ethical assurances.

Restatement of the Problem

Recent structural transitions in business, such as outsourcing, have made management changes within hi-tech companies more frequent because of associated lay-offs and re-organization of personnel. This trend has also forced engineers to stay with a company long enough to assess not only their managers' traits, but also their own commitment to their employing organizations. This interaction may determine whether employees will be looking for new jobs if and when employment opportunities improve.

This study tested for and analyzed any identified significant associations between management traits and the commitment of IT engineers.

Statement of Hypotheses

Hypothesis 1– Identification commitment

Identification commitment is the construct for the attitudes and behaviors that are adopted in order to gain association with a valued third party. It is based on a desire for affiliation (O'Reilly & Chatman, 1986), and associated with external perceptions of the organization. Identification commitment is likely to be influenced by the management traits or attributes since the manager is the primary link between the engineers and the organization.

1. Engineers whose managers demonstrate high aggregate management traits will display high levels of identification commitment.

Hypothesis 2 – Compliance commitment

Compliance commitment is a psychological attachment based on extrinsic reward. It is hypothesized that individuals whose commitment is based on this attachment will not display the positive, pro-social behaviors associated with the high levels of internalized commitment and, to a lesser extent, identification commitment. In addition, they have a much lower intention of remaining as members of the organization (O'Reilly & Chatman, 1986).

Engineers whose managers demonstrate high management traits will very likely not be attached to an organization primarily based on compliance commitment.

2. Engineers whose managers demonstrate low aggregate management traits will display high levels of compliance commitment.

Hypothesis 3 – Intent to leave

3. Engineers whose managers demonstrate high aggregate management traits will show low levels of intent to leave.

Description of Research Design

Quantitative data on perceived management styles were collected and used for this research. The data was collected through a survey questionnaire. A sample questionnaire is shown in Appendix D. The subjects used in the study were engineers who work in the Telecommunications Services and Telephone line of business. To enhance the utility of the study, efforts were made to randomize and diversify the subjects in terms of age, job role, company, experience and educational background. Responses were documented from the selected engineers about their relationships with their managers and how management traits affect these experiences.

The questionnaires were mailed to the subjects along with an explanatory invitation letter (Appendix A). Demographic information such as age, gender, position, years of experience and educational background were also requested in a survey cover page. A copy of the survey cover letter is shown in Appendix C.

Operational Definition of Variables

Compliance Commitment

Compliance commitment is defined as a psychological attachment based on extrinsic rewards; individuals whose commitment is based on this exchange relationship do not display the positive, pro-social behaviors associated with high levels of internalized commitment and have a much lower intention of remaining as members of the organization (O'Reilly & Chatman, 1986).

Engineer

For this study, an engineer is defined from a job role standpoint. An engineer is defined loosely as someone that performs an engineering duty, such as a software engineer, network engineer, computer engineer, system engineer, design engineer, hardware engineer or software architect. In this study, the engineer does not need to have an engineering degree to be described as an engineer. The work experience and job role qualifies individuals to be referred to as an engineer. This approach is taken because the Internet boom of the late nineties has attracted a new breed of motivated and self-trained "engineers" with a lot of hands-on talent with or without an engineering degree. While many in this category have engineering degrees, some do not have college degrees at all.

Identification Commitment

Identification commitment is the construct for the attitudes and behaviors that are adopted in order to gain association with a valued third party. It is based on a desire for affiliation (O'Reilly & Chatman, 1986), and associated with external perceptions of the organization.

Leader

A leader is someone that leads, or who is in charge or in command of others. In the context of this study, anyone to whom an engineer reports is considered a leader.

Leadership styles

These are the traits or characteristics of a manager as perceived by the subordinates. These may be deduced from their operational style, reaction to employees' work, general demeanor and interaction with their subordinates. They include to what degree the supervisor is inspirational, visionary, charismatic, competent, and honest, as well as his

or her ability to model proper behavior, provide individual consideration, offer intellectual stimulation, enable action, and encourage success for those being led. These are only a few of the multitudes of behaviors that are components of a leader's managerial style (Sipes Salvato, 2001). Effects of nine traits were used in this study to understand this relationship.

Telecommunications Companies

Telecommunications Companies are companies that manufacture and provide telecommunication services such as POTS (Plain Old Telephone Service) or PSTN (Public Switched Telephone Service), DSL (Digital Subscriber Line), ISDN (Integrated Services Digital Networks) and Broadband access such as T1, DS3 and T3. This category also includes companies that manufacture products and deliver services for VoIP (Voice over Internet Protocol) and wireless.

Description of Materials and Instruments

A survey questionnaire was distributed and used for this study. The questions were designed to inquire about specific areas of perceived management characteristics that represent management styles and traits. The leadership traits or characteristics considered in this research are: accountability, communication skills, courage, expertise, integrity, intellect, persistence, team building and vision. The commitment dimensions considered are identification, compliance and intent to leave.

A five-point Likert scale was developed to obtain responses to the questions based on the nine traits listed above. A five-point scale was also utilized to get the engineers'

responses on factors that were used to measure their commitment levels, which represent the dependent variable.

Selection of Subjects

Some basic criteria were used in selecting the participants in this study. Each participant was an engineer working in the telecommunications industry. Apart from the basic criteria stated above, efforts were made to assure a diversified sample in terms of age, experience and educational background to help ensure the potential application scope of the research.

The subjects used in this study were Institute of Electrical and Electronics Engineers (IEEE) members. More specifically, they represent design engineers, hardware engineers, and software engineers who work in the Telecommunications Services and Telephone line of business. This group was targeted for the survey because it represents a defined and controlled sample pool that covers the demographic bases considered in the study. Since the main hypotheses focused on relationships among variables, the sample size was determined based on a power of .80 for Pearson correlation coefficient *(r)* for large effects. The sample size required to achieve .80 power value at .01 significance level is 41 (Cohen, 1992). The 57 valid responses received at the beginning of this study were used.

Procedures

A questionnaire was administered to each subject via regular mail. The questionnaire asked questions about the nine different traits considered in this study. The questionnaire consisted of 39 questions on a five-point Likert scale and six open-ended

questions about the interaction between the subjects and their respective managers. This instrument is included in Appendix D.

Discussion of Data Processing

Once the survey was completed, the results were collated. A worksheet was developed to code the data by age, gender, position, years of experience and educational background. The responses were also included in the worksheet.

The responses were categorized into the following nine management traits: accountability, communication skills, courage, expertise, integrity, intellect, persistence, team building and vision. SPSS statistical software package was used for statistical analysis (Norusis, 2004a; 2004b). Statistical methods such as tables, graphs, analysis of variance (ANOVA) and correlation tests were then used to analyze the collated data and test the research hypotheses. The mean scores were plotted to represent the engineers' opinions about the nine managerial traits previously defined in the study. The responses from the commitment questionnaire were also categorized and analyzed in the same manner.

Descriptive statistics such as means and standard deviations were calculated from the data. Analyses were performed to model and estimate the relationships and degree of correlation between managerial traits and engineers' commitment. Specifically, the research hypotheses were tested using Pearson correlation coefficients *(r)*, while multiple factor ANOVA was used to investigate both the differences within, and the interactions among, the comparative groups considered in the study. Further analyses were performed to investigate the effects of multiple factors. The Tukey-Kramer *post*

hoc multiple-comparison procedure was used for this purpose (Hinkle, Wiersma, & Jurs, 1998).

Methodological Assumptions and Limitations

The purpose of this research was to examine the relationship between management traits and the level of commitment of IT engineers. As stated earlier, this study specifically focused on 57 valid respondents in the telecommunications industry. The assumption was that it would give an insight into the perspective of the general population of engineers across the IT industry. Since only IEEE members were sampled, data may or may not be representative of non-IEEE engineers' responses.

Human error or bias due to the human subjective nature should also be considered a limitation in the research. These occur because when the engineers were asked about their views based on their personal experiences, they provided information and responses from their own point of view. This tendency cannot be eliminated and must be noted as a possible limitation.

Ethical Assurances

Ethics are an indispensable ingredient in any research study. The subjects were provided informed consent forms of all areas of the survey that might affect willingness to participate and answer all the questions. A sample of the informed consent form is shown in Appendix B. It was specifically noted that neither the names of subjects nor their employing organizations would be revealed in the final paper. As with all research, every effort was made to conform to basic ethical rules to maintain the validity and integrity of the research.

The research methodology and research instruments used in this study were approved by the NCU Ethics Committee. The research instrument is shown in Appendix D.

CHAPTER IV

FINDINGS

Overview

This chapter reports the findings, analysis and evaluation of the findings, and presents a summary of the findings from the study. The research investigated the associations between management traits and the commitment of IT engineers who work in the telecommunications industry.

Quantitative data on management traits and engineers' organizational commitment were collected through a survey questionnaire and used for the research. Responses were documented from the selected engineers about their relationships with their managers and how management traits affect these experiences. The subjects used in the study were IEEE members who work in the Telecommunications Services and Telephone line of business. Efforts were made to assure a random and diversified sample in terms of age, job role, company, experience and educational background. These demographic data were used to stratify the data collected for analysis.

A total of 300 surveys were mailed to the subjects via the Postal Services system in two phases. The first phase consisted of 200 surveys that yielded 39 responses, while phase two produced 22 additional responses out of 100 surveys. Sixty-one responses were therefore received, with a response rate of 20.3 percent. Out of these, three declined participation in the survey for different reasons and one survey was returned with a note that the respondent was out of the country and, as such, was unavailable to complete the survey. Therefore, the data sets for this research were generated using 57 responses. These 57 respondents represent a 19 percent positive response rate.

Since the response rate is relatively low, the issue of non-respondents is reported here (McMillan & Schumacher, 2000; Fowler, 1993). A number of steps were taken during the survey design and distribution to reduce non-respondent bias. These included ensuring a diversified sample in terms of age, experience and educational background.

Findings

The demographic data of the participating respondents are presented in Tables 1 through 5 and Figures 1 through 5. In the gender classification, 86 percent of the respondents (49 respondents) were males while females constituted 14 percent (8 respondents). The majority of the respondents (47 respondents or 82.5%) were 33 years or older, with the remaining respondents (10 respondents or 17.5%) younger than 33 years of age. The first two age categories in the questionnaire (<28 years, and 28 to 32 years) were combined and reported together due to the low number of respondents (2) younger than 28 years. In terms of highest level of education, most of the respondents (40 respondents or 70.2%) held graduate degrees, while 11 of them (19.3%) had four-year degrees. The remaining respondents (6 respondents or 10.5%) did not have a bachelor's degree.

With regard to length of service within the organization, 68.4 percent (39 respondents) had been with the same organization for less than 6 years, 21.1 percent (12 respondents) for 6 to 10 years, and 10.5 percent (6 respondents) for more than 10 years. With reference to years of experience as an engineer, 50.9 percent of respondents had 10-19 years experience, 28.1 percent of respondents had 20 years or more engineering experience, and 21.1 percent had less than 10 years experience.

Efforts were made to compare these demographic distributions to the IEEE membership, but a comparable membership breakdown does not exist. The only relevant distribution that was obtained are gender (male, 93.3%; female, 6.7%) and level of education (4-year college graduate, 96.8%; masters/doctorate degree, 58.8%) (Institute of Electrical and Electronics Engineers, Inc. [IEEE], n.d.). The 96.8 percent with a 4-year college degree includes the 58.8 percent that also have graduate degrees, so those whose highest level of education is a 4-year college degree comprise about 38 percent. Since the sample's characteristics approximate the available membership characteristics for gender and level of education, this suggests a reasonably representative sample of the IEEE membership base was obtained for the study.

Scores obtained by averaging the survey responses from the different comparative groups are presented in Tables 6 through 10. The standard deviations are also included to give a picture of the extent of variation from the mean. All responses, except Question 38, have a scoring scale ranging from 1 (strongly disagree) to 5 (strongly agree). Question 38, which is part of the intent to leave section, is rated differently as shown within the questionnaire.

For the management traits, high scores correspond to a very strong existence of a particular trait, while lower scores correspond to a weak existence. A similar relationship applies to the identification and commitment dimensions, while lower scores signify lower existence and higher scores signify higher existence of the dimensions. For intention to leave, a high score indicates a strong intention to leave, while a low score indicates a low intention to leave.

Table 1

Demographic Data of Respondents - Gender

Gender	Respondents	Percentage
Male	49	86.0%
Female	8	14.0%
Total	57	

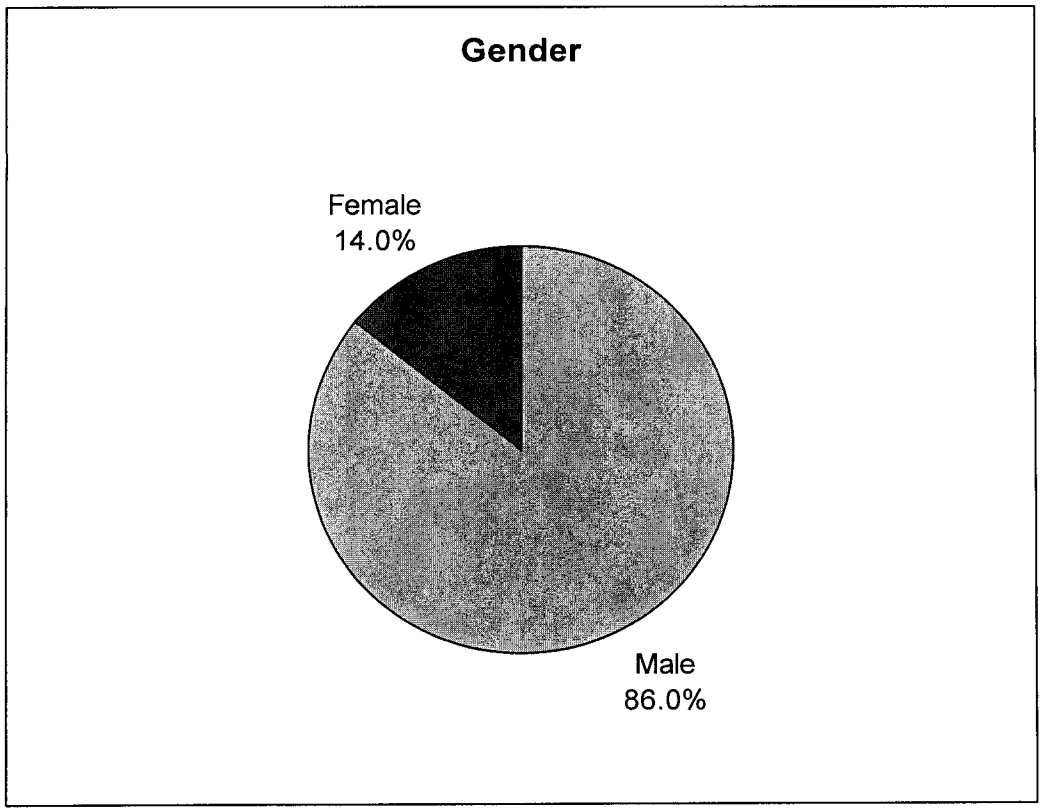


Figure 1. Graphical representation of respondents – gender.

Table 2

Demographic Data of Respondents - Age

Age	Respondents	Percentage
Under 33 yrs.	10	17.5%
33 yrs.+	47	82.5%
Total	57	

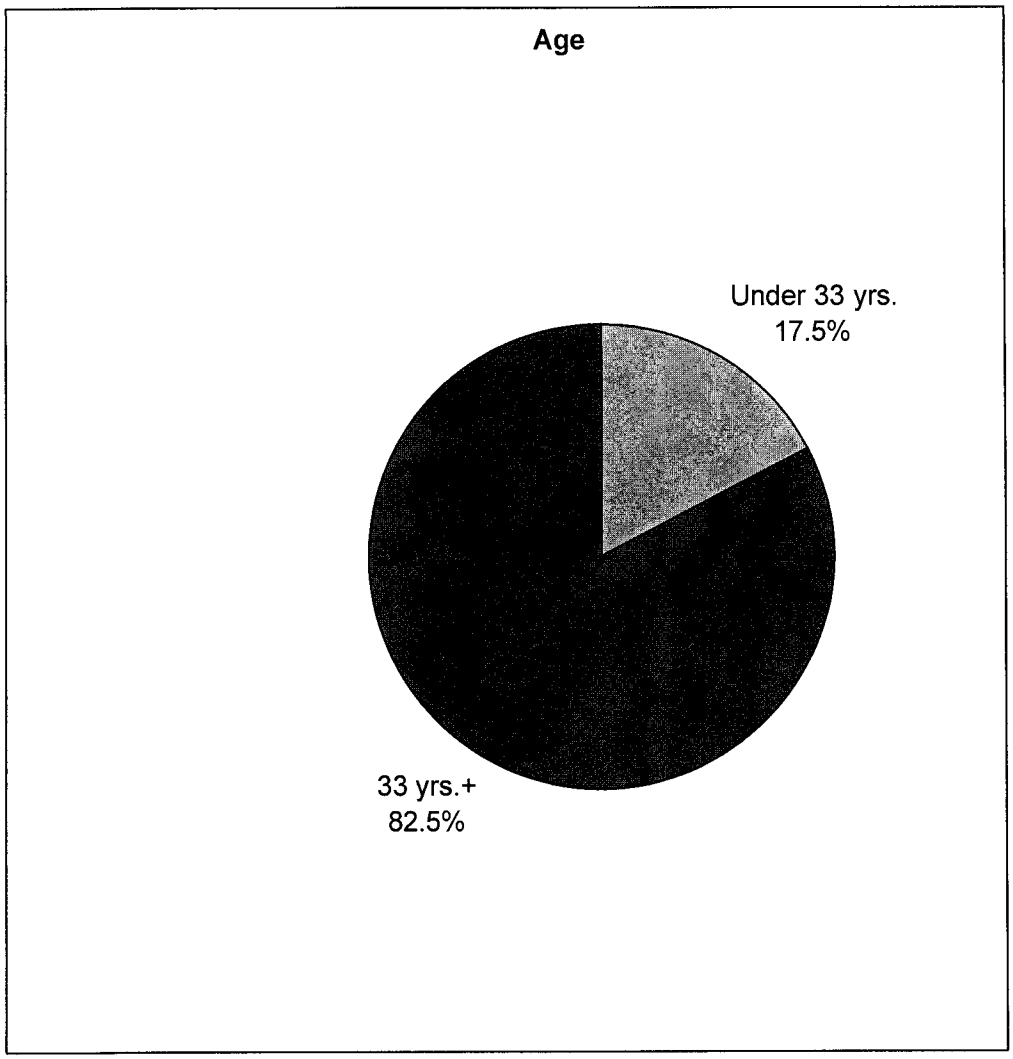


Figure 2. Graphical representation of respondents – age.

Table 3

Demographic Data of Respondents - Education

Education	Respondents	Percentage
No bachelor degree	6	10.5%
Bachelor degree	11	19.3%
Graduate degree	40	70.2%
Total	57	

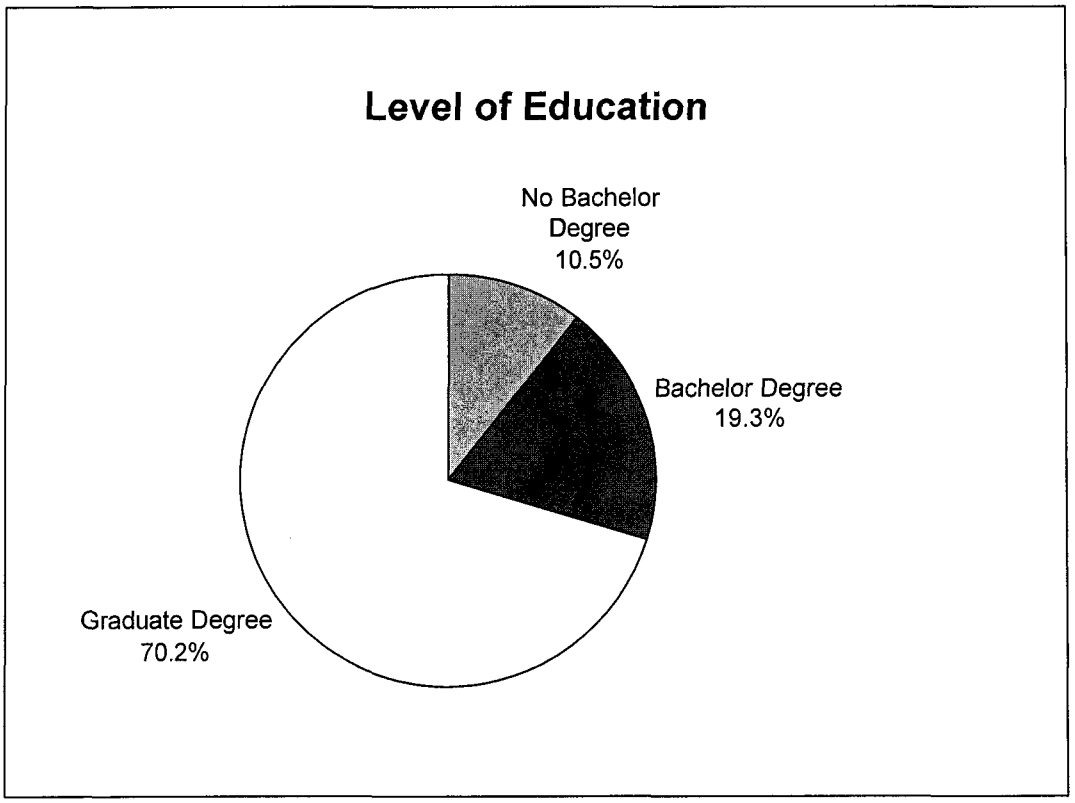


Figure 3. Graphical representation of respondents – education.

Table 4

Demographic Data of Respondents - Years in Company

Yrs in company	Respondents	Percentage
0-5 yrs.	39	68.4%
6-10 yrs.	12	21.1%
More than 10 yrs.	6	10.5%
Total	57	

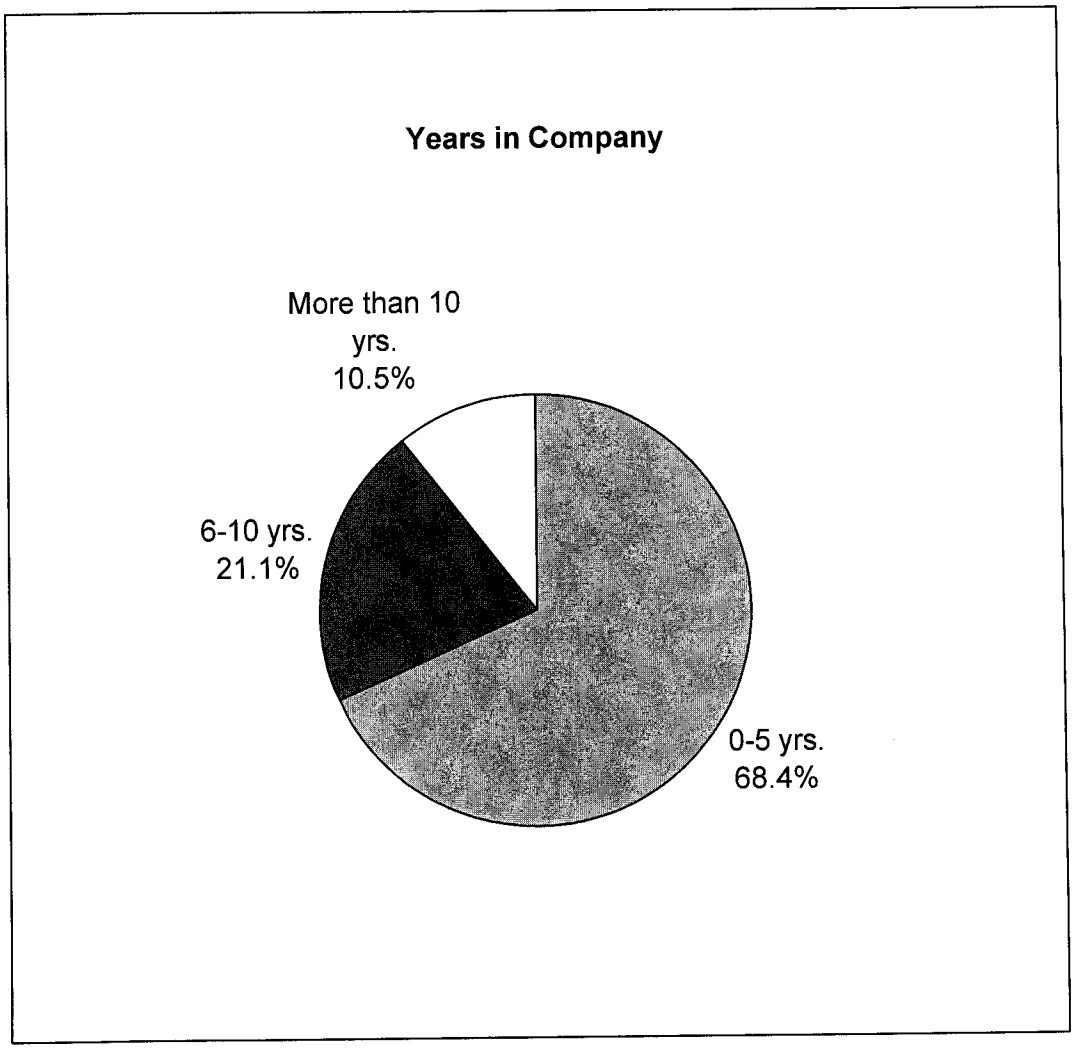


Figure 4. Graphical representation of respondents – years in company.

Table 5

Demographic Data of Respondents - Years of Experience as Engineer

Experience	Respondents	Percentage
0-9 yrs.	12	21.1%
10-19 yrs.	29	50.9%
20 yrs.+	16	28.1%
Total	57	

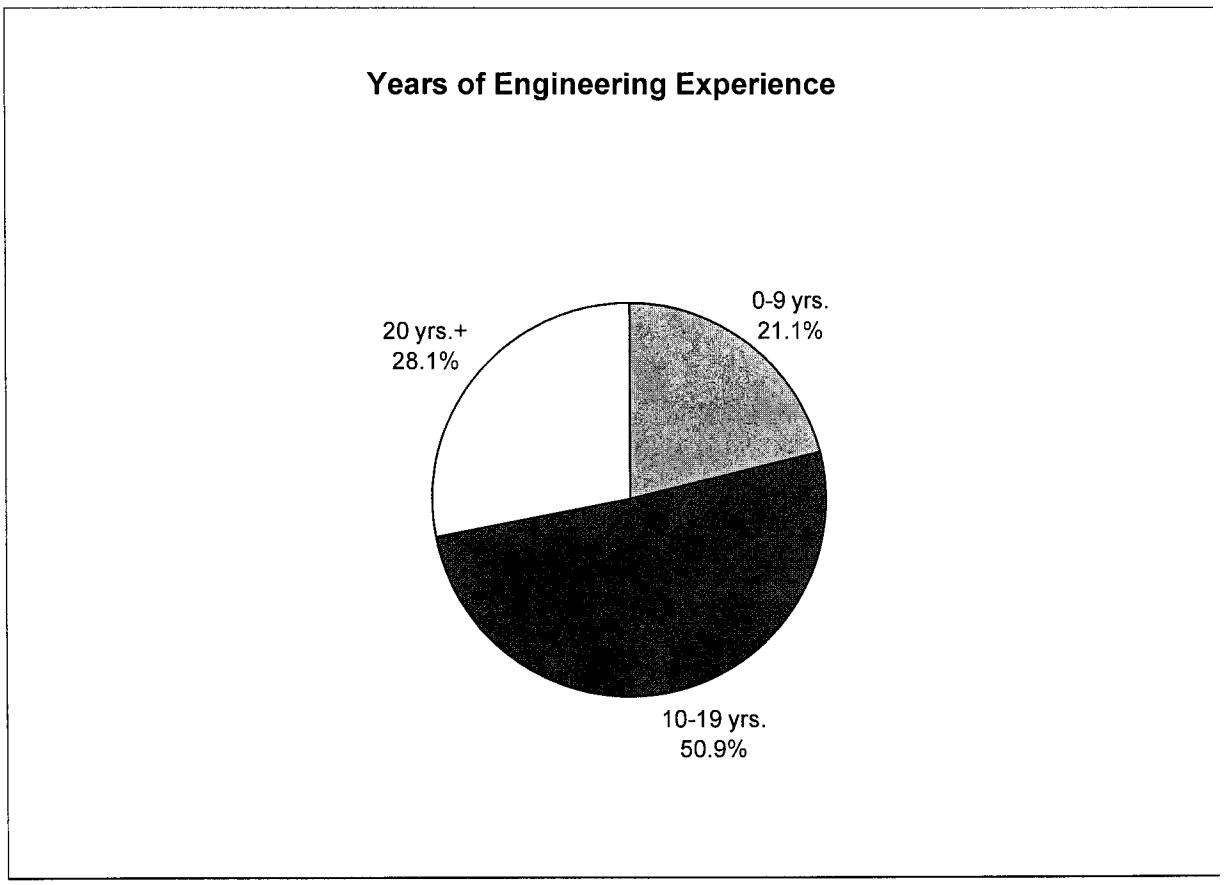


Figure 5. Graphical representation of respondents – years of experience as engineer.

Table 6

Aggregate Trait and Commitment Mean Scores and Standard Deviations Based on Gender

Management trait		Gender	
		Female	Male
Team building	Mean score	3.73	3.64
	Standard deviation	*1.07*	*0.76*
Expertise	Mean score	4.54	4.29
	Standard deviation	*0.50*	*0.65*
Initiative	Mean score	3.54	3.37
	Standard deviation	*0.96*	*0.85*
Persistence	Mean score	3.71	3.58
	Standard deviation	*1.10*	*0.97*
Integrity	Mean score	4.04	3.71
	Standard deviation	*0.88*	*0.84*
Vision	Mean score	3.04	3.31
	Standard deviation	*1.10*	*0.70*
Communication	Mean score	4.08	3.73
	Standard deviation	*0.81*	*0.74*
Accountability	Mean score	3.96	3.69
	Standard deviation	*0.70*	*0.74*
Courage	Mean score	3.75	3.65
	Standard deviation	*1.08*	*0.85*
Aggregate trait	Mean score	3.82	3.66
	Standard deviation	*0.86*	*0.59*
Commitment dimension			
Identification commitment	Mean score	3.71	3.55
	Standard deviation	*1.30*	*1.10*
Compliance commitment*	Mean score	2.75	3.30
	Standard deviation	*0.24*	*0.70*
Intent to leave	Mean score	3.16	2.88
	Standard deviation	*1.76*	*1.01*

*Significant at the .05 level.

Table 7

Aggregate Trait and Commitment Mean Scores and Standard Deviations Based on Age

Management trait		Age	
		<33 yrs	33 yrs+
Team building	Mean score	3.52	3.68
	Standard deviation	*0.78*	*0.81*
Expertise	Mean score	4.07	4.38
	Standard deviation	*0.60*	*0.63*
Initiative	Mean score	3.93	3.28
	Standard deviation	*0.52*	*0.87*
Persistence	Mean score	3.77	3.56
	Standard deviation	*0.92*	*1.00*
Integrity	Mean score	3.87	3.73
	Standard deviation	*0.77*	*0.87*
Vision	Mean score	3.47	3.23
	Standard deviation	*0.76*	*0.76*
Communication	Mean score	3.97	3.74
	Standard deviation	*0.76*	*0.75*
Accountability	Mean score	3.93	3.69
	Standard deviation	*0.44*	*0.78*
Courage	Mean score	3.87	3.62
	Standard deviation	*0.69*	*0.91*
Aggregate trait	Mean score	3.82	3.66
	Standard deviation	*0.52*	*0.65*
Commitment dimension			
Identification commitment	Mean score	3.27	3.64
	Standard deviation	*1.15*	*1.12*
Compliance commitment	Mean score	3.13	3.24
	Standard deviation	*0.77*	*0.67*
Intent to leave**	Mean score	3.55	2.79
	Standard deviation	*0.79*	*1.15*

**Significant at the .10 level.

Table 8

Aggregate Trait and Commitment Mean Scores and Standard Deviations Based on Level of Education

Management trait		Highest level of education		
		No bachelor	Bachelor	Graduate
Team building	Mean score	4.33	3.55	3.58
	Standard deviation	*0.27*	*0.90*	*0.79*
Expertise	Mean score	4.28	3.94	4.43
	Standard deviation	*0.80*	*0.76*	*0.53*
Initiative	Mean score	4.00	3.15	3.37
	Standard deviation	*0.60*	*0.64*	*0.91*
Persistence	Mean score	4.00	3.48	3.57
	Standard deviation	*0.87*	*1.14*	*0.96*
Integrity	Mean score	3.83	3.55	3.80
	Standard deviation	*1.01*	*1.05*	*0.78*
Vision	Mean score	4.17	2.97	3.23
	Standard deviation	*0.18*	*0.62*	*0.76*
Communication	Mean score	4.39	3.61	3.74
	Standard deviation	*0.57*	*0.59*	*0.78*
Accountability	Mean score	4.44	3.94	3.57
	Standard deviation	*0.27*	*0.55*	*0.76*
Courage	Mean score	3.83	3.97	3.55
	Standard deviation	*1.01*	*0.88*	*0.85*
Aggregate trait	Mean score	4.14	3.57	3.65
	Standard deviation	*0.36*	*0.69*	*0.62*
Commitment dimension				
Identification commitment*	Mean score	4.11	2.64	3.75
	Standard deviation	*0.40*	*1.19*	*1.04*
Compliance commitment*	Mean score	3.50	2.58	3.36
	Standard deviation	*0.46*	*0.37*	*0.68*
Intent to leave	Mean score	3.46	3.11	2.79
	Standard deviation	*0.53*	*1.27*	*1.14*

*Significant at the .05 level.

Table 9

Aggregate Trait and Commitment Mean Scores and Standard Deviations Based on Number of Years in Company

Management trait		Years in company		
		0-5 yrs	6-10 yrs	>10 yrs
Team building	Mean score	3.58	3.83	3.77
	Standard deviation	*0.62*	*1.00*	*1.35*
Expertise	Mean score	4.28	4.17	4.89
	Standard deviation	*0.57*	*0.80*	*0.17*
Initiative	Mean score	3.33	3.28	4.11
	Standard deviation	*0.89*	*0.72*	*0.50*
Persistence	Mean score	3.52	3.78	3.83
	Standard deviation	*0.85*	*1.22*	*1.30*
Integrity	Mean score	3.70	3.86	3.94
	Standard deviation	*0.71*	*1.10*	*1.16*
Vision	Mean score	3.20	3.22	4.00
	Standard deviation	*0.74*	*0.78*	*0.47*
Communication	Mean score	3.62	3.89	4.56
	Standard deviation	*0.72*	*0.74*	*0.50*
Accountability	Mean score	3.62	4.11	3.72
	Standard deviation	*0.69*	*0.62*	*1.04*
Courage	Mean score	3.38	4.22	4.44
	Standard deviation	*0.75*	*0.86*	*0.62*
Aggregate trait	Mean score	3.58	3.82	4.14
	Standard deviation	*0.68*	*0.60*	*0.57*
Commitment dimension				
Identification commitment*	Mean score	3.56	3.03	4.83
	Standard deviation	*0.93*	*1.46*	*0.18*
Compliance commitment*	Mean score	3.43	2.72	2.94
	Standard deviation	*0.68*	*0.55*	*0.33*
Intent to leave*	Mean score	3.14	2.98	1.33
	Standard deviation	*0.97*	*1.26*	*0.20*

*Significant at the .05 level.

Table 10

Aggregate Trait and Commitment Mean Scores and Standard Deviations Based on Years of Experience as Engineer

Management trait		Total experience as engineer		
		0-9 yrs	10-19 yrs	20 yrs+
Team building	Mean score	3.82	3.43	3.93
	Standard deviation	*0.90*	*0.77*	*0.71*
Expertise	Mean score	4.42	4.14	4.58
	Standard deviation	*0.77*	*0.69*	*0.39*
Initiative	Mean score	3.61	3.20	3.58
	Standard deviation	*0.60*	*0.80*	*0.88*
Persistence	Mean score	3.61	3.30	4.13
	Standard deviation	*1.08*	*0.86*	*0.88*
Integrity	Mean score	3.53	3.64	4.13
	Standard deviation	*1.10*	*0.79*	*0.70*
Vision	Mean score	3.78	2.93	3.52
	Standard deviation	*0.67*	*0.71*	*0.63*
Communication	Mean score	3.83	3.60	4.08
	Standard deviation	*0.78*	*0.86*	*0.69*
Accountability	Mean score	4.14	3.38	4.06
	Standard deviation	*0.56*	*0.69*	*0.65*
Courage	Mean score	3.92	3.38	3.98
	Standard deviation	*0.78*	*0.93*	*0.71*
Aggregate trait	Mean score	3.85	3.44	4.00
	Standard deviation	*0.68*	*0.60*	*0.50*
Commitment dimension				
Identification commitment	Mean score	3.53	3.44	3.85
	Standard deviation	*1.51*	*0.99*	*0.99*
Compliance commitment	Mean score	3.42	3.08	3.33
	Standard deviation	*0.81*	*0.60*	*0.76*
Intent to leave*	Mean score	3.10	3.22	2.25
	Standard deviation	*0.63*	*0.88*	*1.15*

*Significant at the .05 level.

Comparative analysis of the mean responses was performed using analysis of variance (ANOVA). The ANOVA used to test for statistically significant difference(s) among the means of the dependent variables used in the study are presented in Appendix E. For each commitment dimension, the significance of the concomitant factors, which are: gender, age, highest level of education, years of service in organization, and years of experience as an engineer, and their interactions, were analyzed.

When significant main effects or interactions were found, further analysis was carried out on the level of education, years of service with company, and years of experience as engineer comparative groups to determine which factors' levels contributed to the significant differences. The Tukey-Kramer *post hoc* multiple-comparison procedure was used for this purpose (Hinkle, Wiersma, & Jurs, 1998); their results are shown in Appendix E. Simple effects and cell plots for significant interactions among the factors considered in the study are presented and also included in Appendix E.

Correlation analysis was performed to investigate the relationship between aggregate trait mean scores and the commitment dimensions. Pearson Product-Moment Correlation Coefficient *(r)* analysis was used for this purpose. The analysis was expanded to explore the associations among the commitment dimensions. The value of r can vary from -1.0 to +1.0, with the sign signifying the direction of the relationship while the absolute value indicates the strength. The level of statistical significance of the Pearson Product-Moment Correlation Coefficient *(r)* for each test was also reported. Table 11 shows the summary correlation table.

Table 11

Summary of Correlation among Parameters

		Aggregate trait	Identification commitment	Compliance commitment	Intent to leave
Aggregate trait	Pearson correlation	1	0.64 (**)	0.23	-0.55 (**)
	Significance (2-tailed)		0.000	0.087	0.000
Identification commitment	Pearson correlation		1	0.55(**)	-0.65(**)
	Significance (2-tailed)			0.000	0.000
Compliance commitment	Pearson correlation			1	-0.28(*)
	Significance (2-tailed)				0.037
Intent to leave	Pearson correlation				1
	Significance (2-tailed)				

* Correlation is significant at the 0.05 level (2-tailed).

** Correlation is significant at the 0.01 level (2-tailed).

The results revealed moderate positive correlations between aggregate management trait scores and identification commitment ($r = 0.64$), and between identification commitment and compliant commitment ($r = 0.55$); both were significant at .01 level. Moderate negative correlations were found, at .01 level of statistical significance, between management traits and intention to leave ($r = -0.55$), and identification commitment and intention to leave ($r = -0.65$). The detailed results and scatter plots for the correlated scores are shown in Appendix F.

Response frequencies from each question in the survey were compiled to show the percentage and number of respondents at each level of the five-point Likert scale. The mean score and standard deviation of each question were also calculated, as shown in Appendix G. (Question 30 was not applicable to one of the respondents who was a contractor, and not an employee of the organization in question. Hence, there were 56 respondents to that particular question.)

Appendix H contains a graphical representation of the mean scores of question responses within the different comparative groups, while Appendix I shows the mean scores for the comparative groups. Responses to the open-ended questions are presented in Appendix J.

Analysis and Evaluation of Findings

Hypothesis 1 – Identification commitment

Engineers whose managers demonstrate high aggregate management traits will display high levels of identification commitment.

Pearson Product-Moment Correlation Coefficient *(r)* analysis was used to determine if any significant relationship exists between reported perceived aggregate management traits and identification commitment. The aggregate management traits were calculated as the means of all the management trait mean scores for each respondent. The data are presented in Appendix F.

The value of r was determined to be 0.64 and was significant at the .01 level, which indicates a moderate positive correlation between perceived management traits and identification commitment. This result supports the first hypothesis.

As previously stated, the identification commitment construct represents attitudes and behaviors that are adopted in order to gain association with a valued third party--in this case an organization. The result is therefore not surprising since managers are typically the primary link between engineers and the organization as an entity. If engineers are well treated by their management, and the engineers feel very highly of their management in terms of managerial skills, they are likely to develop a desire for identification with the organization.

The results were also stratified into the pre-defined comparative groups as shown in Tables 6 through 10. Analysis of variance (ANOVA) was used to determine if there were any significant differences among the identification commitment mean scores of the different variables (Appendix E). In the gender classification, Table 6 shows that female respondents have slightly higher identification commitment mean scores ($M = 3.77$, $SD = 1.30$) than their male counterparts ($M = 3.55$, $SD = 1.10$). However, the main effects in the ANOVA, shown in Table E1, did not indicate any statistically significant difference between the two identification commitment means ($p > .05$). The mean scores for each

question in this category are shown in Figure H10. Figure I2 shows a graphical representation of the mean scores for all the commitment dimensions in the gender comparative group.

The age comparative group results also reflected no significant difference ($p > .05$) in the main effects of identification commitment mean scores when ANOVA were performed (Table E2). While no statistically significant difference was observed, Table 7 shows that older respondents (33 yrs.+) reported a higher identification commitment mean score ($M = 3.64$, $SD = 1.12$) than younger respondents ($M = 3.27$, $SD = 1.15$) who are less than 33 years old. Figure H22 shows the mean scores for each of the three questions in the identification commitment dimension. The mean scores for all the commitment dimensions in the age comparative group are shown in Figure I4.

There was a significant interaction effect between age and years of service with company, $F(1, 52) = 10.16$, $p < .10$ (Table E12) and identification commitment. The output of the simple effects test of these factors is also shown in Table E13. It shows that the identification commitment of engineers with 6 – 10 years of service is dependent upon age. Specifically, within the group with six to ten years of service, older engineers (33 years or older) show more identification commitment than their younger colleagues (less than 33 years of age).

The ANOVA analysis of the years of experience as an engineer factor indicated no statistical significance in the main effects of identification commitment mean scores ($p > .05$). This is shown in Table E5. Table 10 shows slightly different identification commitment mean scores within this group. Figure H58 shows the mean scores for the questions related to identification commitment dimension for the years of experience as

an engineer comparative group. Figure I10 shows the mean scores for all the commitment dimensions in this group.

The highest level of education comparative group demonstrates a statistically significant difference in the main effects of identification commitment mean scores as shown in Table E3 ($p < .05$). While this indicates that a statistically significant difference exists within this cluster, it does not shed light on which pair(s) show(s) statistical significance. The Tukey-Kramer multiple comparison algorithm (Hinkle, Wiersma, & Jurs, 1998) was used to clarify which of the identification commitment mean scores are indeed statistically significant. The results of this procedure are shown in Table E6. The results show statistical significance in the main effects of identification commitment mean scores of the following pairs: between bachelor's degree and graduate degree ($p < .05$), and between bachelor's degree and those without bachelor's ($p < .05$). The mean scores for identification commitment based on highest level of education are presented in Table 8.

The survey therefore also shows that engineers with bachelor's degrees had lower levels of identification commitment ($M = 2.64$, $SD = 1.19$) than those who hold either graduate degrees ($M = 3.75$, $SD = 1.04$) or those without bachelor's degrees ($M = 4.11$, $SD = 0.40$). Figure H34 shows the identification commitment mean scores for each question in this cluster. The mean scores for all the commitment dimensions in the highest level of education comparative group are shown in Figure I6.

In terms of years of service with the company, there is statistically significant difference in the main effects of identification commitment mean scores ($p < .05$) (Table E4). The Tukey-Kramer procedure was again used to sort which of the mean scores

statistically differ. As depicted in Table E7, the pairs of identification mean scores that are statistically significant ($p < .05$) are 6 to 10 years of service and more than 10 years of service, and 1 to 5 years of service and more than 10 years of service.

Similarly, Table 9 shows the identification commitment mean scores based on years of service. From this table, it can be inferred that engineers with more than 10 years of service with their respective companies will show higher levels of identification commitment to the company ($M = 4.83$, $SD = 0.18$) than those with less years of service. That is, six to ten years ($M = 3.03$, $SD = 1.46$), or one to five years of service ($M = 3.56$, $SD = 0.93$). Figure H46 shows the mean scores for each of the questions in this category. Figure I8 shows the mean scores for all the commitment dimensions in the years of service within the company's comparative groups.

The statistical difference among respondents with more than 10 years of service is supported by other research literature. Yates (2002) notes that longer serving employees are expected to display relatively higher identification commitment levels during which period they would have embraced the organization's core values. The study also suggests that those who did not embrace the core values would be more likely to have left the organization.

As discussed earlier, a significant interaction effect was observed between age and years of service with a company, $F(1, 52) = 10.16$, $p < .10$ (Table E12). The result of the simple effects test of these factors is also shown in Table E13. It shows that age has an impact on the identification commitment of engineers with six to ten years of service. Older engineers (33 years or older) with six to ten years of service demonstrate more

identification commitment than their younger colleagues (less than 33 years of age) with the same length of service.

In summary, since there is a moderate positive correlation between perceived management traits and identification commitment, the research hypothesis is accepted.

Hypothesis 2 – Compliance commitment

Engineers whose managers demonstrate low aggregate management traits will display high levels of compliance commitment.

The relationship (if any) between perceived aggregate management traits and compliance commitment was investigated using the Pearson Product-Moment Correlation Coefficient *(r)* analysis. The aggregate management traits were calculated as the means of all the management trait mean scores for each respondent. The data are presented in Appendix F. The value of r was determined to be 0.23, with no statistical significance at the .01, .05 or .10 level. This shows little if any relationship between management traits and compliance commitment. This is contrary to the research hypothesis, which proposed a negative correlation between the two. This points to the possibility of management traits being a non-factor as far as compliance commitment is concerned. Further investigation, reported later in this chapter, explores the correlation among the commitment dimensions (i.e., identification compliance vs. compliance commitment; identification compliance vs. intent to leave; and compliance commitment vs. intent to leave). The compliance commitment dimensions mean scores are shown in Tables 6 through 10. Results of the ANOVA used to explore the possibility of significant difference are shown in Appendix E.

Table 6, which stratified the results based on gender, shows a higher compliance commitment mean score for male respondents ($M = 3.30$, $SD = 0.70$) than their female counterparts ($M = 2.75$, $SD = 0.24$). ANOVA also supported this observation by returning a statistically significant difference ($p < .05$) in the main effects of the compliance commitment mean scores of the two groups of respondents (Table E1). Figure H11 shows the compliance commitment mean scores for each question under this dimension, while Figure I2 shows the mean scores for all the commitment dimensions in the gender category.

With regard to age, the results of Table 7 show slightly higher compliance commitment mean scores for older engineers ($M = 3.24$, $SD = 0.67$) than for their younger counterparts ($M = 3.13$, $SD = 0.77$), but the results of the ANOVA (Table E2) did not statistically support this ($p > .05$). Figure H23 shows the mean scores for each of the questions in the compliance commitment dimension for the age category. Mean scores of all the commitment dimensions in the age category are presented in Figure I4.

For the highest level of education attained factor, Table 8 shows the compliance commitment mean scores by highest level of education attained, while Figure H35 shows the compliance commitment mean scores per question in this category. Figure I6 shows a graphical representation of the commitment dimension mean scores by highest level of education. The ANOVA (Table E3) demonstrates the statistically significant difference in the main effects of the compliance commitment mean scores vs. level of education ($p < .05$).

Further analysis was undertaken using the Tukey-Kramer procedure to determine which pairs of mean scores statistically differ. The results are shown in Table E8. The

pairs that show statistical significance are bachelor's degree and graduate degree ($p < .05$), and between bachelor's degree and those without the bachelor's ($p < .05$). From Table 8, it can therefore be inferred that both non-degree ($M = 3.50$, $SD = 0.46$) and graduate degree holders ($M = 3.36$, $SD = 0.68$) show more compliance commitment than do their bachelor's degree counterparts ($M = 2.58$, $SD = 0.37$), regardless of their managers' perceived managerial traits.

For the factor years of service with company, the commitment dimension mean scores are presented in Table 9. The ANOVA for this category, summarized in Table E4, shows a statistical significance of the compliance commitment mean scores ($p < .05$). Again, the Tukey-Kramer *post-hoc* method was used to investigate this, as shown in Table E9. The output shows a statistical significance difference ($p < .05$) in the main effects of the compliance commitment mean scores for respondents that have been with the company for 6-10 years ($M = 2.72$, $SD = 0.55$) and those that have less than 6 years of service ($M = 3.43$, $SD = 0.68$). This indicates that respondents with up to 5 years of service have a higher compliance commitment than those who have been with their companies longer, regardless of their managers' perceived managerial traits. This is consistent with earlier studies (Durkin & Bennett, 1999; Bennett & Durkin, 2000). Figure H47 shows the compliance commitment mean scores of individual questions in this category, while the commitment scores by years of service are presented in Figure I8.

ANOVA for the years of experience as an engineer comparative group is shown in Table E5. No statistically significant difference was observed between the main effects of the compliance commitment mean scores in this group ($p > .05$). Table 10 shows the compliance commitment mean scores for the different years of experience ranges, while

Figure H59 shows the mean scores for each of the questions relating to compliance commitment for the years of experience as an engineer group. Figure I10 also shows a graphical representation of the commitment dimension mean scores for this group.

No statistically significant interaction ($p > .05$) was found in the compliance commitment scores among the factors and, as such, no further evaluation was required.

In summary, since there is little or no correlation between perceived management traits and compliance commitment, the research hypothesis is rejected.

Hypothesis 3 – Intent to leave

Engineers whose managers demonstrate high aggregate management traits will show low levels of intent to leave.

Pearson Product-Moment Correlation Coefficient *(r)* analysis was also used to determine the relationship between perceived aggregate management traits and intent to leave. As previously stated, the aggregate management traits were calculated as the means of all the management trait mean scores for each respondent. The data are presented in the scatter plot of Appendix F.

The value of r was determined to be -0.55 and was significant at the .01 level. This signifies a moderate negative correlation between perceived management traits and intent to leave. This result is in agreement with the hypothesis. This is a very logical result as engineers whose managers exhibit high management traits will most likely want to remain in their current position. While other factors and their interactions might militate against their staying with the company, the effect of management traits still made strong impact on intention to leave. The intent to leave data are included in Tables 6 through

10, while Appendix E presents the ANOVA tables used to investigate the differences in the intent to leave mean scores of the different comparative groups.

The results for the gender category, shown in Table 6, indicate a higher intent to leave mean scores for female ($M = 3.16$, $SD = 1.76$) than male respondents ($M = 2.88$, $SD = 1.01$). However, as shown in Table E1, there is no statistically significant difference between the main effects of the two mean scores ($p > .05$). Figure H12 shows the intent to leave mean scores per question within the gender section of the survey, while Figure I2 shows the mean scores for the commitment dimension in the gender comparative group.

A significant interaction effect was observed between intent to leave mean scores of education and gender $F(2, 52) = 3.46$, $p < .05$ (Table E16). The output of the simple effects tests for these factors, which is presented in Table E17, indicates that female engineers with bachelor's degrees show more intent to leave than those with graduate degrees for the same mean aggregate level of perceived management traits.

Table 7 shows that the intent to leave mean scores for older respondents (33 and over) are lower ($M = 2.79$, $SD = 1.15$) than their younger counterparts ($M = 3.55$, $SD = 0.79$). Figure H24 shows the mean score for this comparative group, while Figure I4 shows the commitment dimension mean scores for the age category. From the information above it is clear that older respondents report lower intent to leave scores for a given level of perceived managerial skill than do younger engineers.

Table 8 shows the mean scores for the highest level of education comparative group and Figure H36 shows the intent to leave mean scores per question in this category. Figure I6 also shows a graphical representation of all the commitment dimension mean scores by highest level of education. The ANOVA in Table E3 shows no significant

difference in the intent to leave mean scores ($p > .05$). This implies that the level of education has no effect on respondents' intent to leave their company regardless of their managers' perceived managerial traits.

While no indication of significance was found in the main effect of education on intent to leave, education has a significant interaction effect with both gender $F(2, 52) = 3.46, p < .05$ (Table E16) and experience as engineer $F(2, 49) = 7.08, p < .05$ (Table E14). Output of the simple effects tests for education and years of experience is shown in Table E15. The table shows that the intent to leave of engineers with 20 or more years of experience is dependent upon level of education. Specifically, within the group with 20 or more years of experience, those with graduate degrees show less intent to leave their employing company than those with only bachelor's degrees. Output of the simple effects tests for education and gender is shown in Table E17. The table indicates that female engineers with bachelor's degrees show more intent to leave than those with graduate degrees.

For the years of service factor, the intent to leave mean scores are included in Table 9. The ANOVA in Table E4 shows that there is a statistically significant difference in mean scores ($p < .05$). Tukey-Kramer procedure, shown in Table E10, specifically indicates a statistically significant difference between intent to leave mean scores of respondents with more than ten years of service and those who have put in less time. It is therefore inferred that respondents with more than ten years of service show less intention to leave than their colleagues with less years of service, regardless of their managers' perceived managerial traits. This result is not surprising as engineers identify with the values of the company as they stay longer and most of those that wanted to leave

would have left prior to ten years of service. In addition, after ten years of service, most engineers will be looking forward to their long-term benefits when they retire from their company. Figure H48 shows the intent to leave mean scores for individual questions in this category, while the commitment dimension scores for the years of service group is presented in Figure I8.

Table 10 shows the intent to leave mean scores for the different years of engineering experience group. The corresponding ANOVA, shown in Table E5, indicates a statistical significance in the main effects of the intent to leave mean scores in this group ($p < .05$). This implies that years of experience as an engineer has an impact on respondents' intent to leave. Tukey-Kramer procedure, shown in Table E11, indicates that regardless of their managers' perceived managerial traits, engineers with at least 20 years of experience show lower intent to leave their employing company than do their younger colleagues. This outcome should be expected, as more experienced engineers would have tried several organizations before deciding on their current employment, and if conditions are conducive they would prefer to retire at their current company. Figure H60 shows the mean scores for each of the questions relating to intent to leave for the years of experience as an engineer category. Figure I10 shows a graphical representation of all the commitment dimension mean scores for the years of engineering experience comparative group.

Further analyses reveal an interaction between years of experience as engineer and years of service with company, which further indicates that [$F(2, 49) = 5.36, p < .05$ for respondents with 6-10 years of experience within company and $F(2, 49) = 6.28, p < .05$ for those with more than 10 years of experience within a company] (Table E18). The

output of the simple effects test is presented in Table E19. The table shows that within respondents with at least 10 years of engineering experience, those with 10 or more years of service within their employing company have less intent to leave than those who have put in less than ten years.

As previously discussed, education also has a significant interaction effect with years of experience as engineer $F(2, 49) = 7.08, p < .05$ (Table E14). The output of the simple effects tests for education and years of experience, shown in Table E15, indicates that the intent to leave of engineers with 20 or more years of experience is dependent upon their level of education. Specifically, within the group with 20 or more years of experience, those with graduate degrees show less intent to leave their employing company than those with only bachelor's degrees.

In summary, since there is moderate positive correlation between perceived management traits and intent to leave, the research hypothesis is accepted.

Commitment Dimension Relationships

Correlation analysis was also performed between pairs of commitment dimensions using the Pearson Product-Moment Correlation Coefficient *(r)* statistic. The results are presented in Appendix F.

The value of r for the relationship between identification commitment and intent to leave is -0.65 at .01 levels of statistical significance, which shows moderate negative correlation between the two. This implies that respondents with higher levels of identification commitment have lower intention to leave their respective companies. This

relationship should be expected because those who have identified with the values of the company should have little or no reason to leave.

The scatter plot for the correlation between compliance commitment and intent to leave is also shown in Appendix F. The value of r is -0.28, with a statistical significance level of .05, which shows low to moderate negative correlation. This implies that there is little or no relationship between compliance commitment and respondents' intent to leave.

For the identification commitment versus compliance commitment relationship, the value for r is 0.55, which is statistically significant at the .01 confidence level. This indicates moderate positive correlation between the two commitment dimensions. The results indicate that respondents with a higher identification commitment also are likely to possess a stronger compliance commitment. This finding seems to contradict previous research results reported by Durkin and Bennett (1999) and Bennett and Durkin (2000). This discrepancy might be a result of the current flux in the IT industry. Engineers with high identification commitment seemed to maintain their perception, while being increasingly frustrated by their unstable industry. If things do not get better, the reverse might be true, in which case previous studies by Durkin and Bennett would be supported.

Responses to Open-ended Questions

The open-ended questions were included to collect qualitative information from the respondents. These responses could be valuable in further studies in this area. The summary of the responses is presented below.

? What do you like most about being an engineer?

The creative process is what most respondents reported to be the best part about being an engineer. The technical challenges that come with the job were also cited by most engineers. Some respondents also like the profession because it affords them the use of state-of-the-art tools and emerging technologies to solve problems for the benefit of humanity. Some also noted that it gives them satisfaction and a bigger role in the society.

? What do you like least about being an engineer?

Some respondents dislike the stress level in the industry, while some felt alienated because important decisions are being made from upper management without their input. Some are unhappy about the poor job market, decreasing salaries, and job security for older engineers. A few respondents also reported their unhappiness about dealing with bureaucracy at work. Other responses include lack of control over own time, constantly changing project requirements, communication with non-technical people, sometimes being misunderstood by others, and being trapped into performing repetitive tasks once regarded as an expert in an area.

? What traits did the manager have that made him or her perform well as a manager?

The traits the respondents attributed to good managers are experience, expertise, openness, reliability, integrity, trust, challenge, creativity, calmness, competence,

communication, technical skills, innovation, flexibility, good people skills, responsiveness, involved leadership, vision, good listener, and supportive

? How did the manager assist you in doing your job?

Respondents felt that their managers assisted them in doing their jobs by being given freedom to do their jobs after expectations have been set. Some also mentioned that their managers assisted by promoting creative atmospheres, providing regular feedback, and lending technical expertise when needed. Being an effective interface between engineers and upper management also made the list.

? What traits did he or she have that made him or her a poor manager?

The traits that the respondents reported made bad managers are lack of interpersonal skills, inability to stand up for engineers to upper management, lack of initiative, lack of vision, lack of technical knowledge, not open to suggestions, disorganized, unable to multi-task, failure to delegate power, and low expectations of engineers.

? After your projects were completed, what was the reaction of the manager?

The responses to this question vary from very positive to extremely negative. On the positive end are the following responses from the managers: acknowledgement, congratulations, good performance review, project review, and bonuses being paid when goals are being exceeded. On the negative end of the scale, respondents reported that managers provided no feedback and some actually showed lack of interest.

? Other comments

A respondent added that how hard he worked, and his willingness to work overtime, is determined by how well the company treats its customers, which is very poorly. Another respondent reported working for a matrix organization and did not receive tasks from his manager. Therefore, the responses given were based on the person who assigns him tasks.

Summary

This chapter reported and analyzed the data from 57 respondents, representing 19 percent of the 300 surveys mailed out to investigate the effect of management traits on the commitment of engineers to their organizations. The demographic data was also presented in this chapter.

Correlation analysis was used to explore significant relationships between aggregate management traits and the commitment dimensions considered in this study. Same analyses were also performed to inquire about the relationships among the commitment dimensions. The differences in mean scores within each of the different comparative groups were determined using analysis of variance (ANOVA). Further analyses, when required, were carried out using Tukey-Kramer *post hoc* multiple-comparison procedure.

The research hypothesis that engineers whose managers demonstrate high aggregate management traits will display high levels of identification commitment was

accepted. There was moderate positive correlation between the two scores. Furthermore, there were no significant effects of gender, age, or years of engineering experience on the identification commitment of the respondents to their organization. There were, however, significant differences among the mean scores based on highest level of education and years of service with company.

Engineers with bachelor's degrees showed lower levels of identification commitment than those who held either graduate degrees or those without bachelor's degrees, regardless of their managers' perceived managerial traits. Engineers with more than 10 years of service with their respective companies showed higher levels of identification commitment to the company than those with less years of service; that is, six to ten years, or one to five years of service. A significant interaction effect was also observed between age and years of service with company. Older respondents (33 years or older) with six to ten years of service showed more identification commitment than their younger colleagues (less than 33 years old) for the same level aggregate management trait scores.

There was no significant relationship found between management traits and compliance commitment. This is contrary to the second research hypothesis, which stated that engineers whose managers demonstrate low aggregate management traits would display high levels of compliance commitment. Thus the second research hypothesis was not accepted. However, statistically significant differences were observed among mean scores in the gender, highest level of education and years of service categories. Male respondents reported higher compliance commitment scores than their female counterparts. Both non-degree and graduate degree holders showed

more compliance commitment than their bachelor's degree counterparts do regardless of their managers' perceived managerial traits.

The results also showed that respondents with less than six years of service with their companies have higher levels of compliance commitment than those that have been in the companies longer regardless of their managers' perceived managerial traits. Age and years of engineering experience were found to have no significant association with the compliance commitment scores.

The results of the correlation tests also showed that respondents whose managers demonstrate higher aggregate management trait scores reported lower intention to leave scores. This is in agreement with the research hypothesis, which stated that engineers whose managers demonstrate high aggregate management traits would show low levels of intent to leave. Thus the third research hypothesis was accepted. Gender, age, and highest level of education did not influence the intent to leave scores at the .05 significance level. However, older respondents demonstrated lower intent to leave than those that are younger at the .10 level of significance. Those that have been with their companies for more than ten years demonstrated lower intent to leave scores than those that have put in less than ten years in the company. Respondents with 20 or more years of experience showed lower intent of leaving their employing company than did their younger colleagues.

Significant interactions were found with respect to intent to leave, between education vs. years of experience as engineer; education vs. gender; and years of experience as engineer vs. years of service with company. For respondents with 20 or more years of experience, those with graduate degrees showed less intent to leave their

employing company than those with only bachelor's degrees. Female engineers with graduate degrees also demonstrated less intent to leave than those with bachelor's degrees. For respondents with at least 10 years of engineering experience, those with 10 or more years of service within their employing company showed less intent to leave than those with less than ten years of service.

The study also found that respondents with higher levels of identification commitment have lower intent to leave their respective companies. Those with higher identification commitment were also found to show higher levels of compliance commitment. No relationship was found between compliance commitment and intent to leave.

CHAPTER V

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary

One consequence of the demise of the so called "dot-com boom" that raised the value of IT engineers between the late 1990s to early 2000s is that more engineers are staying with their organizations longer. During the dot-com boom era, engineers and technical professionals typically went with the "highest bidder", with employers trying to retain their services using perks mostly in the form of stock options. Once the boom was over, engineers and technicians have become more hesitant about changing jobs. Most end up reluctantly "hanging in there" despite their frustrations, which range from little or no salary increases to bad employment climate and poor management attitudes.

This trend, which is also a result of economic reality, has presented engineers the opportunity to evaluate their managers' traits, as well as their own commitment to the various organizations where they work. It is believed that if the key sources of engineers' frustrations are addressed, more people will like to stay in their current place of employment long enough to make an impact, instead of looking for new jobs when employment opportunities improve. This will also be a welcome development to employers. The purpose of this study was to investigate the relationship between management traits and the commitment of information technology engineers to their organizations.

The leadership traits or characteristics considered in this research were accountability, communication skills, courage, expertise, integrity, intellect, persistence,

team building and vision. Identification, compliance and intent to leave were the commitment dimensions evaluated.

Several studies that focused on issues such as management traits, effective leadership, management expectation of engineers, and commitment dimensions were reviewed. For example, studies such as Rifkin, Fineman and Ruhnke (1999) focus on a competency model for technical managerial development, while Durkin and Bennett (1999) and Bennett and Durkin (2000) address employee commitment. The studies revealed that engineers and technical professionals have certain set of traits, attitudes and behaviors they desire from their managers. Ironically, it was also discovered from literature that the typical engineer does not want to "move up" the management ladder for several reasons. According to previous studies, when engineers are promoted to managerial positions, they often lack the vital management skills to be a successful manager. This is because management requires a different set of skills, and a very good engineer does not necessarily make a good manager.

The results of the present study showed some significant correlations between management traits and the commitment of engineers to their employing organizations. There was also evidence that statistically significant differences exist in the mean scores among some comparative groups considered in the study. Yates (2002), in a study of survivor employee commitment, also observed similar dependencies. The research also found that engineers with higher levels of identification commitment have lower intent to leave their respective companies. Those with higher identification commitment were also found to show higher levels of compliance commitment. A statistically significant

relationship between compliance commitment and intent to leave could not be established.

Conclusions

This study investigated perceived management traits reported by engineers and their effects on their commitment to their organizations. Nine management traits and three commitment dimensions were defined for the study. Three research hypotheses were formulated to evaluate the responses of the engineers.

Hypothesis 1 – Engineers whose managers demonstrate high aggregate management traits will display high levels of identification commitment.

This hypothesis was accepted. Engineers who reported high aggregate management trait scores for their managers also showed high levels of identification commitment. No significant effects of gender, age or years of engineering experience were found on identification commitment. However, there were significant differences in the mean scores within the highest level of education and years of service with company comparative groups. Engineers with bachelor's degrees showed lower levels of identification commitment than those who held either graduate degrees or those without bachelor's degrees, regardless of their managers' perceived managerial traits. Respondents that have more than ten years of service with their respective companies also demonstrated higher average levels of identification commitment to their employing companies than those with less years of service.

Hypothesis 2 – Engineers whose managers demonstrate low aggregate management traits will display high levels of compliance commitment.

There were no statistically significant relationships between aggregate management traits scores and compliance commitment mean scores. This hypothesis was rejected. The result of the analysis of the various comparative groups showed that there was no effect of age and years of engineering experience on the compliance commitment mean scores. There were statistically significant differences between mean scores in the gender, highest level of education and years of service categories. Male respondents showed higher compliance commitment scores than their female counterparts. Both non-degree and graduate degree holders show more compliance commitment than their bachelor's degree counterparts do regardless of their managers' perceived managerial traits. The results also showed that respondents with less than six years of service with their companies have higher levels of compliance commitment than those that have been in the companies longer.

Hypothesis 3 – Engineers whose managers demonstrate high aggregate management traits will show low levels of intent to leave.

The results were in agreement with this hypothesis, and it was accepted. Respondents whose managers demonstrate higher aggregate management trait scores also reported lower intention to leave scores. Gender, age and highest level of education did not influence the intent to leave scores the .05 significance level. However, older respondents demonstrated lower intent to leave than those that are younger at the .10 level of significance. Those that have been with their companies for more than ten years demonstrated lower intent to leave scores than those that have put in ten years or less in the company. Respondents with 20 or more years of experience showed lower intent of leaving their employing company than did their younger colleagues

Commitment Dimension Relationships

The study found that respondents with higher levels of identification commitment have lower intent to leave their respective companies. Those with higher identification commitment mean scores were also found to show statistically significant higher levels of compliance commitment. No significant relationship was found between compliance commitment and intent to leave.

Recommendations

This research explored management traits of engineering managers and their association with the commitment of engineers in the IT industry. Based on the study, some recommendations are presented that will help further research in this area. The result of this study is expected to allow organizations to focus on developing engineering managerial skills that are positively correlated with employee commitment. A concomitant potential benefit could also be to encourage engineers wishing to transition into management to start preparing themselves for the journey through acquiring and practicing the key managerial skills.

It is suggested that organizations focus on developing management skills of engineers prior to their transition to management positions. Older, more experienced engineers should be especially considered for management training, as they tend to be more concerned about their job security, which is a result of younger engineers coming in with more state-of- the-art skills. Outsourcing has added another dimension to their fears. Their experience should be leveraged, by grooming them into positions such as

project management. That might also open them to the possibilities of managing contemporary issues, such as outsourcing.

Other recommendations include expanding the survey to encompass other areas other than the telecommunications group, expanding the commitment dimensions, identifying and exploring other management traits, and adjusting the comparative group ranges. Broadening the comparative ranges will increase the sample size power and encompass a wider spectrum of engineers. An increased number of respondents would also provide more precise results.

Ongoing studies should be carried out, as the dynamics of the market change. When possible, online surveys should be adopted due to the growing popularity of the Internet as a source of communication, vis-à-vis the regular postal system. More responses are anticipated if the online option is used. It would also be "fair and balanced" to perform corresponding studies of managers to find out their perspectives of their engineers' attitudes, and how they affect the managers in performing their duties. Since other factors apart from traits can also affect engineers' commitment, more research is needed to address this area.

References

1000ventures (n.d.). *The GE Leadership Effectiveness Survey (LES)*. Retrieved June 28, 2004, from http://www.1000ventures.com/business_guide/crosscuttings/tests_leadership_ef_byge.html

Allen, T. J., & Katz, R. (1986). The dual ladder: motivational solution or managerial delusion? *R & D Management, 16*(2), 185-197.

Antonioni, D. (1996). How to lead and facilitate teams. *Industrial Management,38*(6), 22-24.

Basu, R., & Green, S. G. (1997). Leader - member exchange and transformational leadership: An empirical examination of innovative behaviors in leader–member dyads. *Journal of Applied Social Psychology, 27*(6), 477-499.

Bateman, T. S., & Strasser, S. (1984). A longitudinal analysis of the antecedents of organizational commitment. *Academy of Management Journal*, *27*(1), 95-112.

Becker, T. E. (1992). Foci and bases of commitment: Are they distinctions worth making? *Academy of Management Journal*, *35*(1), 232-244.

Becker, T. E., & Billings, R. S. (1992). Profiles of commitment: An empirical test. *Journal of Organizational Behavior, 14,* 177-190.

Bell, B. S., & Kozlowski, S. W. J. (2002). A typology of virtual teams. *Group & Organization Management, 27*(1), 14-49.

Bellinger, R. (1997, September 1). Working Together, *Electronic Engineering Times,* p. 74-79.

Bennett, H., & Durkin, M. (2000). The effects of organisational change on employee psychological attachment. *Journal of Managerial Psychology*, *15*(2), 126-147.

Boehnke, K., DiStefano, A., DiStefano, J. J., & Bontis, N. (1999). Leadership for extraordinary performance. *IEEE Engineering Management Review*, *27*(1), 32-37.

Bozionelos, N., & Lusher, S. (2002). Team leaders' development: Findings from a case study. *Career Development International*, *7*(1), 47-51.

Buchanan, B. (1974). Building organization commitment: The socialization of managers in work organizations. *Administrative Science Quarterly*, *19*(3), 533-46.

Cascio, W. F. (2000). Managing a virtual workplace. *Academy of Management Executive, 14*(3), 81-90.

Champy, J. (1995). *Reengineering Management.* New York: Harper Collins.

Chen, C. C., Ford, C. M., & Farris, G. F. (1999). Do rewards benefit the organization? The effects of reward types and the perceptions of diverse R&D professionals. *IEEE Transactions on Engineering Management, 46*(1), 47-55.

Clarke, T. E. (2002). Why do we still not apply what we know about managing R&D personnel? *Research Technology Management*, *45*(2), 9-11.

Clegg, C. W. (1983). Psychology of employee lateness, absence and turnover: A methodological critique and an empirical study. *Journal of Applied Psychology*, *68*(1), 88-101.

Cohen, J. (1992). A power primer. *Psychology Bulletin*, *112*(1), 155-159

Cordero, R. (1999). Developing the knowledge and skills of R&D professionals to achieve process outcomes in cross-functional teams. *The Journal of High Technology Management Research, 10*(1), 61-78.

Cotton, J. L., & Tuttle, J. M. (1986). Employee turnover: A meta-analysis and review with implications for research. *The Academy of Management Review, 11*(1), 55-70.

DeMarco, T., & Lister, T. (1999). *Peopleware: Productive projects and teams* (2nd ed.). New York: Dorset House Publishing.

Durkin, M., & Bennett, H. (1999). Employee commitment in retail banking: identifying and exploring hidden dangers. *The International Journal of Bank Marketing, 17* (3), 124-135.

Farris, G. F. (1988). Technical leadership: much discussed but little understood. *Research Technology Management, 31*(2), 12-16.

Farris, G. F., & Cordero, R. (2002). Leading your scientists and engineers 2002. *Research Technology Management, 45*(6), 13-25.

Finn, M. (1989). Trends in science and engineering education and the US labor market *Invest in People.* Washington, DC: US Department of Labor.

Fowler, F. (1993). *Survey Research Methods* (2nd ed.). California: Sage Publications, Inc. Newbury Park, USA.

Glen, P. (2003). First among equals: How to manage a group of professionals [Review of the book *First among equals: How to manage a group of professionals*]. *Consulting to Management, 14*(1), 52-53.

Glen, P. (2004). Selecting new IT leaders. *Computerworld, 38*(14), 37.

Gomez-Mejia, L., Balkin, D., & Milkovitch, G. (1990). Rethinking rewards for technical employees. *Organsational Dynamics, 18*(4), 62-75.

Grossman, S. (1997). Turning technical groups into high-performance teams. *IEEE Engineering Management Review, 25*(4), 32-34.

Guest, D. (1987). Human resource management and industrial relations. *Journal of Management Studies, 24*(5), 503-21.

Guest, D. (1989). Human resource management: Its implications for industrial relations and trade unions. In Storey, J. (Ed.), *New Perspectives on Human Resource Management.* London: Routledge.

Gwynne, P. (1997). New roles for scientists. *Research & Development. 39*(10), J+.

Henry, J. E., & Hartzler, M. (1998). *Tools for virtual teams.* Milwaukee, WI: ASQ Quality Press.

Hesketh, B., Gardner, D., & Lissner, D. (1992). Technical and managerial career paths. *International Journal of Career Management, 4*(3), 9-16.

Hinkle, D. E., Wiersma, W., & Jurs, S. G (1998). *Applied statistics for the behavioral sciences (*4th ed.). Boston, MA: Houghton-Mifflin Company.

Hooijberg, R. (1996). A multidirectional approach toward leadership: An extension of the concept of behavioral complexity. *Human Relations., 49*(7), 917-946.

Hunter, M. (2004). Teaming with talent. *Supply Management, 9*(17), 34-35

Institute of Electrical and Electronics Engineers, Inc. (n.d.). *IEEE Direct Mail Lists.* Retrieved January 28, 2005, from http://www.spectrum.ieee.org/ieeemedia/dmail.html

James, G. (1996). *Business wisdom of the electronic elite.* New York: Random House,

Johnson, D., & Sargeant, A. (1998). Motives for transition: An exploratory study of engineering managers. *Human Resources Management Journal, 8*(3), 41-53.

Jones, R. (1983). Utilisation of the engineer. *Enhancing Engineering Careers,* Conference Record. The Institute of Electrical and Electronic Engineers, 3rd IEEE Careers Conference, 81-85.

Jung, D. I., & Avolio, B. J. (1999). Effects of leadership style and followers' cultural orientation on performance in group and individual task conditions. *Academy of Management Journal, 42*(12), 208-218.

Keller, R. T. (1995). Transformational leaders make a difference. *Research Technology Management, 38*(3), 41-44.

Kouzes, J. M., & Posner, B. Z. (1995). *The leadership challenge.* San Francisco: Josey Bass.

Kerber, K. W., & Buono, F. (2004). Leadership challenges in global virtual teams: Lessons from the field. *S. A. M. Advanced Management Journal, 69*(4), 4-10.

Lea, H. D. (1991, October 10-11). Technical management: to be or not to be. *Change and Competitiveness in Careers.* The Institute of Electrical and Electronic Engineers, Biennial IEEE-USA Careers Conference, Conference Record, Denver, CO. pp. 30-32.

Leavy, B. (2003). Understanding and triad of great leadership - context, conviction and credibility. *Strategy & Leadership, 31*(1), 56-60.

Lee, J., Huynh, M., Kwok, R., & Pi, S. (2003). IT outsourcing evolution: past, present, future. *Communications of the ACM, 46*(5), 84.

Leonard-Barton, D. (1995). *Wellsprings of knowledge: Building and sustaining the sources of innovation.* Boston: Harvard Business School Press.

Lipnack, J., & Stamps, J. (1997). *Virtual teams: Reaching across space, time, and*

organizations with technology. New York: Wiley Press.

Lynch, P. D., Eisenberger, R., & Armeli, S. (1999). Perceived organizational support: inferior versus superior performance by wary employees. *Journal of Applied Psychology, 54*(4), 467-483.

Maccoby, M. (1995). Teams need open leaders. *Research Technology Management.* (January-February): 57-59.

Mateas, R. C., & Kleiner, B. H. (1999). Managing human behaviour in the information technology industry. *Management Research News, 22*(2/3), 27-31.

Mathieu, J. E., & Zajac, D. M. (1990). A review of meta-analysis of the antecedents, correlates and consequences of organizational commitment. *Psychology Bulletin, 108*(2), 171-194.

Matthews, J. (2004). The rise of the virtual company. *Supply Management, 9*(15), 32-33.

McMillan, J. H., & Schumacher, S. (2000). *Research in education: A conceptual introduction* (5th ed.). Allyn & Bacon Publishers, USA.

Meyer, J. P., & Allen, N. J. (1990). The measurement and antecedents of affective, continuance, and normative commitment to the organization. *Journal of Occupational Psychology, 63,* 1-18.

Miller, D. B. (1986). *Managing professionals in research and development.* San Francisco: Jossey-Bass.

Miller, D. B. (1988). Challenges in leading professionals. *Research Technology Management.* (January-February): 42-46.

Morris, T., Lydka, H. & O'Creevy, F. (1993). Can commitment be managed? *Human Resource Management Journal, 3*(3), 21-42.

Mowday, R. T., Porter, L. W., & Steers, R. M. (1979). The measurement of organizational commitment. *Journal of Vocational Behavior*, *14*, 224-47.

Mowday, R.T., Porter, L. W., & Steers, R. M. (1982). *Employee-organizations linkages: the psychology of commitment, absenteeism and turnover*. New York: Academic Press.

Moyntoya-Weiss, M. M., Massey, A. P., & Song, M. (2001). Getting it together: Temporal coordination and conflict management in global virtual teams. *Academy of Management Journal, 44*(6), 1251-1262.

Nemeth, C. J. (1998). Managing innovation: when less is more. *IEEE Engineering Management Review, 26*(1), 58-66.

Norusis, M. (2004a). *SPSS 12.0 Guide to Data Analysis.* Upper Saddle River, NJ: Prentice Hall.

Norusis, M. (2004b). *SPSS 12.0 Statistical Procedures Companion.* Upper Saddle River, NJ: Prentice Hall.

O'Reilly, C., & Chatman, J. (1986). Organizational commitment and psychological attachment: The effects of compliance, identification and internalization on pro-social behavior. *Journal of Applied Psychology*, *71*(3), 492-499.

Parker. G. (2003). Leading a team of strangers. *T + D, 57*(2), 21-23.

Pawar, B. S., & Eastman, K. K. (1997). The nature and implications of contextual influences on transformational leadership: A conceptual examination. *Academy of Management Review, 22*(1), 80-109.

Pelled, L. H., & Adler, P. S. (1994). Antecedents of intergroup conflict in multifunctional product development teams: A conceptual approach. *IEEE Transactions in Engineering Management, 41*(1), 21-28.

Pfeffer, J., & Veiga, J. F. (1999). Putting people first for organizational success. *IEEE Engineering Management Review, 27*(3), 50-60.

Porter, L., Steers, R., Mowday, R., & Boulian, P. (1974). Organizational commitment, job satisfaction and turnover among psychiatric technicians. *Journal of Psychology, 59*(1), 603-609.

Price, J. L. (1997). *Handbook of organizational measurement*. Bradford, UK: MCB University Press.

Reichers, A. E. (1985). A review and reconceptualization of organizational commitment. *Academy of Management Revie*w, *10*(3), 465-476.

Rifkin, K. I., Fineman, M., & Ruhnke, C. H. (1999). Developing technical managers-first you need a competency model. *Research Technology Management, 42*(2), 53 -57.

Rosenbaum, B. L. (1990). How successful technical professionals achieve results. *Research Technology Management, 33*(1), 24-26.

Ross, S. M., & Offermann, L. R. (1997). Transformational leaders: Measurement of personality attributes and work group performance. *Personality & Social Psychology Bulletin, 23*(10), 1078-1086.

Santo, B. (1997, August 11). Managing EEs by Feel and by metrics. *Electronic Engineering Times,* pp. 113-114.

Seitz, B. (1997, January 20). The engineering environment – A Teaming Concept. *Design News,* p. 55.

Shapira, Z., & Griffith, T. (1990). Comparing the work values of engineers with managers, production and clerical workers: a multivariate analysis. *Journal of Organization Behaviour, 11*(1), 281-292.

Sipes Salvato, C. D. (2001). *The impact of managerial systems on engineering innovations.* Unbublished doctoral dissertation, Northcentral University, Prescott, Arizona.

Steers, R.M., & Rhodes, S. R. (1978). Major influences on employee attendance: A process model. *Journal of Applied Psychology, 63*(4), 391-407.

Taylor, G., Dahnke, K., Snyder, L., & Kuether, G. (1996). The recipe for a successful R&D team. *Chemtech, 26*(5), 7-10.

Toscano, L., & Waddell, J. (2003). Business transformation outsourcing. *Public Utilities Fortnightly, 4*(2), 30-33.

Tracey, J. B., & Hinkin. T. R. (1998). Transformational leadership or effective managerial practices? *Group & Organization Management, 23*(3), 220-236.

Trent, R. J. (1996). Understanding and evaluating cross-functional sourcing team leadership. *International Journal of Purchasing and Materials Management, 32*(4), 29-36.

Trent, R. J. (2003). Planning to use work teams effectively. *Team Performance Management, 9(3/4)* 50-58.

Ulrich, D. (1997). Measuring human resources: An overview of practice and a prescription for results. *Human Resource Management, 36*(3), 303-320.

Van Fleet, J. K. (1992). *Take control of people in 3 weeks or less.* Paramus, NJ: Prentice Hall.

Visual Statistics (n.d.). *Factorial ANOVA: Simple effects.* Retrieved February 4, 2005, from http://www.visualstatistics.net/web%20Visual%20Statistics%20Studio/SPSS%20workbook/simple_effect.htm

Vitton, S. (1991). Switching career paths in a dual ladder system. *Change and competitiveness in careers,* Conference Record. The Institute of Electrical and Electronic Engineers, Seventh Annual Careers Conference, 89-91.

Wortman, L. A. (1981). *Effective management for engineers and scientists.* New York: John Wiley & Sons.

Yates, D. A. (2002). *Measuring employee response to the effectiveness of corporate restructuring and downsizing and its effect on employee commitment to the organization.* Unpublished doctoral dissertation, Northcentral University, Prescott, Arizona.

Zein, K. A., & Buckler, S. A. (1998). Dreams to market: Crafting a culture of innovation. *IEEE Engineering Management Review, 26*(1), 15-26.

Appendices

Appendix A

Invitation to Participate in a Survey

Dear Engineering Professional,

My name is Oludotun Oni, a design engineer working for a Telecommunications company. I am working on a doctorate degree at the Northcentral University, Prescott, Arizona and need your input for my research project. The project involves collecting information from a random sample of engineers.

Your response will be anonymous. Your company's name will also be anonymous and is not even referenced in the research.

Please complete the following:

1. **Informed Consent Form:** Please complete this form, sign and date it. (This form is a requirement of the university ethics committee). Once received, the form will be separated from the survey to ensure anonymity.

2. **Survey:** Please complete this survey and send it to me, along with the informed consent form in the stamped envelope enclosed. Please do not write your name on the survey.

The results from the survey will be included in the research paper and reported as a group and not by individual survey response. It will take several months to compile the information. The results will be made available to you upon request.

Please complete the above-mentioned forms **within the next week** or so, if possible.

I sincerely appreciate the time you put into helping me in my quest for achieving a doctorate degree in management. I thank you very much.

Sincerely,

Oludotun Oni

Appendix B

Informed Consent Form

Research Title: Identifying and addressing the effect of management traits on the commitment of information technology engineers.

1. You are invited to participate in a research study. The purpose of this study is to the effect of management traits on the commitment of information technology engineers.

2. You will be asked to complete a thirty nine (39)-item questionnaire and six open-ended questions about how you view life and manage your time. The survey will take about 20 minutes of your time.

3. There are no direct benefits to you of participating in this research. No incentives are offered. The results will have scientific interest that may eventually be beneficial to the ways engineers are being treated by management.

4. The data collected in this study are confidential. All data are coded such that your name is not associated with them. In addition, the coded data are made available only to the researchers associated with this project.

5. You have the right to withdraw from the study at any time without penalty. You may omit questions on the questionnaire if you do not want to answer them.

6. If you have further questions, please contact the researcher at the address or phone number below.

Signatures

I have read the above description of the study titled "Identifying and addressing the

effect of management traits on the commitment of information technology engineers" and I understand the conditions of my participation. My signature indicates that I agree to participate in the study.

Participant's Name: _____ Participant's Signature: _____

Date: _____

Researcher's Name: Oludotun Oni Researcher's Signature: _____ Date: _____

E-mail address: dotgo2001@yahoo.com Phone Number: (818) 368 5939 Fax Number: (208) 567 2453

Appendix C

Cover Page for the Survey

Directions: This survey asks for your opinions about management traits and your commitment to the organization you work for.

Please respond based on your own ability, regardless of what you think is expected, or what is acceptable. Consider each item independently, without regard to the other items. There is no time limit, but do not waste time unnecessarily on any one item.

The data collected from this study are confidential. In order to ensure anonymity, the questionnaire will not ask for your name or organization, but will ask you to provide information as shown below. This information will be used only to cluster responses in order to understand how the commitment of different groups of is affected by management traits in their organizations (e.g., group means and medians). The information will not be used to identify or trace the responses of individuals.

Please complete the following items:

Male: _____ Female: _____

Age: Under 28yrs. _____, 28-32yrs._____, over 32yrs._____

Job Position: _____

Highest Level of Education: High School____ Two-year college degree____

Four-year degree_____ Masters degree_____ Doctorate degree_____

Professional certification(s)/license(s):_____

Years of Service within Company: 1 to 5 yrs. __6-10 yrs. _____more than 10 yrs. __

Total years of Experience as an Engineer:_____

Appendix D

Research Instrument

MANAGEMENT TRAITS:

Respond to the following statements using the rating scale provided. Rate each item according to the degree to which it relates to your opinions about your manager. Please base these responses on your opinions about your manager, and not what you hope for or what characteristics you think are ideal for a manager. Circle the number that corresponds to your rating.

***1** - Strongly Disagree **2** - Disagree **3** - Neutral **4** - Agree **5** - Strongly Agree*

Team Building

1. *Provides mentoring and feedback to develop team members to their fullest potential.*

   1 2 3 4 5

2. *Distributes workload to leverage resources.*

   1 2 3 4 5

3. *Delegates duties and empowers team members to maximize effectiveness.*

   1 2 3 4 5

4. *Creates positive and conducive work environment for the team.*

   1 2 3 4 5

5. *Provides inspiration to team members.*

   1 2 3 4 5

Expertise

6. *Possesses technical/professional knowledge and expertise.*

1 2 3 4 5

7. *Exhibits extensive knowledge/understanding of the business.*

1 2 3 4 5

8. *Possess self-confidence in abilities and knowledge.*

1 2 3 4 5

Initiative

9. *Initiates new and improved ways of doing things.*

1 2 3 4 5

10. *Bypasses ineffective procedures and encourages simplicity and clearness.*

1 2 3 4 5

11. *Strives for the use of speed and efficiency.*

1 2 3 4 5

Persistence

12. *Exhibits determination and resiliency when obstacles or difficulties arise.*

1 2 3 4 5

13. *Persistently follows up with team members on uncompleted projects.*

1 2 3 4 5

14. *Persistently follows up with upper management on behalf of team members regarding their requests.*

1 2 3 4 5

Integrity

15. *Consistent in approach towards team members.*

1 2 3 4 5

16. Backs up words with actions.

1 2 3 4 5

17. Trusted by others.

1 2 3 4 5

Vision

18. Anticipates problems and act in ways to avoid difficult situations.

1 2 3 4 5

19. Develops clear and focused vision for the company.

1 2 3 4 5

20. Always thinking ahead; stretches and challenges imaginations.

1 2 3 4 5

Communication

21. Communicates in clear manner.

1 2 3 4 5

22. Listens effectively and responds as appropriate.

1 2 3 4 5

23. Ability to influence and persuade team members based on facts and rationality.

1 2 3 4 5

Accountability

24. Establishes and meets commitments to meet business goals.

1 2 3 4 5

25. *Assumes responsibility for own actions.*

1 2 3 4 5

26. *Encourages team members to take ownership and accept responsibility for their actions.*

1 2 3 4 5

Courage

27. *Demonstrates courage to stand up for beliefs and ideas*

1 2 3 4 5

28. *Demonstrates courage to stand up for team members*

1 2 3 4 5

29. *Willingness to confront and make difficult decisions.*

1 2 3 4 5

OPEN-ENDED QUESTIONS:

-What do you like most about being an engineer?

-What do you like the least about being an engineer?

-What traits did the manager have that made him or her perform well as a manager?

-How did the manager assist you in doing your job?

-What traits did he or she have that made him or her a poor manager?

-After your projects were completed, what was the reaction of the manager?

COMMITMENT DIMENSIONS:

Respond to the following statements using the rating scale provided. Rate each item according to the degree to which it relates to your opinion about your company. Circle the number that corresponds to your rating. ***1** - Strongly Disagree **2** - Disagree **3** - Neutral **4** - Agree **5** - Strongly Agree*

Identification (Hypothesis 1)

30. I feel a sense of ownership of this company rather than just being an employee

1 2 3 4 5

31. I am proud to tell others that I work for this company.

1 2 3 4 5

32. I tell my friends that this company is a great place to work.

1 2 3 4 5

Compliance (Hypothesis 2)

33. How hard I work for this company is directly linked to how well I am rewarded.

1 2 3 4 5

34. *Unless I am rewarded for it in some way, I see no reason to expend extra effort on behalf of the company.*

1 2 3 4 5

35. *In order for me to be rewarded by this company, it is necessary to express the right attitude.*

1 2 3 4 5

Intent To Leave (Hypothesis 3)

36. *You would prefer another more ideal job than the one you work in right now.*

1 2 3 4 5

37. *You would have seriously thought about changing companies since you began working here.*

1 2 3 4 5

38. *How long do you intend remaining with this company? (scale: less than 1 yr. {5}; 1 to 3 yrs {4}; 4 to 5 yrs {3}; 6 to 10 yrs {2}; Until Retirement {1}*

1 2 3 4 5

39. *If you have your own way, you will not be working for this company three years from now.*

1 2 3 4 5

**Source: O'Reilly & Chatman (1986)*

*** Question 38 is rated differently as shown within the question item*

Appendix E

Results of Analysis of Variance, Tukey-Kramer Procedure and Significant Interaction Plots

Table E1

Summary ANOVA for Gender

Category	Source	Sum of squares	df	Mean square	*F*	Sig.
Identification commitment	Main Effect:					
	Between groups	.142	1	.142	0.111	.740
	Within groups	70.359	55	1.279		
	Total	70.501	56			
	Interactions:					
	Gender * Age	2.095	1	2.095	1.646	.205
	Gender * Education	.929	1	.929	.869	.356
	Gender * Yrs..in Co.	1.077	2	.539	.492	.615
	Gender * Experience	.808	1	.808	.618	.435
Compliance commitment	Main Effect:					
	Between groups	2.057	1	2.057	4.673	.035(*)
	Within groups	24.207	55	0.440		
	Total	26.264	56			
	Interactions:					
	Gender * Age	.003	1	.003	.007	.936
	Gender * Education	.784	1	.784	2.254	.139
	Gender * Yrs..in Co.	.301	2	.151	.385	.682
	Gender * Experience	.406	1	.406	.913	.344
Intent to leave	Main Effect:					
	Between groups	0.515	1	0.515	0.401	.529
	Within groups	70.630	55	1.284		
	Total	71.145	56			
	Interactions:					
	Gender * Age	2.691	1	2.691	2.251	.139
	Gender * Education	7.094	1	7.094	6.106	.017(*)
	Gender * Yrs..in Co.	4.827	2	2.413	2.837	.068
	Gender * Experience	1.215	1	1.215	1.117	.295

*Significant at the .05 level.

Table E2

Summary ANOVA for Age

Category	Source	Sum of squares	df[a]	Mean square	*F*	Sig.
Identification commitment	Main Effect:					
	Between groups	.765	1	.765	0.603	.441
	Within groups	69.736	55	1.268		
	Total	70.501	56			
	Interactions:					
	Age * Gender	2.095	1	2.095	1.646	.205
	Age * Education	2.328	2	1.164	1.139	.328
	Age * Yrs..in Co.	4.096	1	4.096	4.028	.05(**)
	Age * Experience	.883	1	.883	.678	.414
Compliance commitment	Main Effect:					
	Between groups	0.097	1	0.097	0.205	.653
	Within groups	26.167	55	0.476		
	Total	26.264	56			
	Interactions:					
	Age * Gender	.003	1	.003	.007	.936
	Age * Education	.802	2	.401	1.067	.352
	Age * Yrs..in Co.	.273	1	.273	.695	.408
	Age * Experience	.534	1	.534	1.138	.291
Intent to leave	Main Effect:					
	Between groups	4.797	1	4.797	3.977	.051(**)
	Within groups	66.347	55	1.206		
	Total	71.145	56			
	Interactions:					
	Age * Gender	2.691	1	2.691	2.251	.139
	Age * Education	5.907	2	2.954	2.568	.087
	Age * Yrs..in Co.	.060	1	.060	.060	.808
	Age * Experience	.956	1	.956	.855	.359

[a]The between groups degree of freedom (df) for main effects in all categories is one (1) because the first two age categories in the questionnaire (<28 years, and 28 to 32 years) were combined and reported together.

*Significant at the .05 level.

**Significant at the .10 level.

Table E3

Summary ANOVA for Highest Level of Education

Category	Source	Sum of squares	df[a]	Mean squar	*F*	Sig.
Identification commitment	Main Effect:					
	Between groups	13.427	2	6.713	6.352	.003(*)
	Within groups	57.074	54	1.057		
	Total	70.501	56			
	Interactions:					
	Education * Gender	.929	1	.929	.869	.356
	Education * Age	2.328	2	1.164	1.139	.328
	Education * Yrs..in Co.	1.507	1	1.507	1.733	.194
	Education * Experience	4.529	3	1.510	1.431	.245
Compliance commitment	Main Effect:					
	Between groups	5.797	2	2.899	7.647	.001(*)
	Within groups	20.467	54	.379		
	Total	26.264	56			
	Interactions:					
	Education * Gender	.784	1	.784	2.254	.139
	Education * Age	.802	2	.401	1.067	.352
	Education * Yrs..in Co.	.317	1	.317	.854	.360
	Education * Experience	1.680	3	.560	1.592	.203
Intent to leave	Main Effect:					
	Between groups	2.853	2	1.427	1.128	.331
	Within groups	68.291	54	1.265		
	Total	71.145	56			
	Interactions:					
	Education * Gender	7.094	1	7.094	6.106	.017(*)
	Education * Age	5.907	2	2.954	2.568	.087
	Education * Yrs..in Co.	.575	1	.575	.564	.456
	Education * Experience	9.414	3	3.138	3.023	.038(*)

[a]The between groups degree of freedom (df) for main effects in all categories is 2 because the High School, and Associate Degree categories in the questionnaire were combined and reported together, while the Masters degree and Doctorate degree were combined as Graduate degree.

*Significant at the .05 level.

Table E4

Summary ANOVA for Number of Years in Company

Category	Source	Sum of squares	df	Mean square	*F*	Sig.
Identification commitment	Main Effect:					
	Between groups	13.121	2	6.561	6.174	.004(*)
	Within groups	57.380	54	1.063		
	Total	70.501	56			
	Interactions:					
	Yrs. in Co. * Gender	1.077	2	.539	.492	.615
	Yrs. in Co. * Age	4.096	1	4.096	4.028	.05(**)
	Yrs. in Co. * Education	1.507	1	1.507	1.733	.194
	Yrs. In Co. * Experience	.805	3	.268	.237	.870
Compliance commitment	Main Effect:					
	Between groups	4.958	2	2.479	6.282	.004(*)
	Within groups	21.307	54	0.395		
	Total	26.264	56			
	Interactions:					
	Yrs. in Co. * Gender	.301	2	.151	.385	.682
	Yrs. in Co. * Age	.273	1	.273	.695	.408
	Yrs. in Co. * Education	1.507	1	1.507	1.733	.194
	Yrs. In Co. * Experience	.317	1	.317	.854	.360
Intent to leave	Main Effect:					
	Between groups	17.164	2	8.582	8.585	.001(*)
	Within groups	53.980	54	1.000		
	Total	71.145	56			
	Interactions:					
	Yrs. in Co. * Gender	4.827	2	2.413	2.837	.068
	Yrs. in Co. * Age	.060	1	.060	.060	.808
	Yrs. in Co. * Education	.575	1	.575	.564	.456
	Yrs. In Co. * Experience	8.141	3	2.714	3.246	.030(*)

*Significant at the .05 level.

**Significant at the .10 level.

Table E5

Summary ANOVA for Number of Years of Experience as Engineer

Category	Source	Sum of squares	df[a]	Mean square	*F*	Sig.
Identification commitment	Main Effect:					
	Between groups	1.636	2	.818	0.641	.531
	Within groups	68.865	54	1.275		
	Total	70.501	56			
	Interactions:					
	Experience * Gender	.808	1	.808	.618	.435
	Experience * Age	.883	1	.883	.678	.414
	Experience * Education	4.529	3	1.510	1.431	.245
	Experience * Yrs. In Co.	.805	3	.268	.237	.870
Compliance commitment	Main Effect:					
	Between groups	1.243	2	.621	1.341	.270
	Within groups	25.022	54	.463		
	Total	26.264	56			
	Interactions:					
	Experience * Gender	.406	1	.406	.913	.344
	Experience * Age	.534	1	.534	1.138	.291
	Experience * Education	1.680	3	.560	1.592	.203
	Experience * Yrs. In Co.	.317	1	.317	.854	.360
Intent to leave	Main Effect:					
	Between groups	10.122	2	5.061	4.479	.016(*)
	Within groups	61.023	54	1.130		
	Total	71.145	56			
	Interactions:					
	Experience * Gender	1.215	1	1.215	1.117	.295
	Experience * Age	.956	1	.956	.855	.359
	Experience * Education	9.414	3	3.138	3.023	.038(*)
	Experience * Yrs. In Co.	8.141	3	2.714	3.246	.030(*)

[a]The between groups degree of freedom (df) for main effects in all categories is one (2) because the years of engineering experience factor were combined and reported as three groups.

*Significant at the .05 level.

Table E6

Tukey-Kramer Procedure Summary for Identification Commitment by Highest Level of Education

(I) Education	(J) Education	Mean difference (I-J)	Std. error	Sig.	95% Confidence interval	
					Lower bound	Upper bound
No bachelor degree	Bachelor degree	1.5853(*)	.52177	.010	.3279	2.8428
	Graduate degree	.4712	.45009	.551	-.6135	1.5559
Bachelor degree	No bachelor degree	-1.5853(*)	.52177	.010	-2.8428	-.3279
	Graduate degree	-1.1141(*)	.35001	.007	-1.9577	-.2706
Graduate degree	No bachelor degree	-.4712	.45009	.551	-1.5559	.6135
	Bachelor degree	1.1141(*)	.35001	.007	.2706	1.9577

Based on observed means.

*The mean difference is significant at the .05 level.

Table E7

Tukey-Kramer Procedure Summary for Identification Commitment by Number of Years in Company

(I) Yrs. in Co.	(J) Yrs. in Co.	Mean difference (I-J)	Std. error	Sig.	95% Confidence interval	
					Lower bound	Upper bound
0 - 5 years	6 - 10 years	.5369	.34029	.264	-.2832	1.3569
	More than 10 years	-1.2706(*)	.45204	.019	-2.3601	-.1812
6 - 10 years	0 - 5 years	-.5369	.34029	.264	-1.3569	.2832
	More than 10 years	-1.8075(*)	.51541	.003	-3.0496	-.5654
More than 10 years	0 - 5 years	1.2706(*)	.45204	.019	.1812	2.3601
	6 - 10 years	1.8075(*)	.51541	.003	.5654	3.0496

Based on observed means.

*The mean difference is significant at the .05 level.

Table E8

Tukey-Kramer Procedure Summary for Compliance Commitment by Highest Level of Education

(I) Education	(J) Education	Mean difference (I-J)	Std. error	Sig.	95% Confidence interval	
					Lower bound	Upper bound
No bachelor degree	Bachelor degree	.9236(*)	.31245	.013	.1706	1.6766
	Graduate degree	.1413	.26953	.860	-.5083	.7908
Bachelor degree	No bachelor degree	-.9236(*)	.31245	.013	-1.6766	-.1706
	Graduate degree	-.7824(*)	.20960	.001	-1.2875	-.2773
Graduate degree	No bachelor degree	-.1413	.26953	.860	-.7908	.5083
	Bachelor degree	.7824(*)	.20960	.001	.2773	1.2875

Based on observed means.

*The mean difference is significant at the .05 level.

Table E9

Tukey-Kramer Procedure Summary for Compliance Commitment by Number of Years in Company

(I) Yrs. in co.	(J) Yrs. in co.	Mean difference (I-J)	Std. error	Sig.	95% Confidence interval	
					Lower bound	Upper bound
0 - 5 years	6 - 10 years	.6956(*)	.20736	.004	.1959	1.1954
	More than 10 years	.4740	.27546	.207	-.1899	1.1378
6 - 10 years	0 - 5 years	-.6956(*)	.20736	.004	-1.1954	-.1959
	More than 10 years	-.2217	.31407	.761	-.9786	.5352
More than 10 years	0 - 5 years	-.4740	.27546	.207	-1.1378	.1899
	6 - 10 years	.2217	.31407	.761	-.5352	.9786

Based on observed means.

*The mean difference is significant at the .05 level.

Table E10

Tukey-Kramer Procedure Summary for Intent to Leave by Number of Years in Company

(I) Yrs.in co	(J) Yrs.in co	Mean difference (I-J)	Std. error	Sig.	95% Confidence interval	
					Lower bound	Upper bound
0 - 5 years		.1683	.1683	.33005	.867	-.6272
	More than 10 years	1.8141(*)	1.8141	.43845	.000	.7574
6 - 10 years	0 - 5 years	-.1683	-.1683	.33005	.867	-.9637
	More than 10 years	1.6458(*)	1.6458	.49991	.005	.4411
More than 10 years	0 - 5 years	-1.8141(*)	-1.8141	.43845	.000	-2.8708
	6 - 10 years	-1.6458(*)	.49991	.005	-2.8506	-.4411

Based on observed means.

*The mean difference is significant at the .05 level.

Table E11

Tukey-Kramer Procedure Summary for Intent to Leave by Years of Experience

(I) Experience	(J) Experience	Mean difference (I-J)	Std. error	Sig.	95% Confidence interval	
					Lower bound	Upper bound
< 10 years	10 - 19 years	-.1114	.36488	.950	-.9907	.7680
	20 years or more	.8542	.40595	.098	-.1242	1.8325
10 - 19 years	< 10 years	.1114	.36488	.950	-.7680	.9907
	20 years or more	.9655(*)	.33105	.014	.1677	1.7633
20 years or more	< 10 years	-.8542	.40595	.098	-1.8325	.1242
	10 - 19 years	-.9655(*)	.33105	.014	-1.7633	-.1677

Based on observed means.

*The mean difference is significant at the .05 level.

Table E12

Tests for Significance for Interaction Between Identification Commitment Scores for Age and Years in Company[1]

Source of variation	SS	DF	MS	F	Sig of F
Within cells	52.89	52	1.02		
Age within yrs.in co(1)	.16	1	.16	.15	.697
Age within yrs.in co(2)	.01	1	.01	.01	.939
Age within yrs.in co(3)	10.33	1	10.33	10.16	.002

[1] Test of significance calculated using UNIQUE sums of squares (Visual Statistics, n.d.).

Table E13

Identification Commitment Cell Means for Age and Years in Company Interaction

	0 - 5 years	6 - 10 years	More than 10 years
< 33 years old	3.593	1.000	- (a)
33 years or older	3.556	3.212	4.835

a This level combination of factors is not observed, thus the corresponding population marginal mean is not estimable.

Table E14

Tests for Significance for Interaction Between Intent to Leave Scores for Education and Experience[1]

Source of variation	SS	DF	MS	F	Sig of F
Within cells	50.86	49	1.04		
Education within experience(1)	2.64	2	1.32	1.27	.289
Education within experience(2)	.70	2	.35	.34	.715
Education within experience(3)	14.69	2	7.35	7.08	.002

[1] Test of significance calculated using UNIQUE sums of squares (Visual Statistics, n.d.).

Table E15

Intent to Leave Cell Means for Experience and Education Interaction

	< 10 years	10 - 19 years	20 years or more
No bachelor degree	3.917	3.000	- (a)
Bachelor degree	2.938	2.958	4.75
Graduate degree	2.75	2.325	2.083

a This level combination of factors is not observed, thus the corresponding population marginal mean is not estimable.

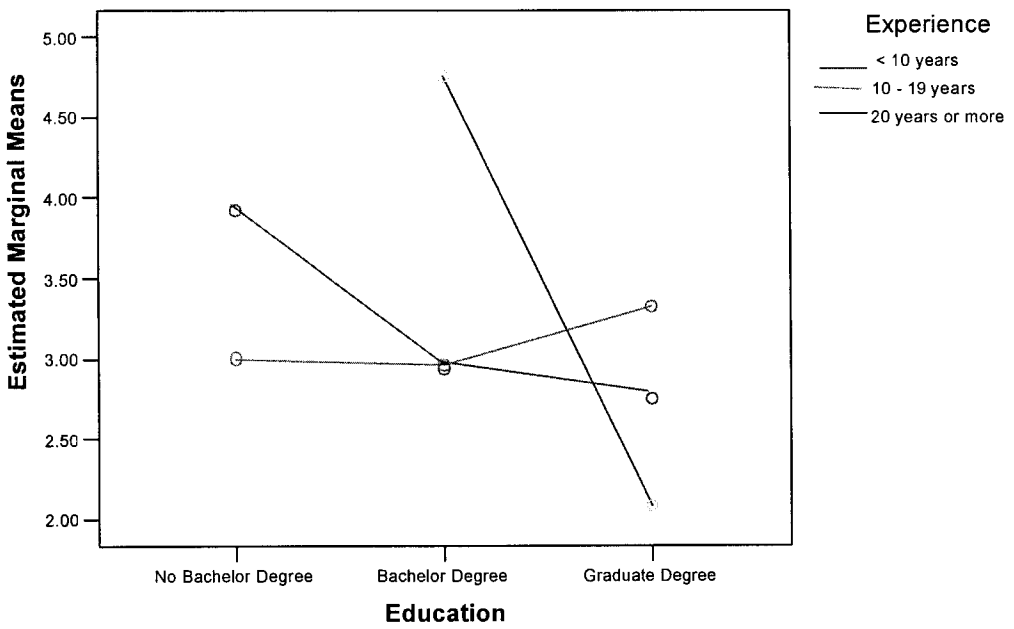


Figure E1. Plot of intent to leave cell means for experience and education interaction

Table E16

Tests for Significance for Interaction Between Intent to Leave Scores for Education and Gender[1]

Source of variation	SS	DF	MS	F	Sig of F
Within cells	60.41	52	1.16		
Education within gender(1)	2.34	2	1.17	1.01	.372
Education within gender(2)	8.03	2	4.01	3.46	.039

[1] Test of significance calculated using UNIQUE sums of squares (Visual Statistics, n.d.).

Table E17

Intent to Leave Cell Means for Gender and Education Interaction

	No bachelor degree	Bachelor degree	Graduate degree
Male	3.458	2.722	2.824
Female	-(a)	4.875	2.583

a This level combination of factors is not observed, thus the corresponding population marginal mean is not estimable

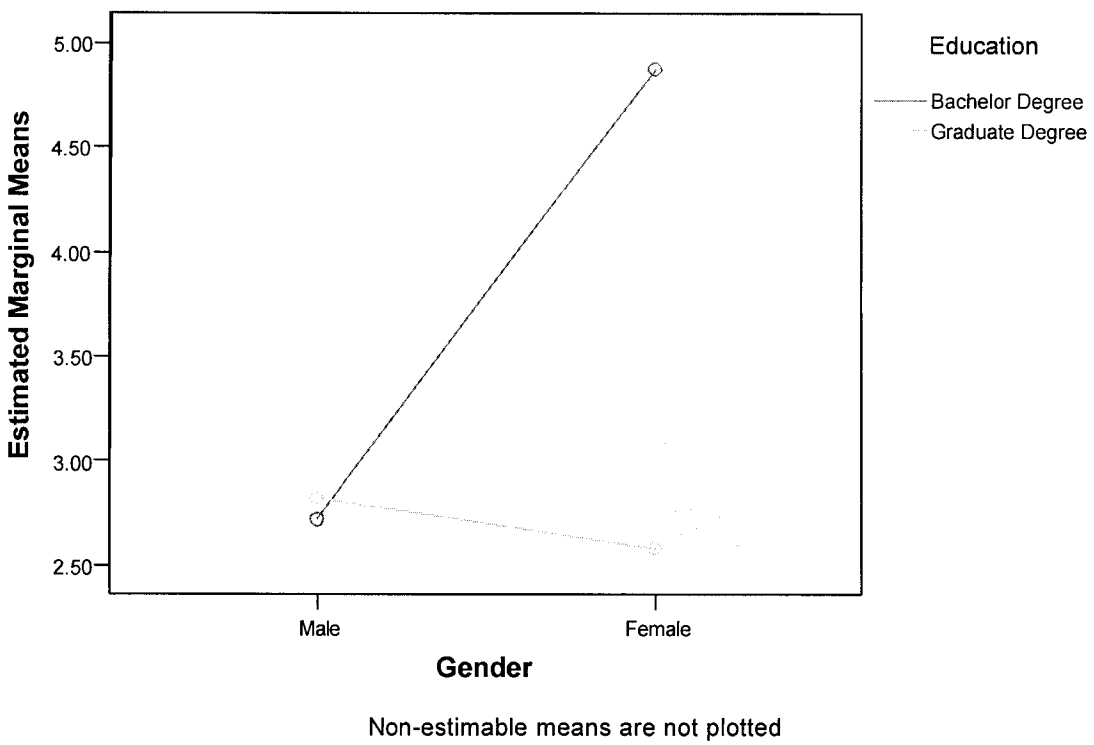


Figure E2. Plot of intent to leave cell means for education and gender interaction.

Table E18

Tests for Significance for Interaction Between Intent to Leave Scores for Years in Company and Experience[1]

Source of variation	SS	DF	MS	F	Sig of F
Within cells	40.97	49	.84		
Yrs. in co. within experience(1)	3.27	2	1.64	1.96	.152
Yrs. in co. within experience(2)	8.96	2	4.48	5.36	.008
Yrs. in co. within experience(3)	10.49	2	5.25	6.28	.004

[1] Test of significance calculated using UNIQUE sums of squares (Visual Statistics, n.d.).

Table E19

Intent to Leave Cell Means for Years in Company and Experience Interaction

Years in company	Year of experience		
	< 10 years	10 - 19 years	20 years or more
0 - 5 years	3.5	3.443	2.364
6 - 10 years	2.708	2.95	4.75
More than 10 years	2.979	1.375	1.313

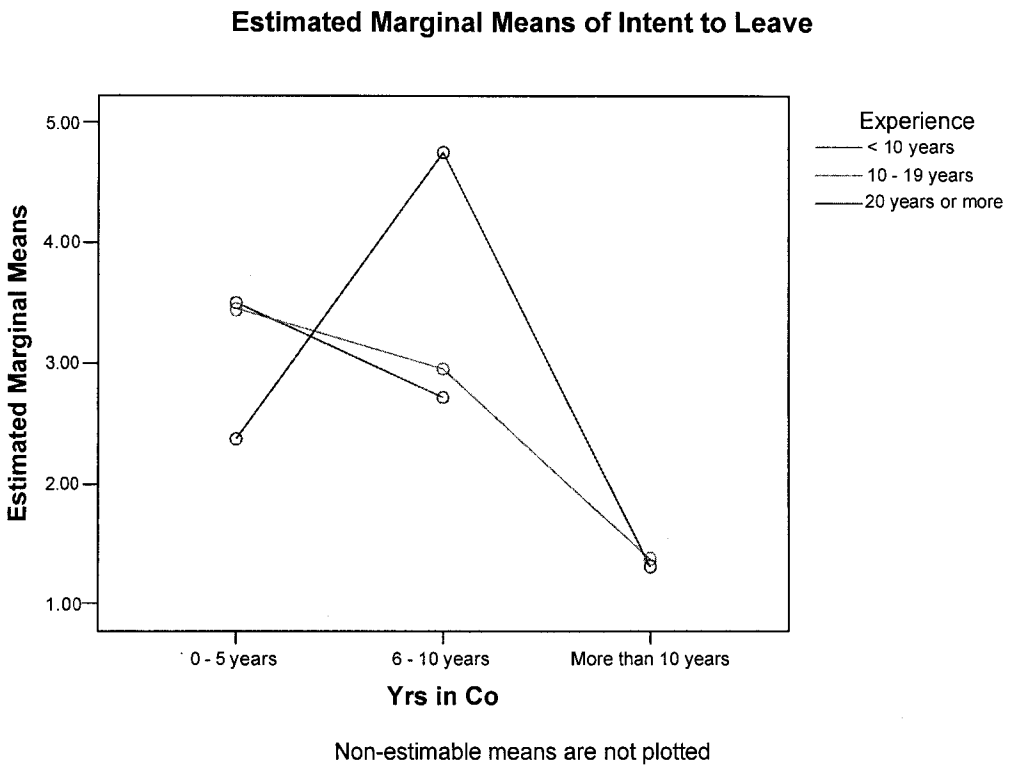


Figure E3. Plot of intent to leave cell means for years in company and years of experience interaction.

Appendix F

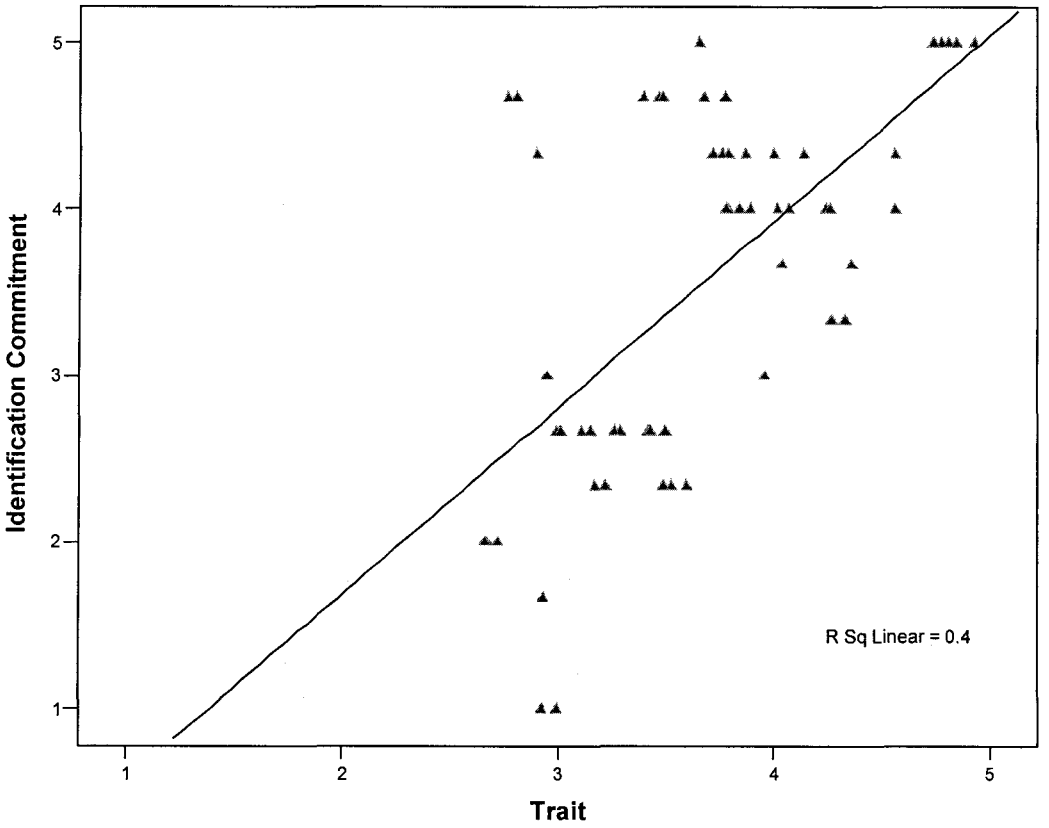
Correlation Analysis

Table F1

Correlation Analysis for Aggregate Trait and Identification Commitment

		Aggregate trait	Identification commitment
Aggregate trait	Pearson correlation	1	.64(**)
	Sig. (2-tailed)		.000
	Sum of squares and cross-products	22.085	25.258
	Covariance	.394	.451
	N	57	57

**Correlation is significant at the 0.01 level (2-tailed).



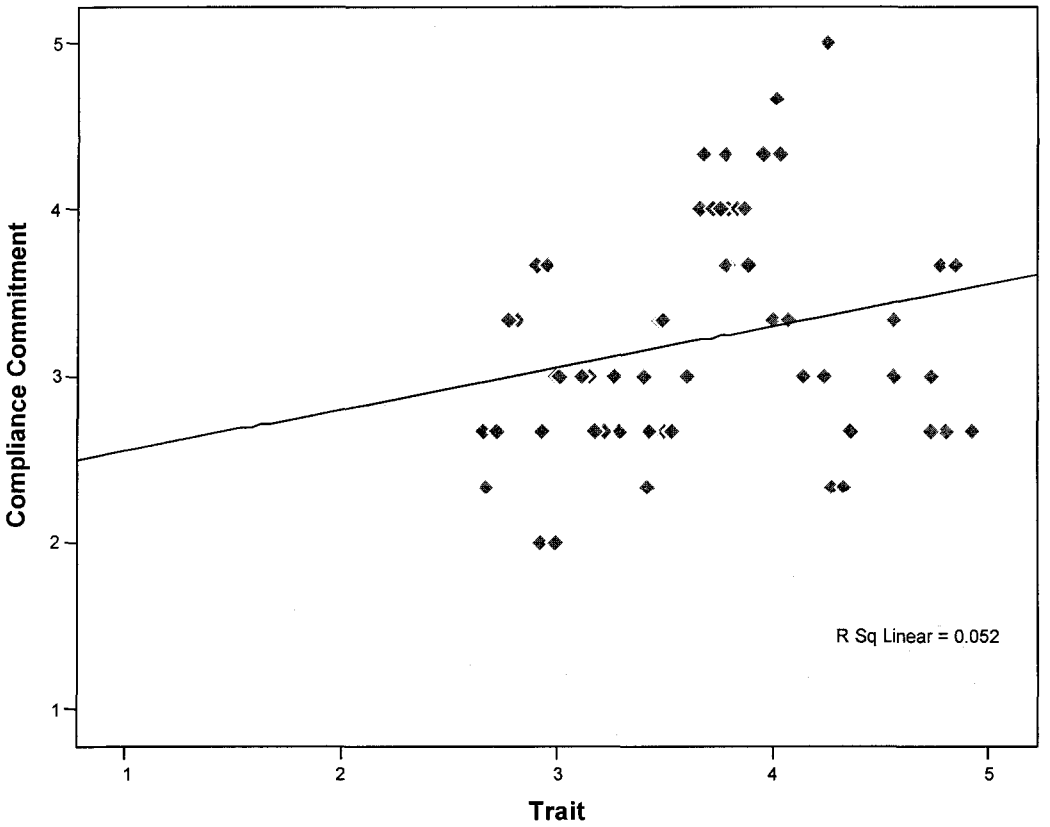
$r = +0.64$

Figure F1. Scatter plot for traits vs. identification commitment.

Table F2

Correlation Analysis for Aggregate Trait and Compliance Commitment

		Aggregate trait	Compliance commitment
Aggregate trait	Pearson correlation	1	.23
	Sig. (2-tailed)		.087
	Sum of squares and cross-products	22.085	5.513
	Covariance	.394	.098
	N	57	57



$r = +0.23$

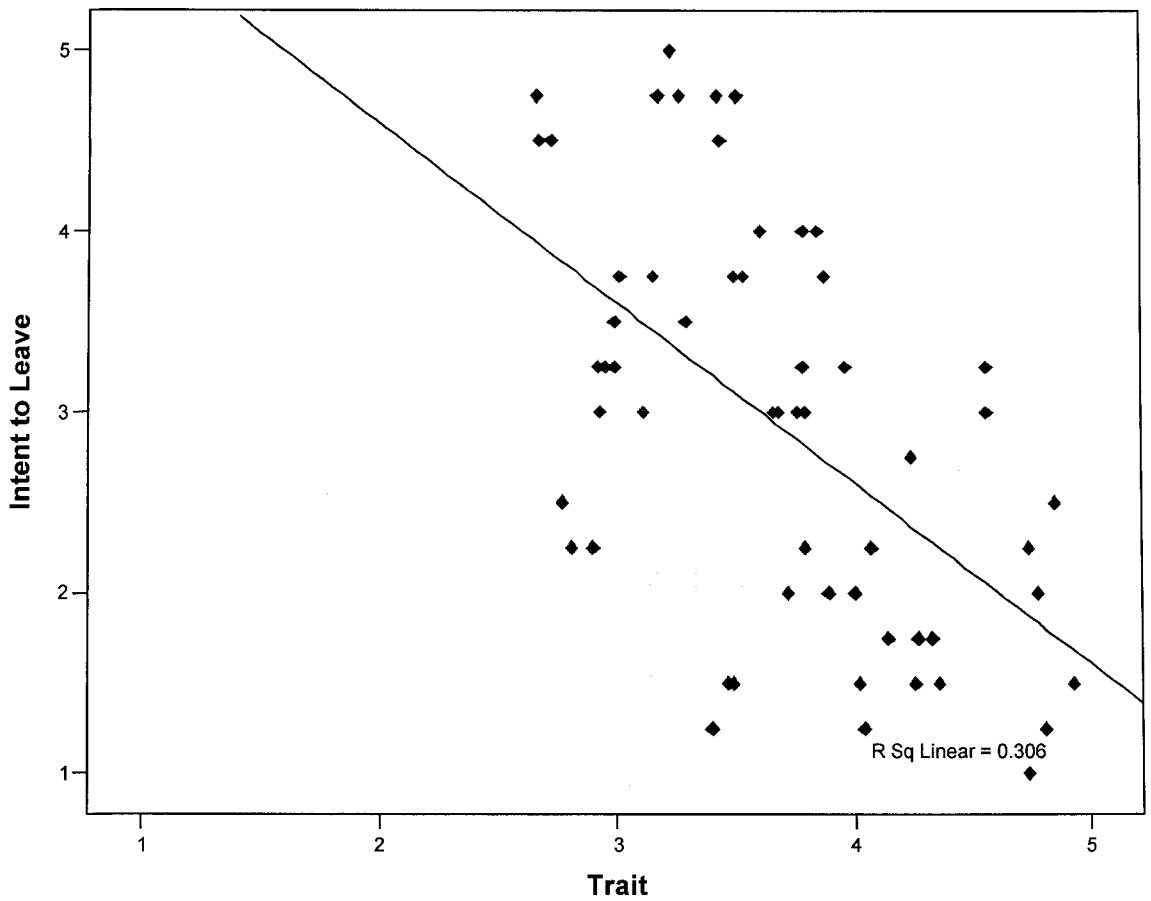
Figure F2. Scatter plot for traits vs. compliance commitment.

Table F3

Correlation Analysis for Aggregate Trait and Intent to Leave

		Aggregate trait	Intent to leave
Aggregate trait	Pearson correlation	1	-.55(**)
	Sig. (2-tailed)		.000
	Sum of squares and cross-products	22.085	-21.921
	Covariance	.394	-.391
	N	57	57

**Correlation is significant at the 0.01 level (2-tailed).



$r = -0.55$

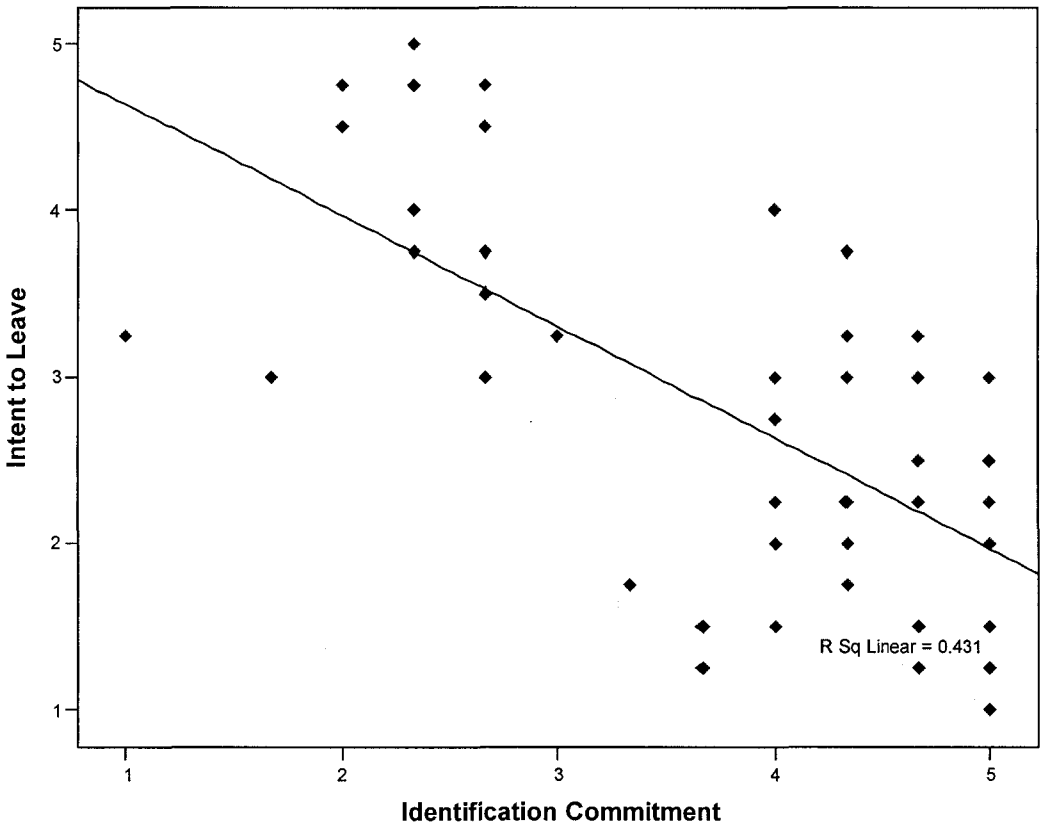
Figure F3. Scatter plot for traits vs. intent to leave.

Table F4

Correlation Analysis for Identification Commitment and Intent to Leave

		Identification commitment	Intent to leave
Identification commitment	Pearson correlation	1	-.65(**)
	Sig. (2-tailed)		.000
	Sum of squares and cross-products	70.501	-45.782
	Covariance	1.259	-.818
	N	57	57

**Correlation is significant at the 0.01 level (2-tailed).



$r = -0.65$

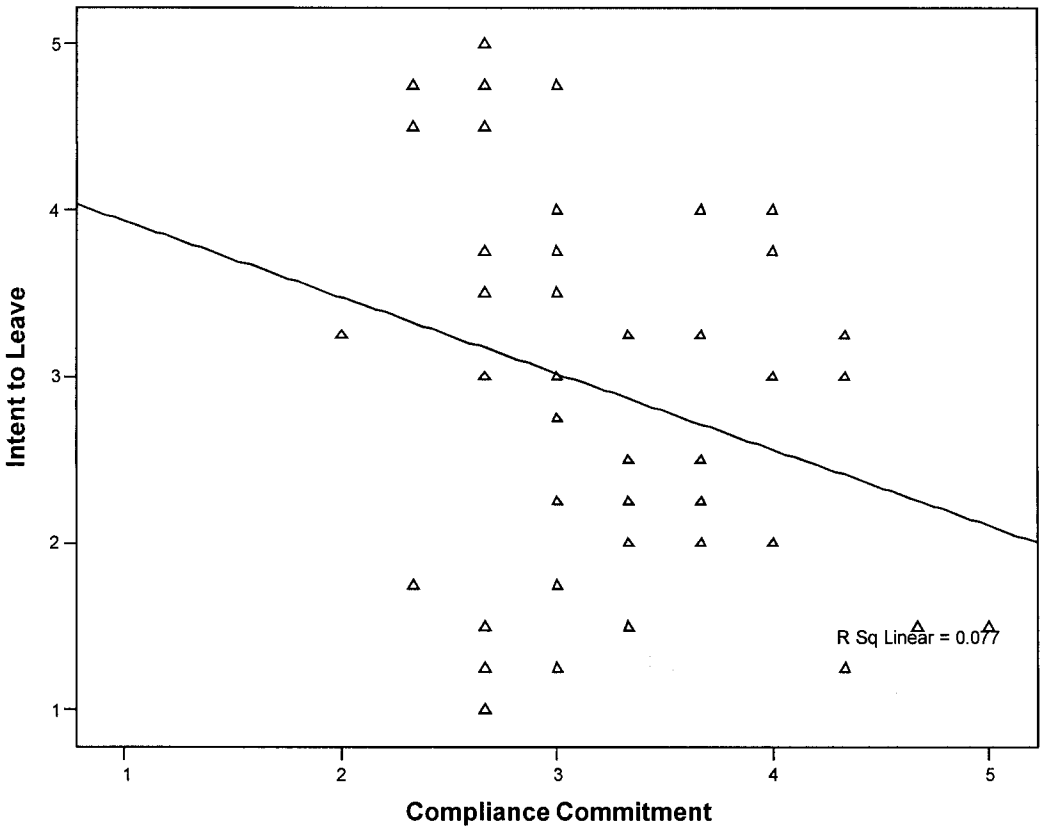
Figure F4. Scatter plot for identification commitment vs. intent to leave.

Table F5

Correlation Analysis for Compliance Commitment and Intent to Leave

		Compliance commitment	Intent to leave
Compliance commitment	Pearson correlation	1	-.28(*)
	Sig. (2-tailed)		.037
	Sum of squares and cross-products	26.264	-11.973
	Covariance	.469	-.214
	N	57	57

*Correlation is significant at the 0.05 level (2-tailed)



$r = -0.28$

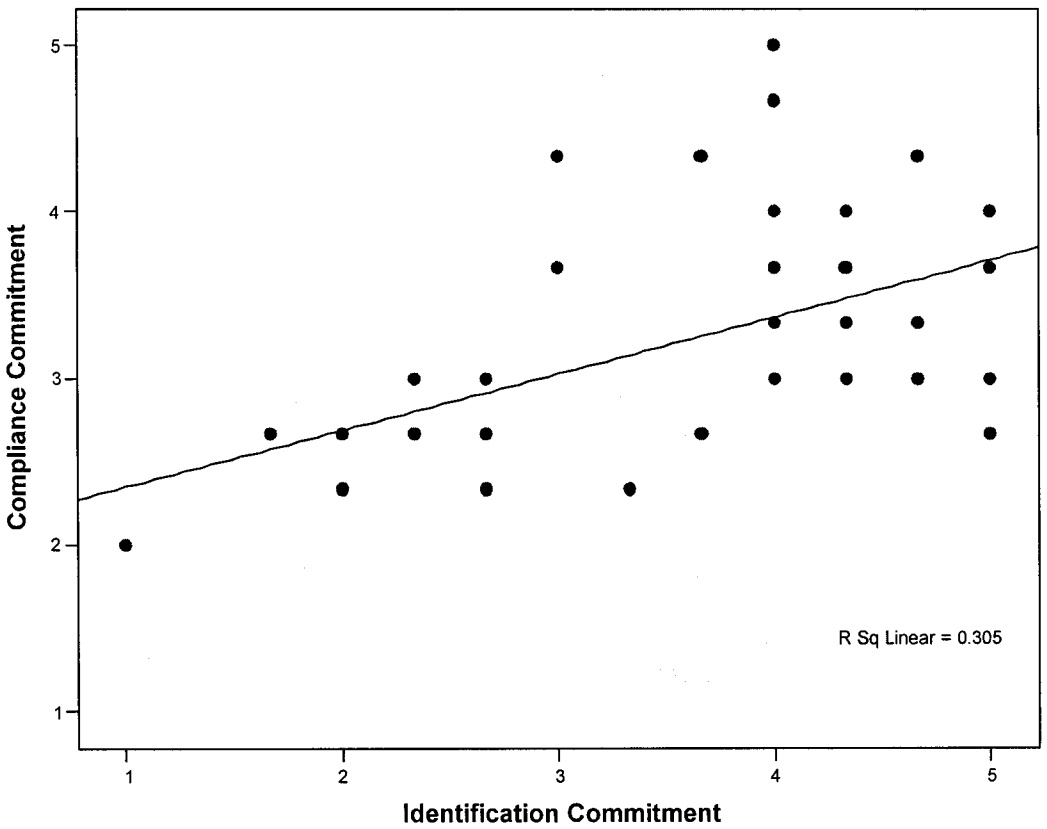
Figure F5. Scatter plot for compliance commitment vs. intent to leave.

Table F6

Correlation Analysis for Identification Commitment and Compliance Commitment

		Identification commitment	Compliance commitment
Identification commitment	Pearson correlation	1	.55 (**)
	Sig. (2-tailed)		.000
	Sum of squares and cross-products	70.501	23.562
	Covariance	1.259	.421
	N	57	57

**Correlation is significant at the 0.01 level (2-tailed).



$r = +0.55$

Figure F6. Scatter plot for identification commitment vs. compliance commitment.

Appendix G

Responses from Survey Questions with Mean Scores and Standard Deviations

Table G1

Survey Question Responses with Mean Scores and Standard Deviations - Team Building

					Strongly disagree		Disagree		Neutral		Agree		Strongly agree	
					1		2		3		4		5	
		Mean score	Std. dev.	No of respondents	#	%	#	%	#	%	#	%	#	%
	Team building													
Q.1	Provides mentoring and feedback to develop team members to their fullest potential.	3.63	1.02	57	0	0%	10	18%	13	23%	22	39%	12	21%
Q.2	Distributes workload to leverage resources.	3.71	0.95	57	0	0%	7	12%	14	25%	24	42%	12	21%
Q.3	Delegates duties and empowers team members to maximize effectiveness.	3.63	1.09	57	1	2%	8	14%	18	32%	15	26%	15	26%
Q.4	Creates positive and conducive work environment for the team.	3.55	1.08	57	3	5%	5	9%	18	32%	20	35%	11	19%
Q.5	Provides inspiration to team members.	3.77	0.95	57	0	0%	7	12%	13	23%	24	42%	13	23%

Table G2

Survey Question Responses with Mean Scores and Standard Deviations - Expertise

					Strongly disagree		Disagree		Neutral		Agree		Strongly agree	
					1		2		3		4		5	
		Mean score	Std. dev.	# of respondents	#	%	#	%	#	%	#	%	#	%
	Expertise													
Q.6	Possesses technical/professional knowledge and expertise.	4.39	0.78	57	0	0%	2	4%	4	7%	20	35%	31	54%
Q.7	Exhibits extensive knowledge/understanding of the business.	4.13	0.88	57	0	0%	2	4%	12	21%	20	35%	23	40%
Q.8	Possess self-confidence in abilities and knowledge.	4.45	0.69	57	0	0%	1	2%	3	5%	23	40%	30	53%

Table G3

Survey Question Responses with Mean Scores and Standard Deviations - Initiative

					Strongly disagree		Disagree		Neutral		Agree		Strongly agree	
					1		2		3		4		5	
		Mean score	Std. dev.	# of respondents	#	%	#	%	#	%	#	%	#	%
	Initiative													
Q.9	Initiates new and improved ways of doing things.	3.38	0.98	57	1	2%	11	19%	16	28%	23	40%	6	11%
Q.10	Bypasses ineffective procedures and encourages simplicity and clearness.	3.29	0.93	57	1	2%	12	21%	16	28%	25	44%	3	5%
Q.11	Strives for the use of speed and efficiency.	3.48	1.01	57	3	5%	6	11%	14	25%	28	49%	6	11%

Table G4

Survey Question Responses with Mean Scores and Standard Deviations - Persistence

					Strongly disagree		Disagree		Neutral		Agree		Strongly agree	
					1		2		3		4		5	
		Mean score	Std. dev.	# of respondents	#	%	#	%	#	%	#	%	#	%
	Persistence													
Q.12	Exhibits determination and resiliency when obstacles or difficulties arise.	3.95	0.98	57	0	0%	4	7%	16	28%	16	28%	21	37%
Q.13	Persistently follows up with team members on uncompleted projects.	3.41	1.23	57	4	7%	10	18%	14	25%	16	28%	13	23%
Q.14	Persistently follows up with upper management on behalf of team members regarding their requests.	3.41	1.32	57	3	5%	14	25%	14	25%	8	14%	18	32%

Table G5

Survey Question Responses with Mean Scores and Standard Deviations - Integrity

					Strongly disagree		Disagree		Neutral		Agree		Strongly agree	
					1		2		3		4		5	
		Mean score	Std. dev.	# of respondents	#	%	#	%	#	%	#	%	#	%
	Integrity													
Q.15	Consistent in approach towards team members.	3.82	0.96	57	0	0%	6	11%	13	23%	23	40%	15	26%
Q.16	Backs up words with actions.	3.57	1.16	57	3	5%	8	14%	12	21%	21	37%	13	23%
Q.17	Trusted by others.	3.86	0.82	57	0	0%	3	5%	14	25%	28	49%	12	21%

Table G6

Survey Question Responses with Mean Scores and Standard Deviations - Vision

					Strongly disagree		Disagree		Neutral		Agree		Strongly agree	
					1		2		3		4		5	
		Mean score	Std. dev.	# of respondents	#	%	#	%	#	%	#	%	#	%
	Vision													
Q.18	Anticipates problems and act in ways to avoid difficult situations.	3.32	0.94	57	0	0%	12	21%	20	35%	19	33%	6	11%
Q.19	Develops clear and focused vision for the company.	3.18	0.77	57	0	0%	12	21%	22	39%	23	40%	0	0%
Q.20	Always thinking ahead; stretches and challenges imaginations.	3.29	0.93	57	0	0%	15	26%	13	23%	26	46%	3	5%

Table G7

Survey Question Responses with Mean Scores and Standard Deviations - Communication

					Strongly disagree		Disagree		Neutral		Agree		Strongly agree	
					1		2		3		4		5	
		Mean score	Std. dev.	# of respondents	#	%	#	%	#	%	#	%	#	%
	Communication													
Q.21	Communicates in clear manner.	3.64	0.88	57	1	2%	2	4%	24	42%	20	35%	10	18%
Q.22	Listens effectively and responds as appropriate.	3.91	0.82	57	0	0%	3	5%	13	23%	28	49%	13	23%
Q.23	Ability to influence and persuade team members based on facts and rationality.	3.84	1.01	57	0	0%	7	12%	13	23%	20	35%	17	30%

Table G8

Survey Question Responses with Mean Scores and Standard Deviations - Accountability

					Strongly disagree		Disagree		Neutral		Agree		Strongly agree	
					1		2		3		4		5	
		Mean score	Std. dev.	# of respondents	#	%	#	%	#	%	#	%	#	%
	Accountability													
Q.24	Establishes and meets commitments to meet business goals..	3.59	0.91	57	0	0%	6	11%	21	37%	20	35%	10	18%
Q.25	Assumes responsibility for own actions.	3.84	0.97	57	0	0%	7	12%	11	19%	24	42%	15	26%
Q.26	Encourages team members to take ownership and accept responsibility for their actions.	3.77	1.01	57	3	5%	1	2%	15	26%	25	44%	13	23%

Table G9

Survey Question Responses with Mean Scores and Standard Deviations - Courage

					Strongly disagree		Disagree		Neutral		Agree		Strongly agree	
					1		2		3		4		5	
		Mean score	Std. dev.	# of respondents	#	%	#	%	#	%	#	%	#	%
	Courage													
Q.27	Demonstrates courage to stand up for beliefs and ideas.	3.80	0.82	57	0	0%	1	2%	22	39%	21	37%	13	23%
Q.28	Demonstrates courage to stand up for team members	3.46	1.13	57	3	5%	7	12%	20	35%	15	26%	12	21%
Q.29	Willingness to confront and make difficult decisions.	3.71	1.04	57	1	2%	7	12%	13	23%	22	39%	14	25%

Table G10

Survey Question Responses with Mean Scores and Standard Deviations – Identification Commitment

					Strongly disagree		Disagree		Neutral		Agree		Strongly agree	
					1		2		3		4		5	
		Mean score	Std. dev.	# of respondents	#	%	#	%	#	%	#	%	#	%
	Identification commitment													
Q.30	I feel a sense of ownership of this company rather than just being an employee.	3.25	1.36	56[a]	7	13%	12	21%	8	14%	17	30%	12	21%
Q.31	I am proud to tell others that I work for this company.	3.82	1.10	57	2	4%	4	7%	15	26%	17	30%	19	33%
Q.32	I tell my friends that this company is a great place to work.	3.64	1.20	57	2	4%	9	16%	14	25%	14	25%	18	32%

[a] One participant did not respond to question 30 because he was a contractor, and not an employee of the organization.

Table G11

Survey Question Responses with Mean Scores and Standard Deviations – Compliance Commitment

					Strongly disagree		Disagree		Neutral		Agree		Strongly agree	
					1		2		3		4		5	
		Mean score	Std. dev.	# of respondents	#	%	#	%	#	%	#	%	#	%
	Compliance commitment													
Q.33	How hard I work for this company is directly linked to how well I am rewarded.	3.34	0.98	57	0	0%	13	23%	18	32%	18	32%	8	14%
Q.34	Unless I am rewarded for it in some way, I see no reason to expend extra effort on behalf of the company.	2.86	0.94	57	3	5%	19	33%	18	32%	16	28%	1	2%
Q.35	In order for me to be rewarded by this company, it is necessary to express the right attitude.	3.43	0.93	57	0	0%	9	16%	23	40%	17	30%	8	14%

Table G12

Survey Question Responses with Mean Scores and Standard Deviations – Intent to Leave

					Strongly disagree		Disagree		Neutral		Agree		Strongly agree	
					1		2		3		4		5	
		Mean score	Std. dev.	# of respondents	#	%	#	%	#	%	#	%	#	%
	Intent to leave													
Q.36	You would prefer another more ideal job than the one you work in right now.	3.27	1.15	57	2	4%	16	28%	13	23%	17	30%	9	16%
Q.37	You would have seriously thought about changing companies since you began working here.	3.18	1.29	57	9	16%	6	11%	19	33%	13	23%	10	18%
Q.38*	How long do you intend remaining with this company? (scale: less than 1 yr. {5}; 1 to 3 yrs {4}; 4 to 5 yrs {3}; 6 to 10 yrs {2}; Until Retirement {1}.	2.54	1.45	57	19	33%	12	21%	12	21%	5	9%	9	16%
Q.39	If you have your own way, you will not be working for this company three years from now.	2.70	1.45	57	12	21%	21	37%	7	12%	4	7%	13	23%

* Scoring scale as explained in question text.

Appendix H

Graphical Representation of the Mean Scores by Question Number and Descriptive Factor

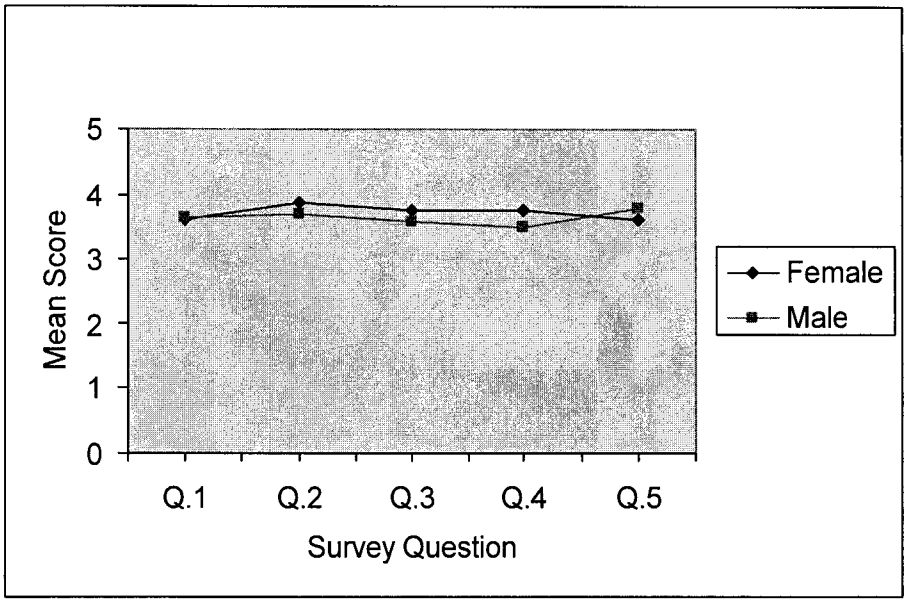


Figure H1. Team building mean scores by gender.

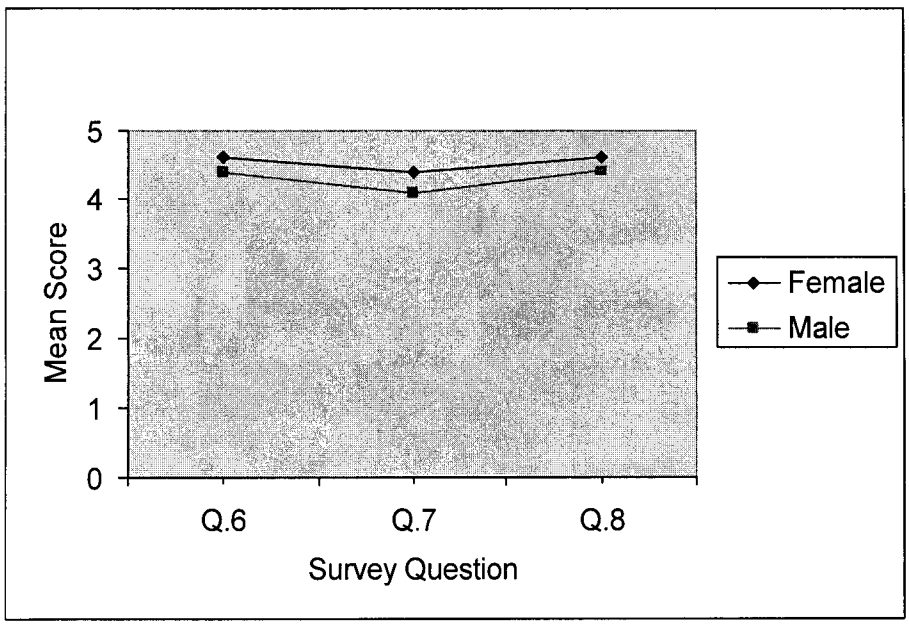


Figure H2. Expertise mean scores by gender.

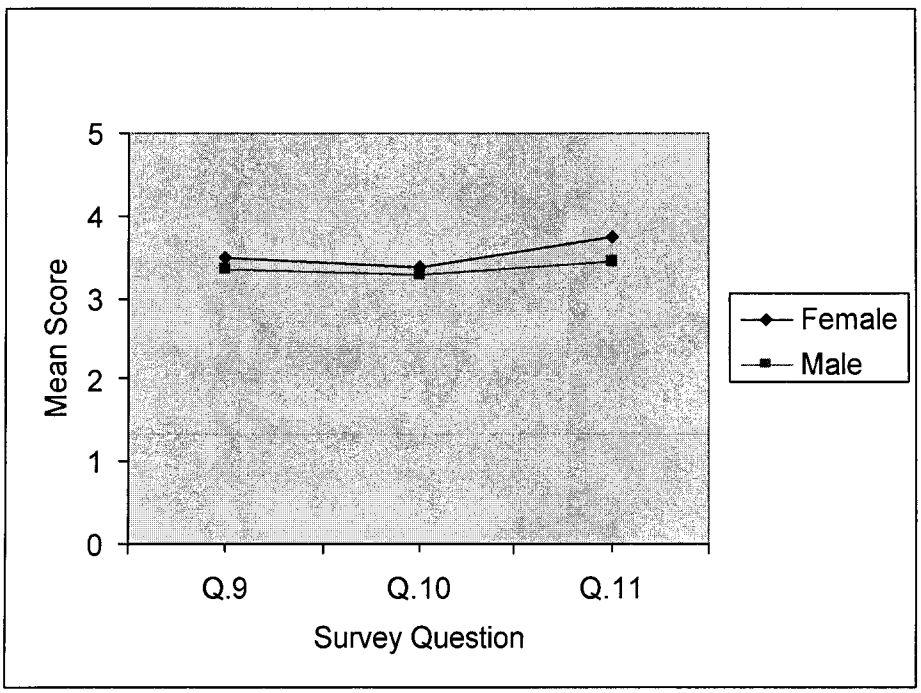


Figure H3. Initiative mean scores by gender.

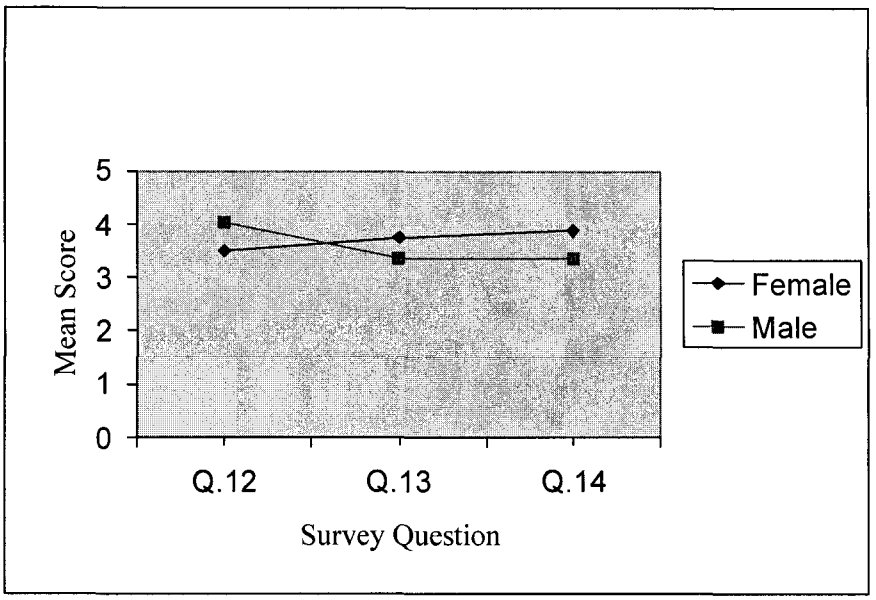


Figure H4. Persistence mean scores by gender.

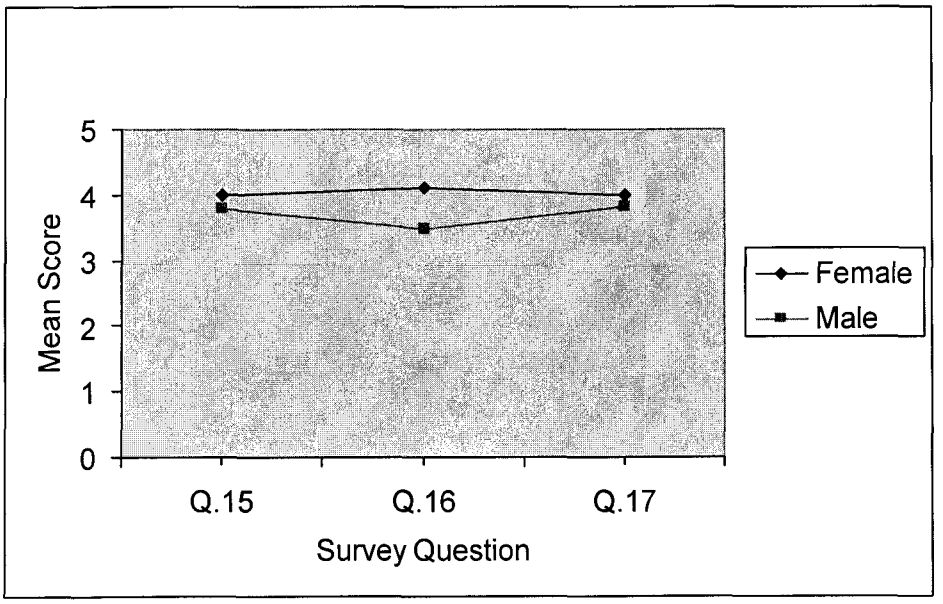


Figure H5. Integrity mean scores by gender.

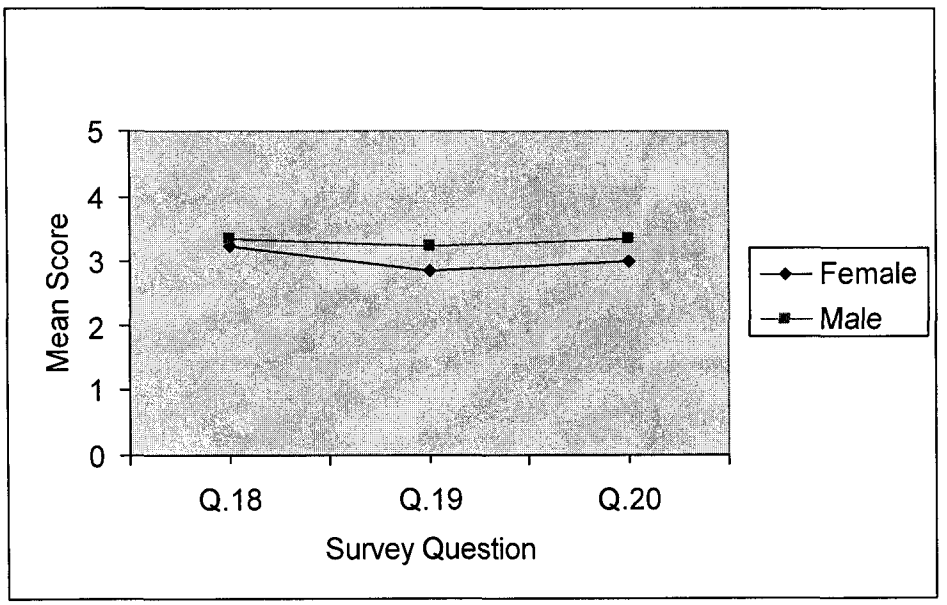


Figure H6. Vision mean scores by gender.

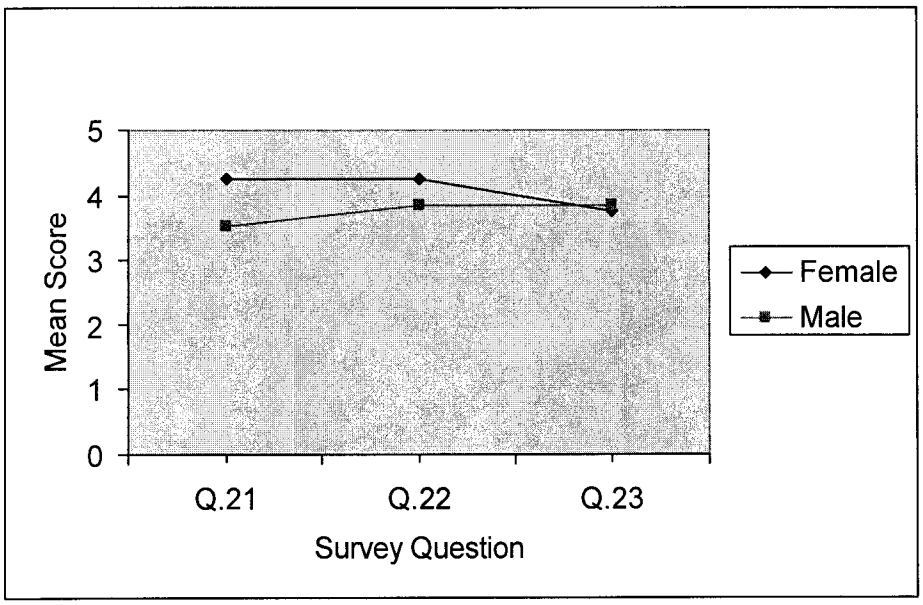


Figure H7. Communication mean scores by gender.

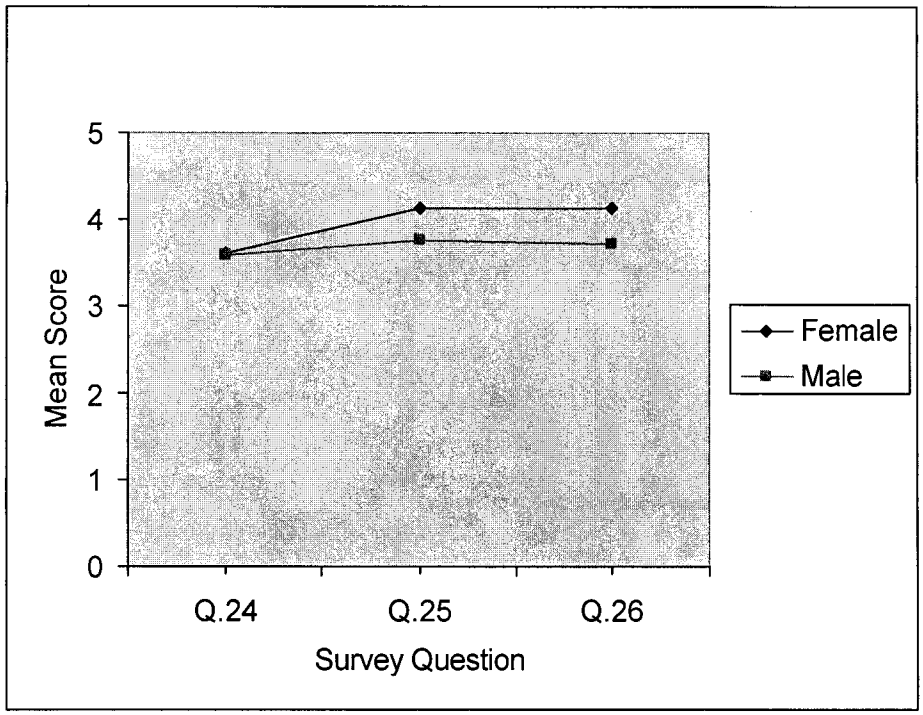


Figure H8. Accountability mean scores by gender.

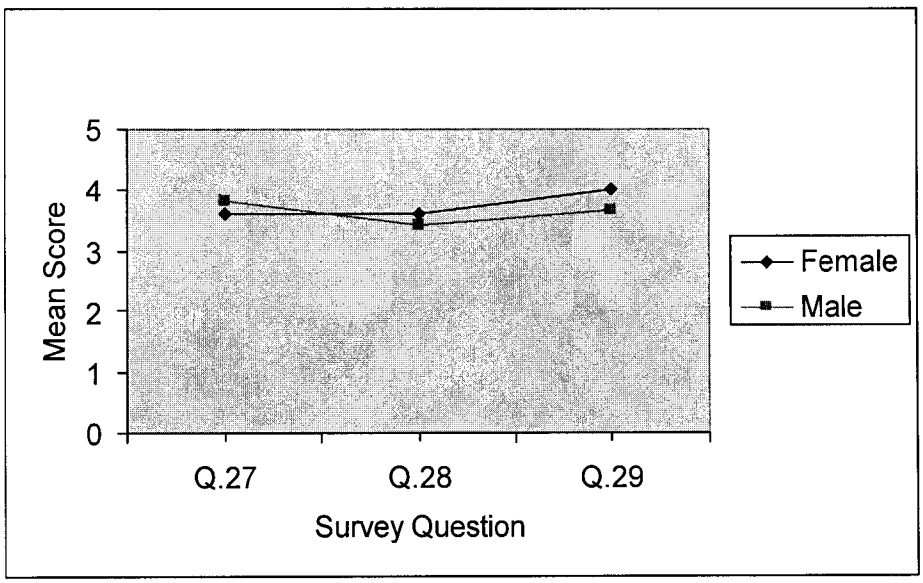


Figure H9. Courage mean scores by gender.

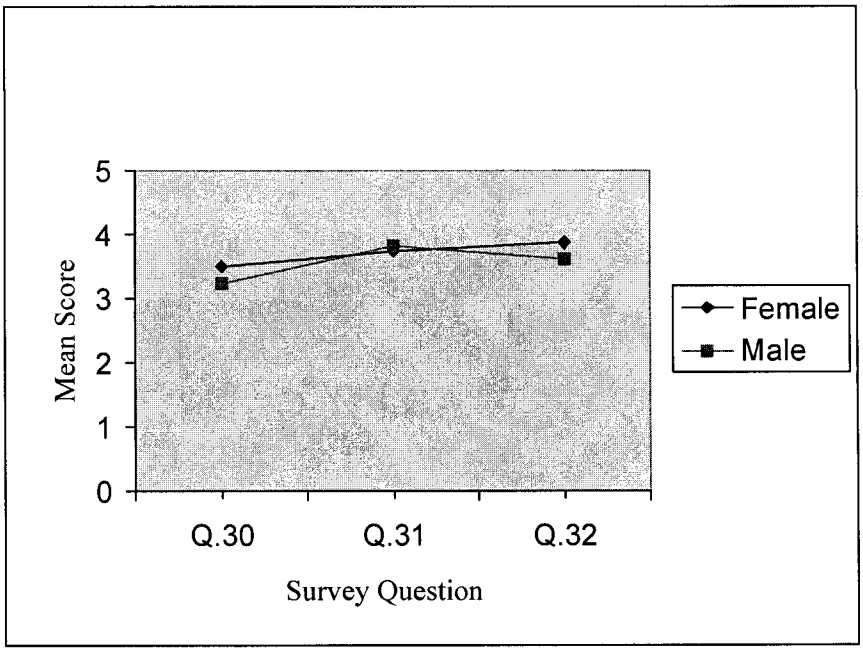


Figure H10. Identification commitment mean scores by gender.

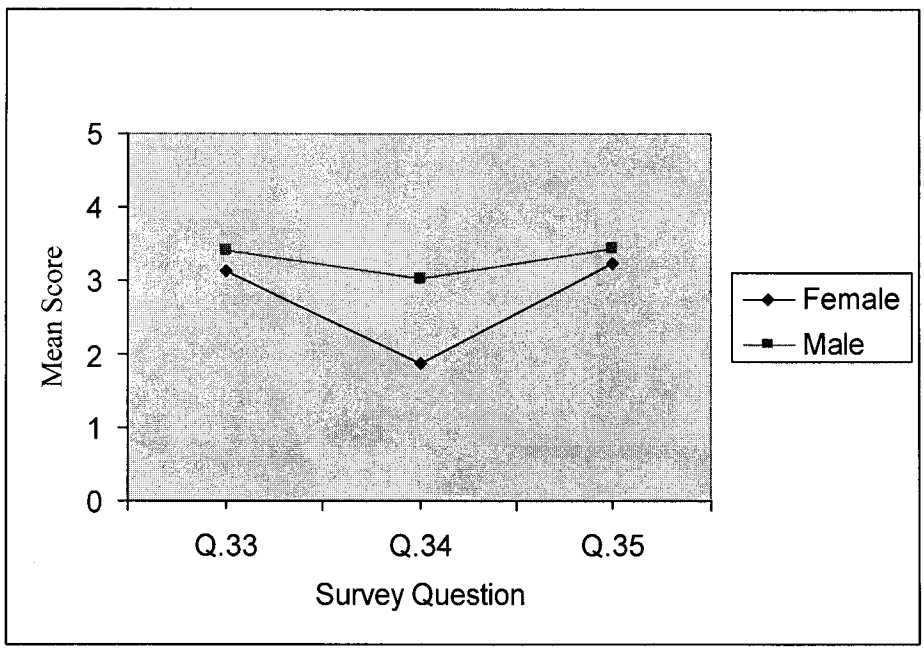


Figure H11. Compliance commitment mean scores by gender.

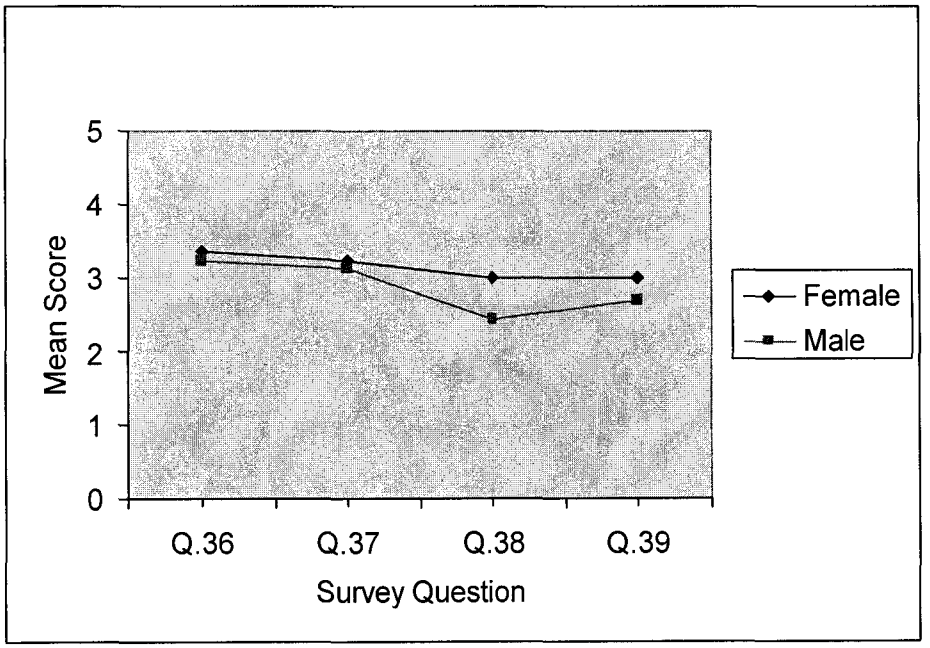


Figure H12. Intent to leave mean scores by gender.

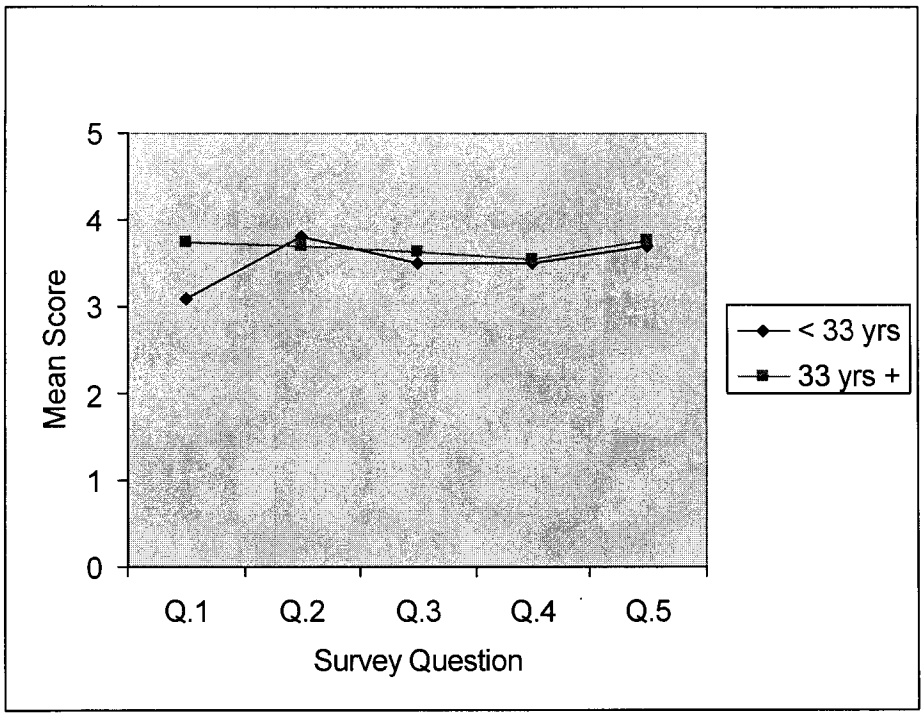


Figure H13. Team building mean scores by age.

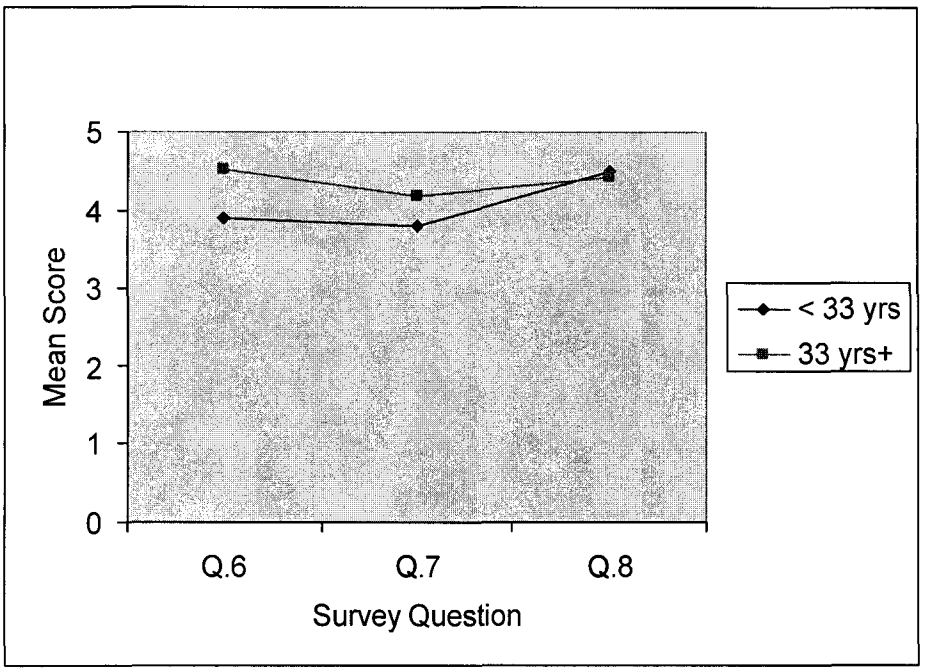


Figure H14. Expertise mean scores by age.

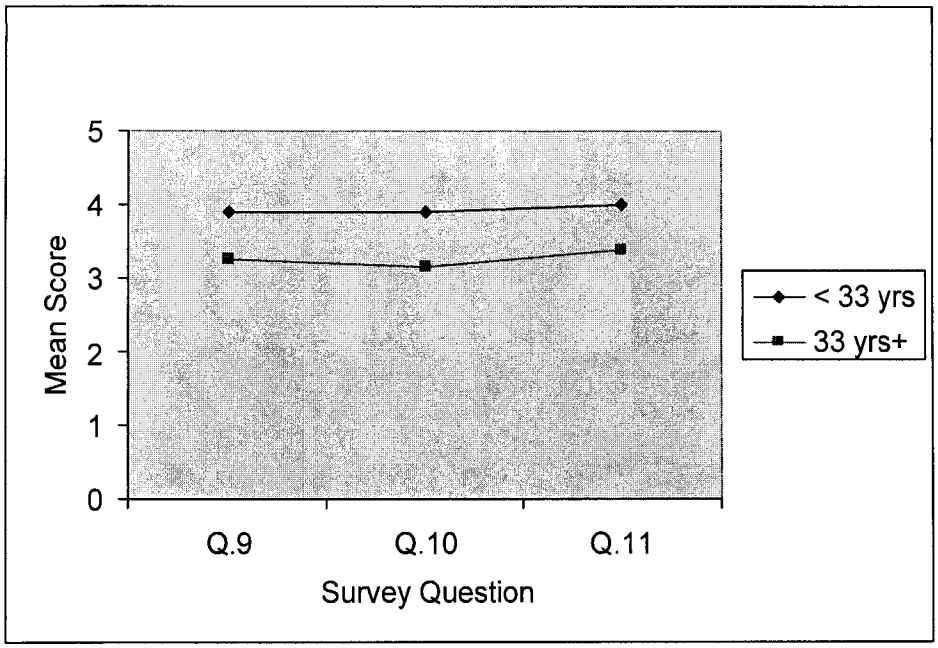


Figure H15. Initiative mean scores by age.

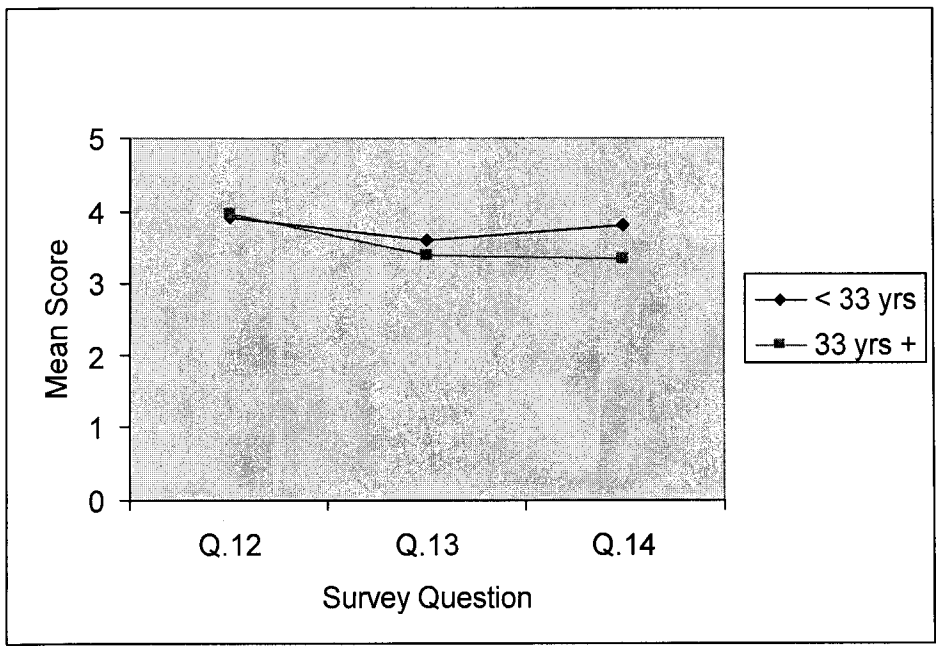


Figure H16. Persistence mean scores by age.

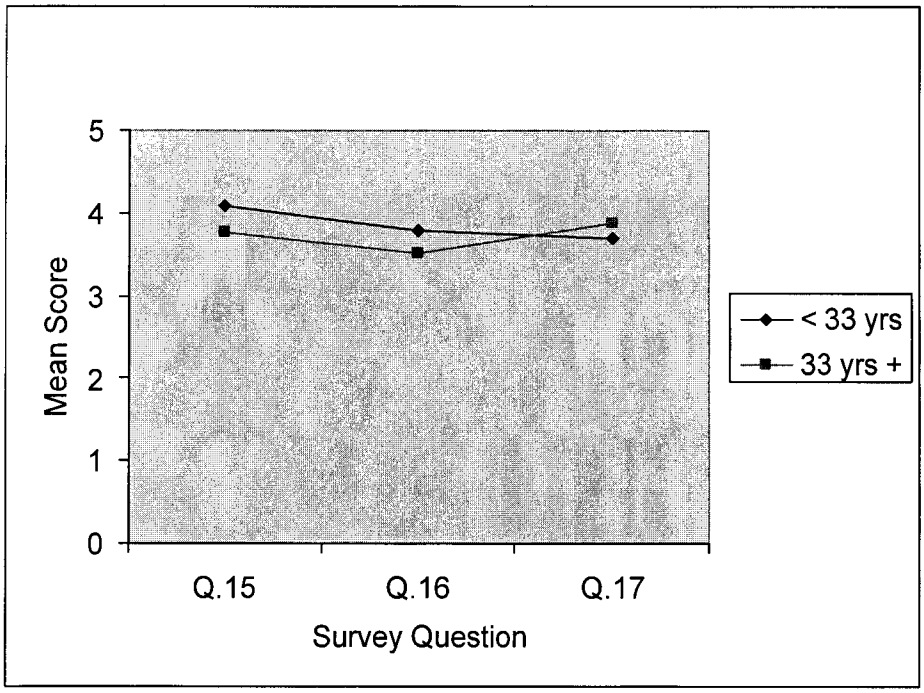


Figure H17. Integrity mean scores by age.

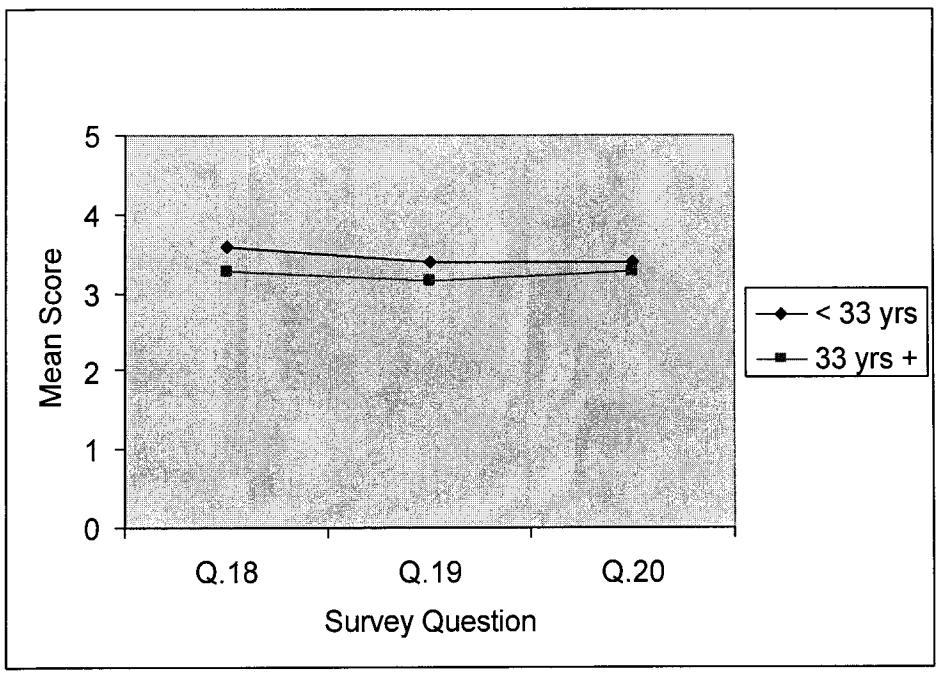


Figure H18. Vision mean scores by age.

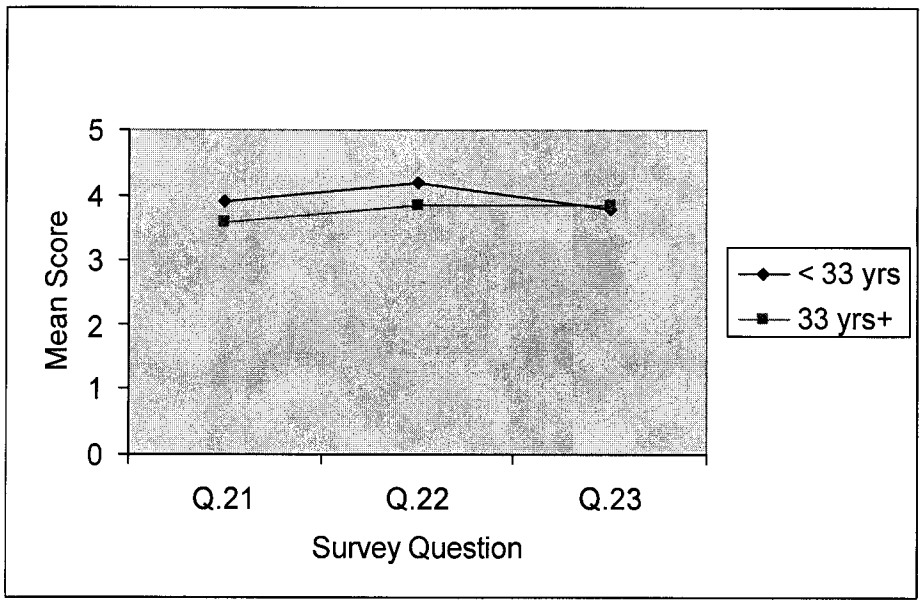


Figure H19. Communication mean scores by age.

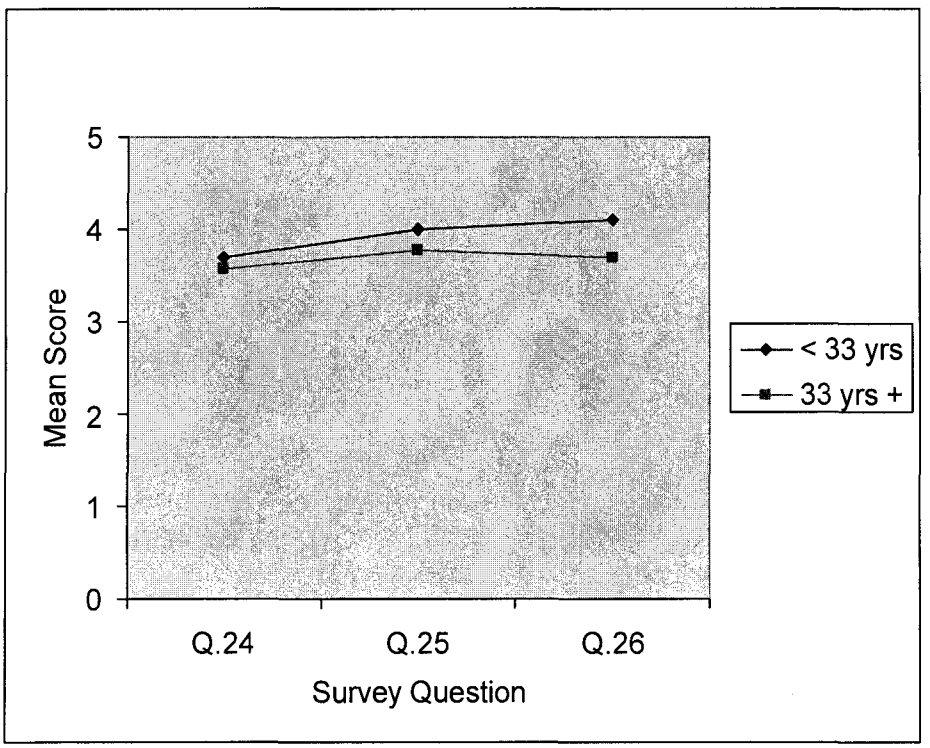


Figure H20. Accountability mean scores by age.

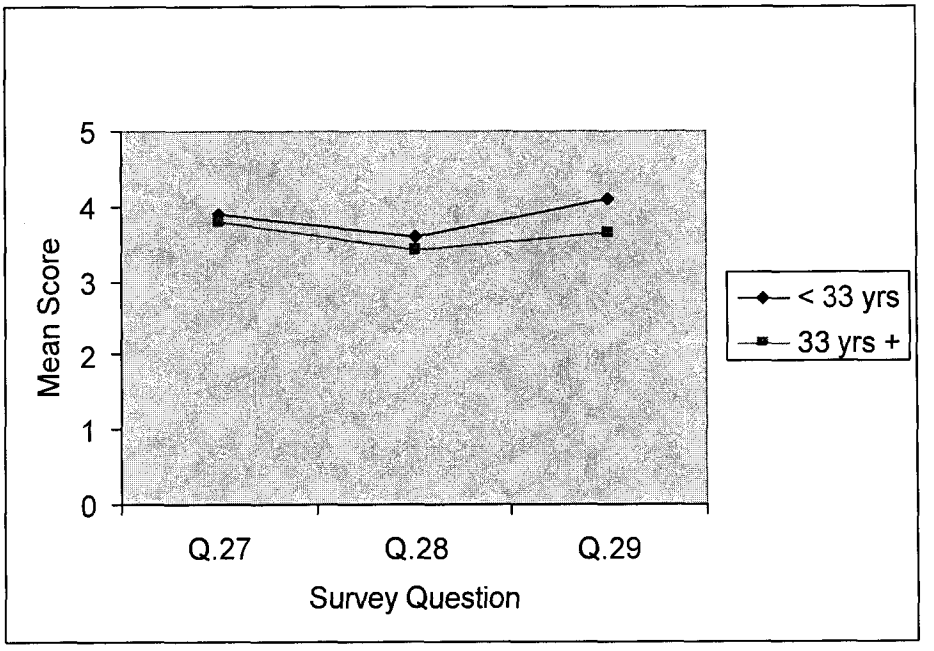


Figure H21. Courage mean scores by age.

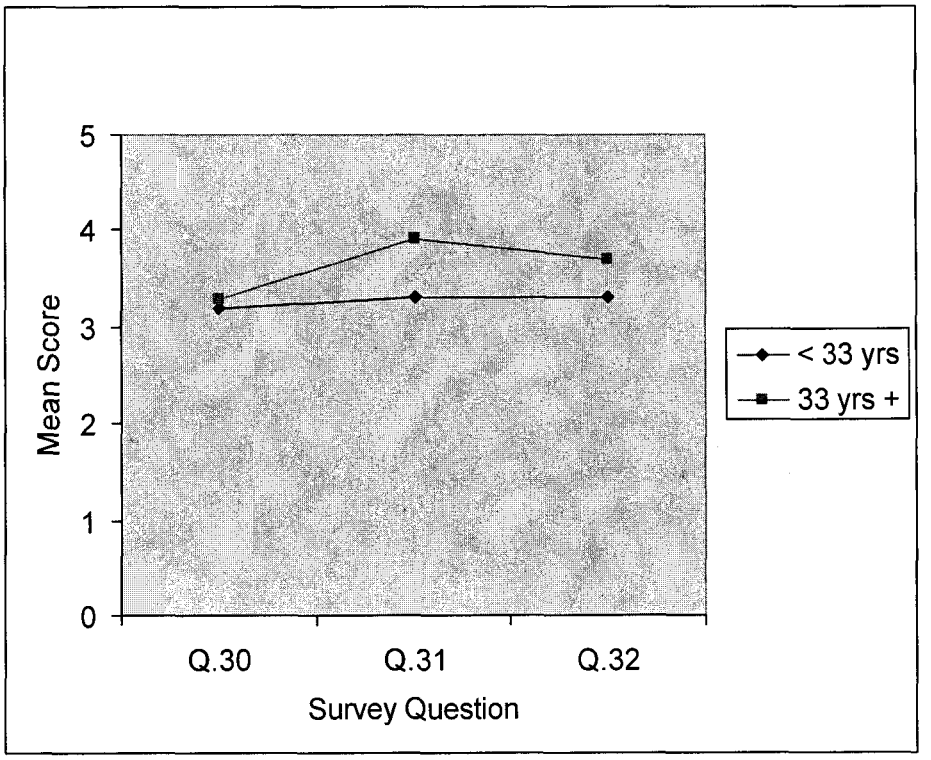


Figure H22. Identification commitment mean scores by age.

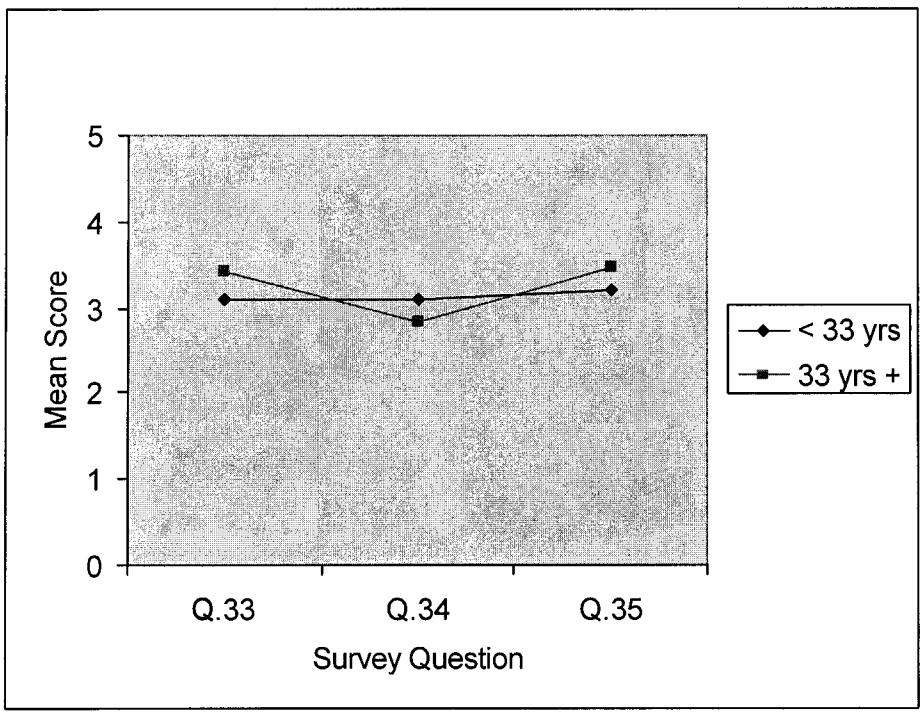


Figure H23. Compliance commitment mean scores by age.

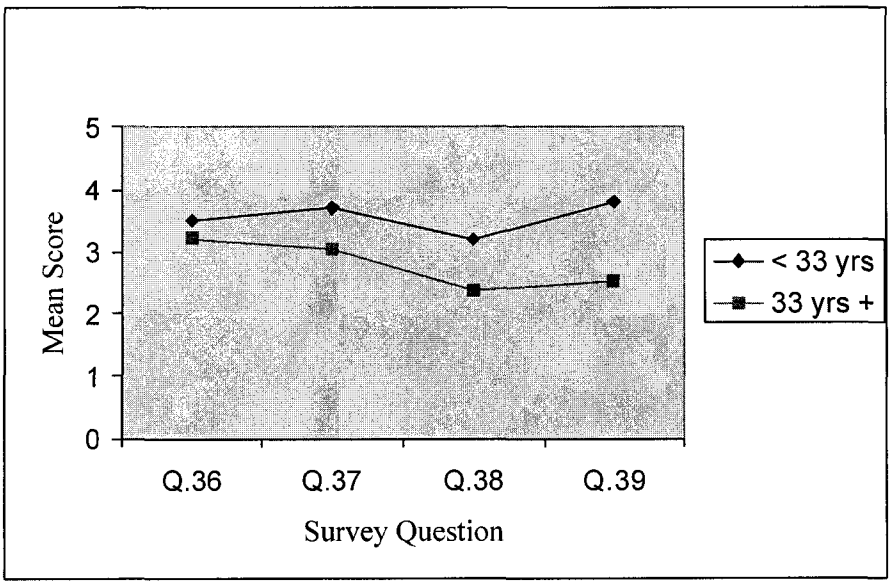


Figure H24. Intent to leave mean scores by age.

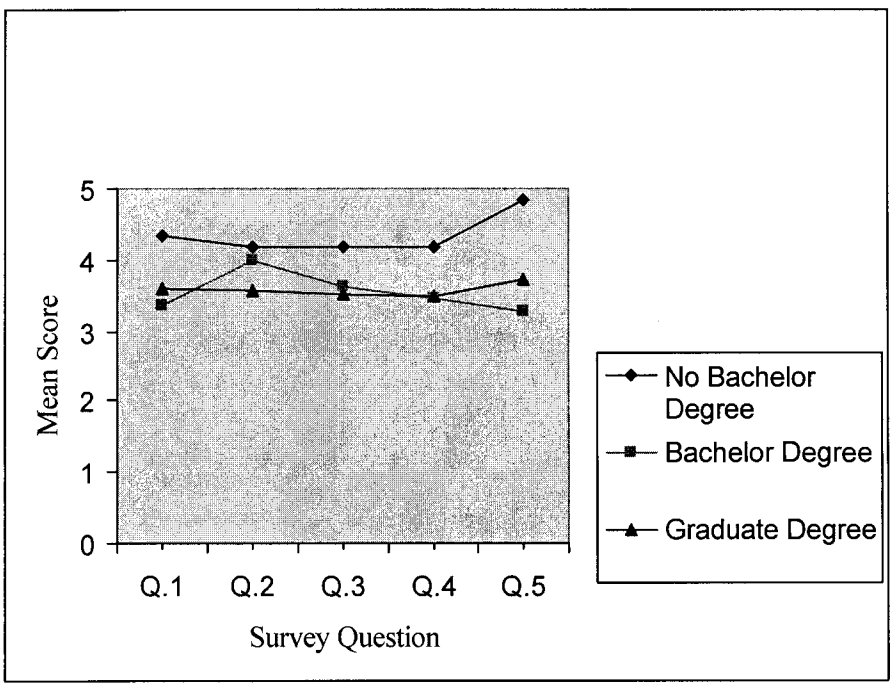


Figure H25. Team building mean scores by level of education.

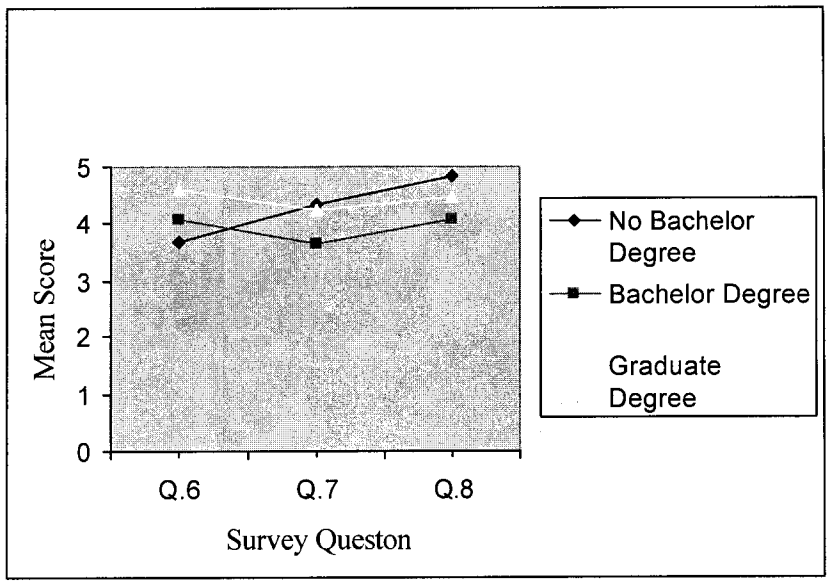


Figure H26. Expertise mean scores by level of education.

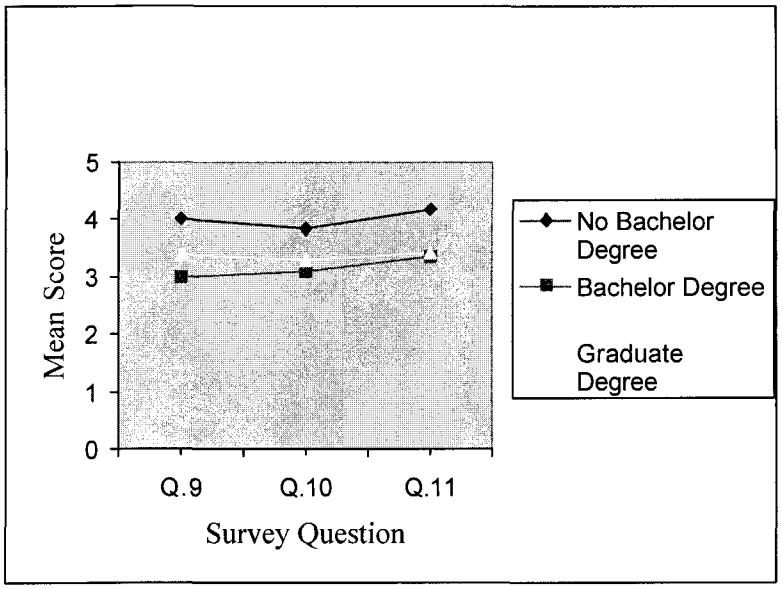


Figure H27. Initiative mean scores by level of education.

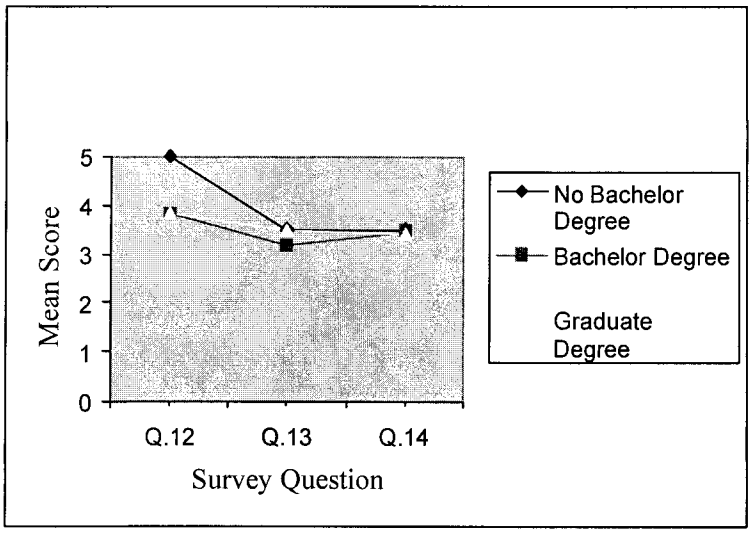


Figure H28. Persistence mean scores by level of education.

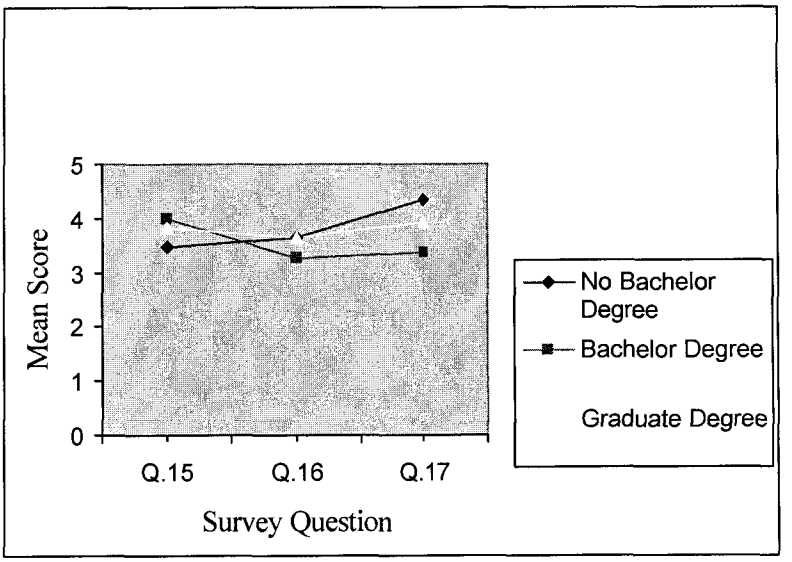


Figure H29. Integrity mean scores by level of education.

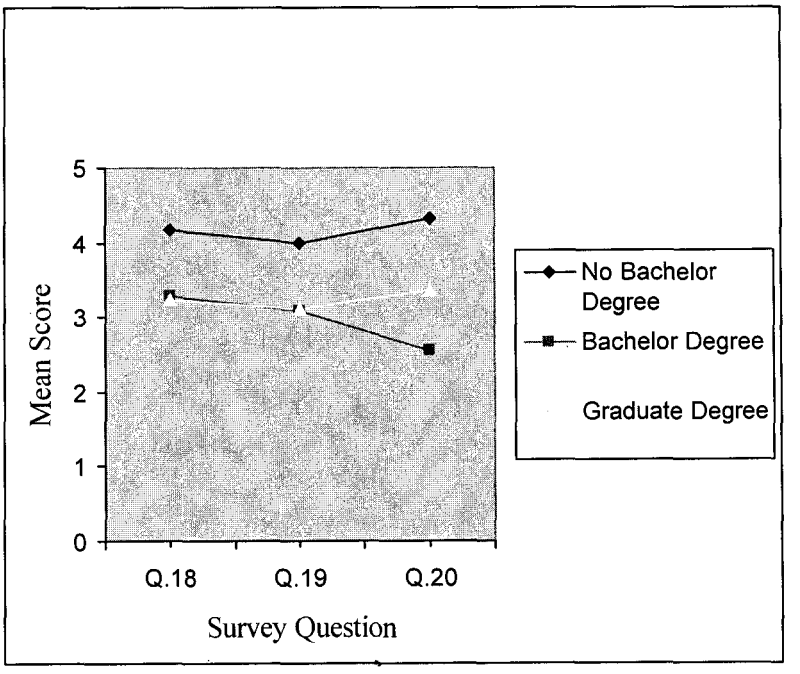


Figure H30. Vision mean scores by level of education.

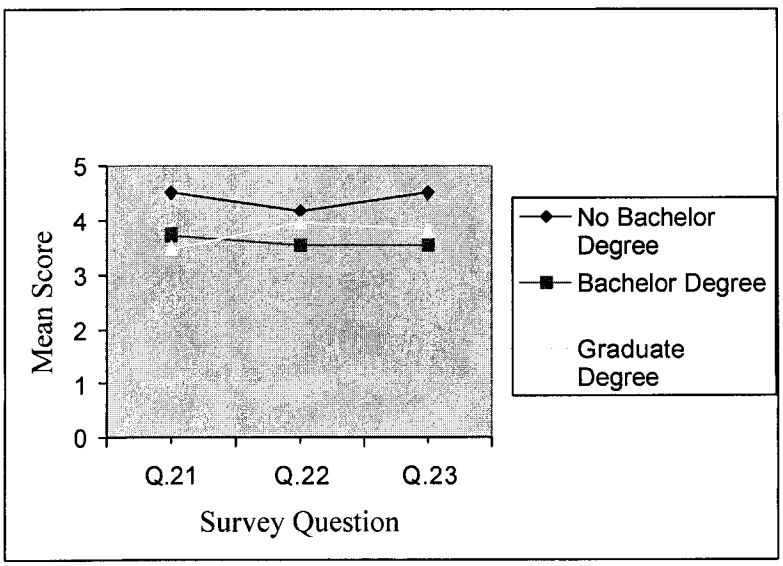


Figure H31. Communication mean scores by level of education.

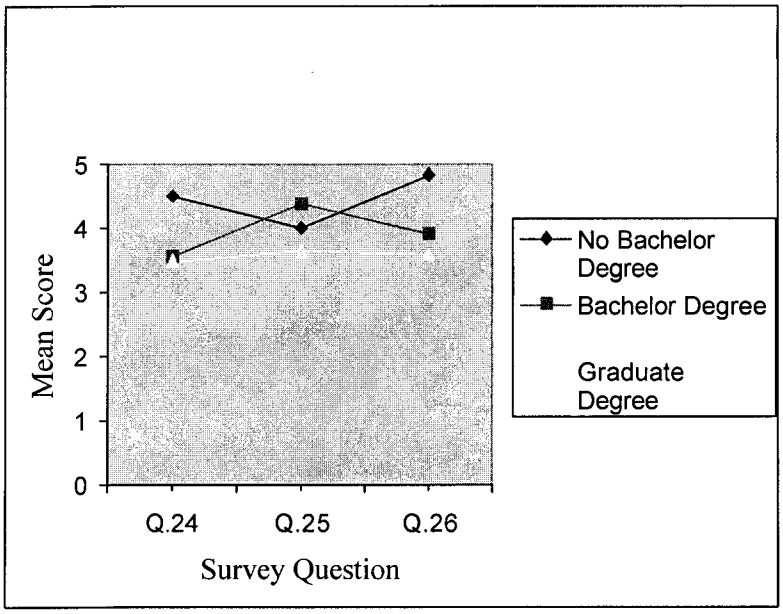


Figure H32. Accountability mean scores by level of education.

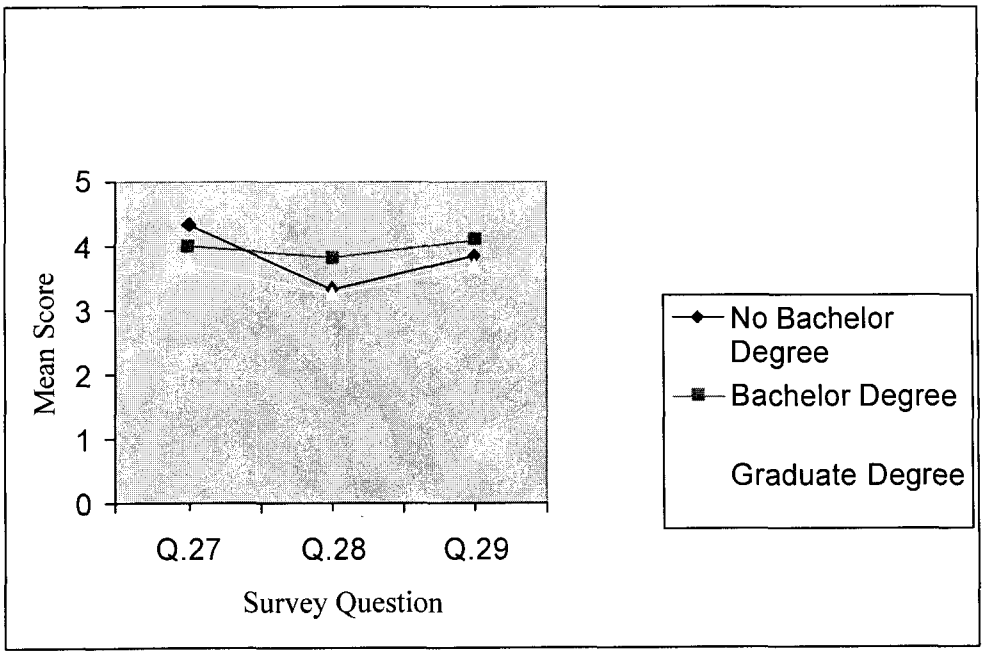


Figure H33. Courage mean scores by level of education.

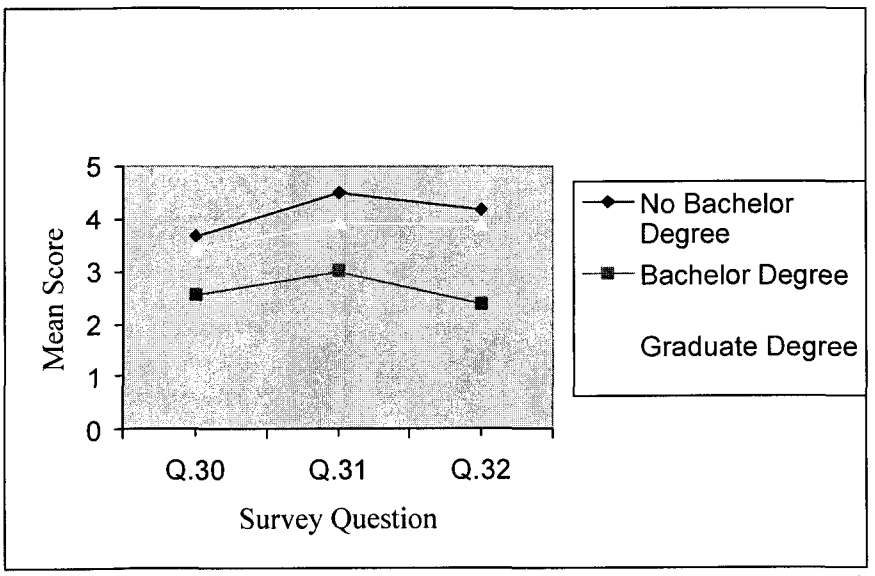


Figure H34. Identification commitment mean scores by level of education.

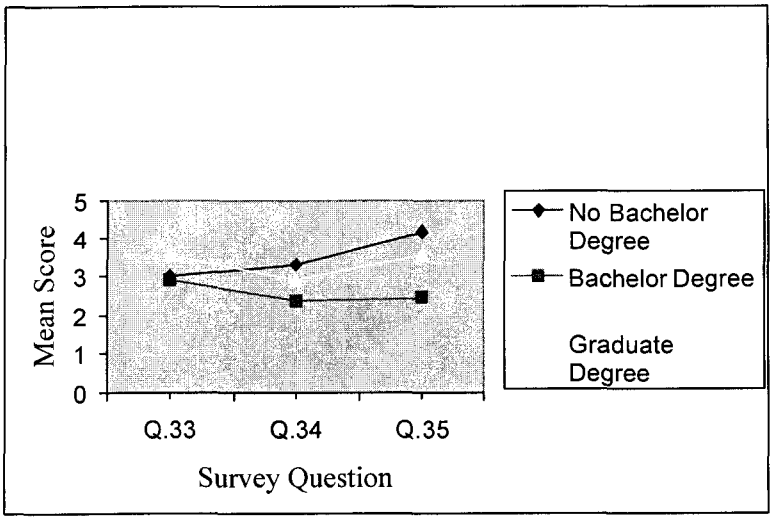


Figure H35. Compliance commitment mean scores by level of education.

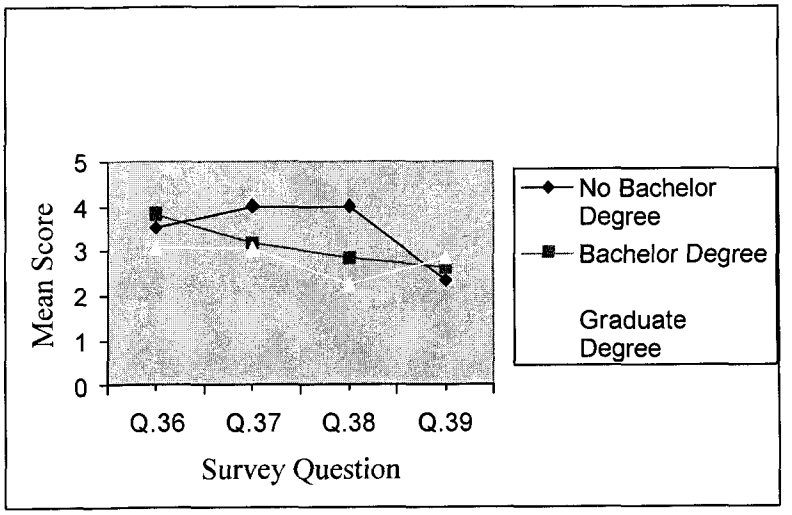


Figure H36. Intent to leave mean scores by level of education.

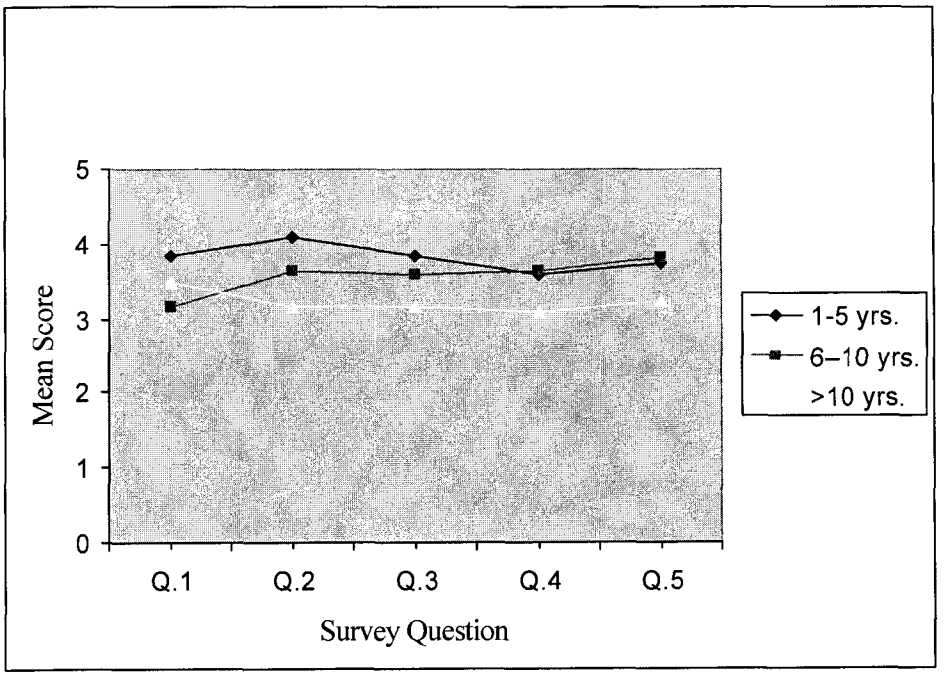


Figure H37. Team building mean scores by years in company.

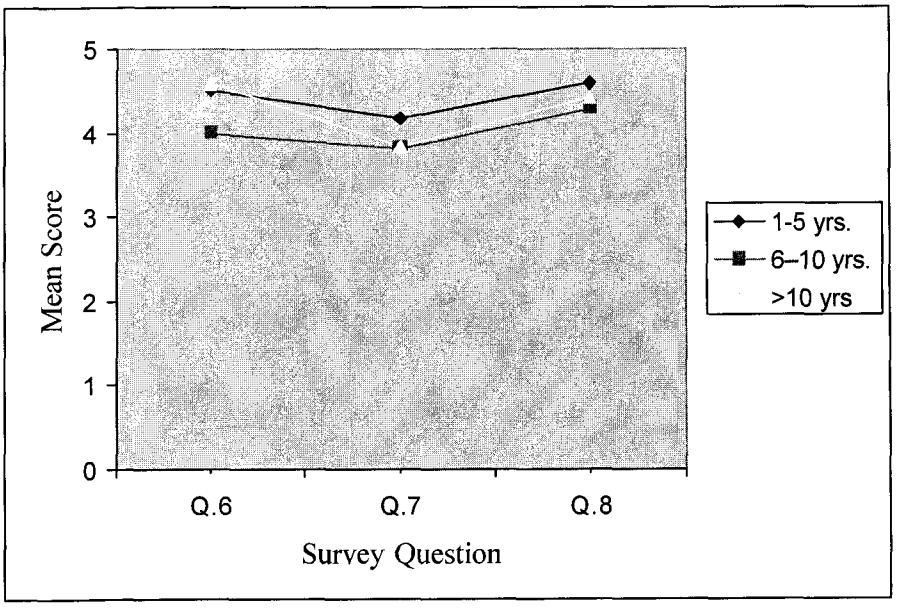


Figure H38. Expertise mean scores by years in company.

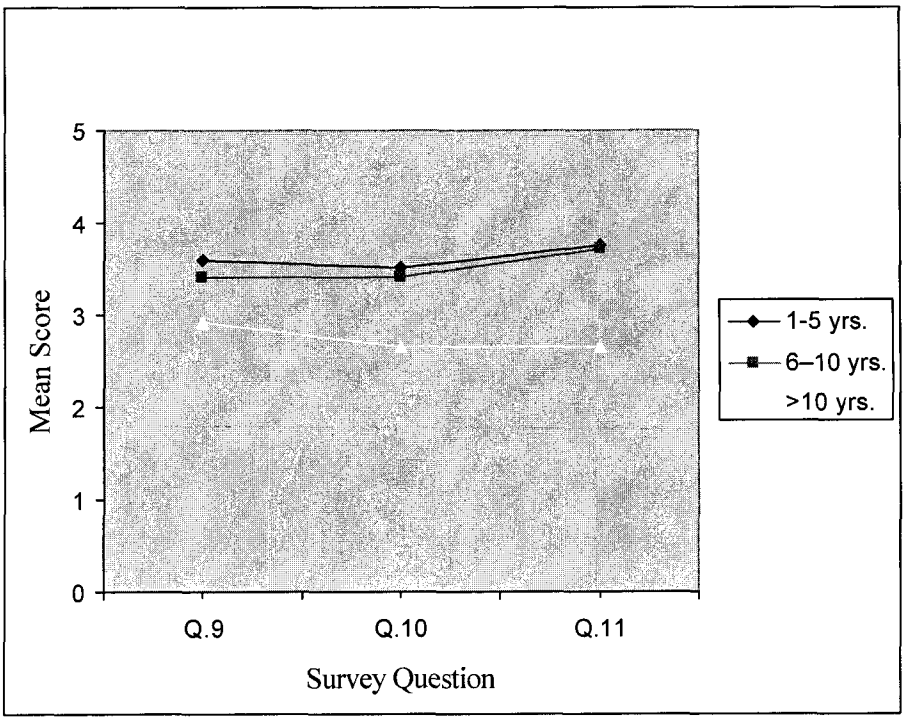


Figure H39. Initiative mean scores by years in company.

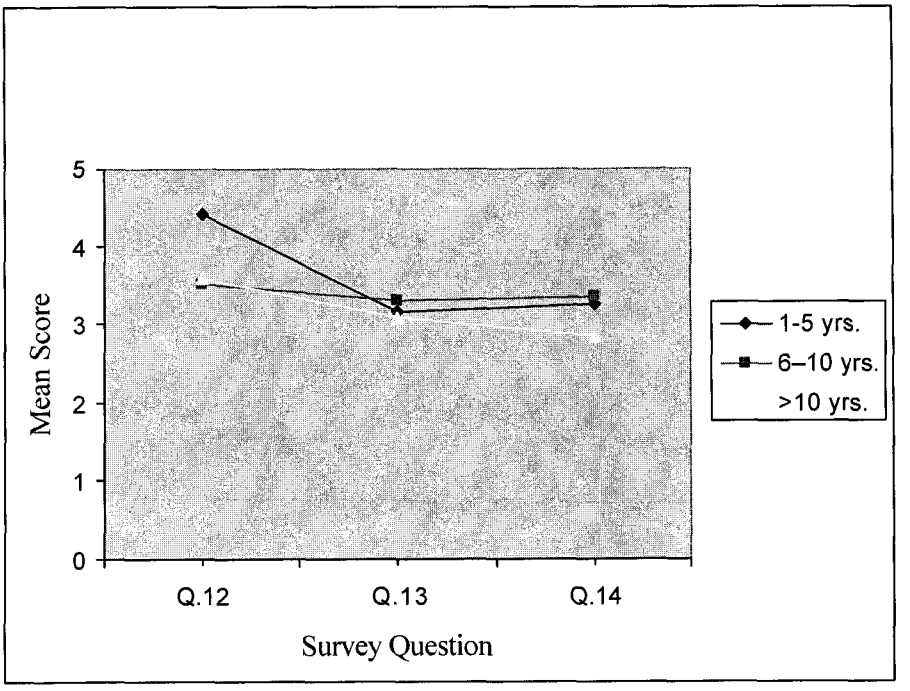


Figure H40. Persistence mean scores by years in company.

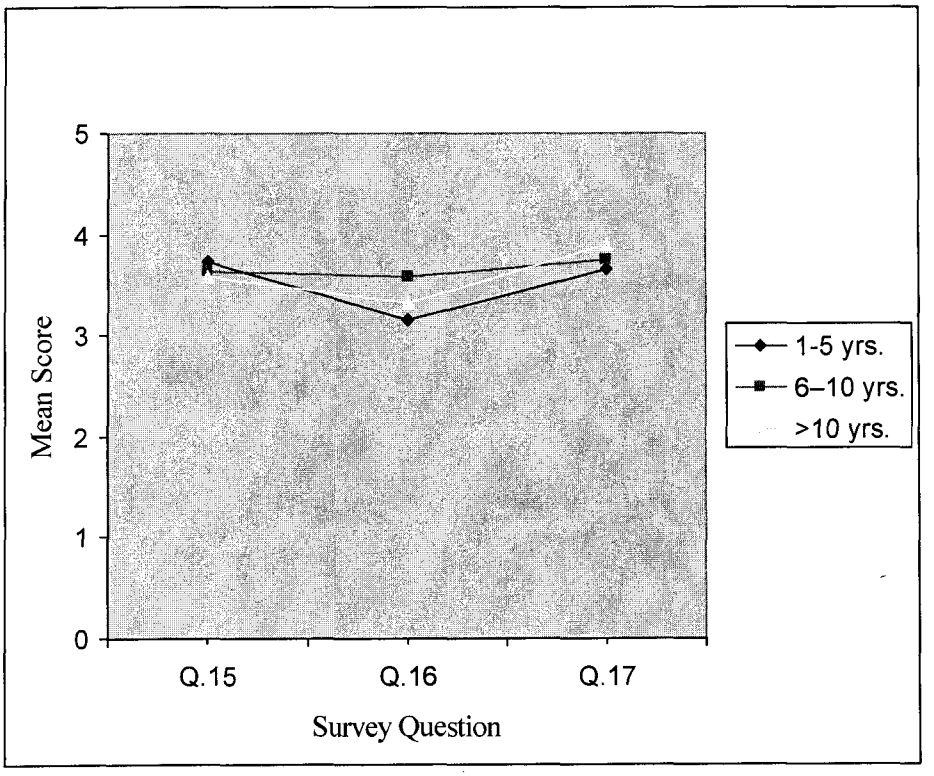


Figure H41. Integrity mean scores by years in company.

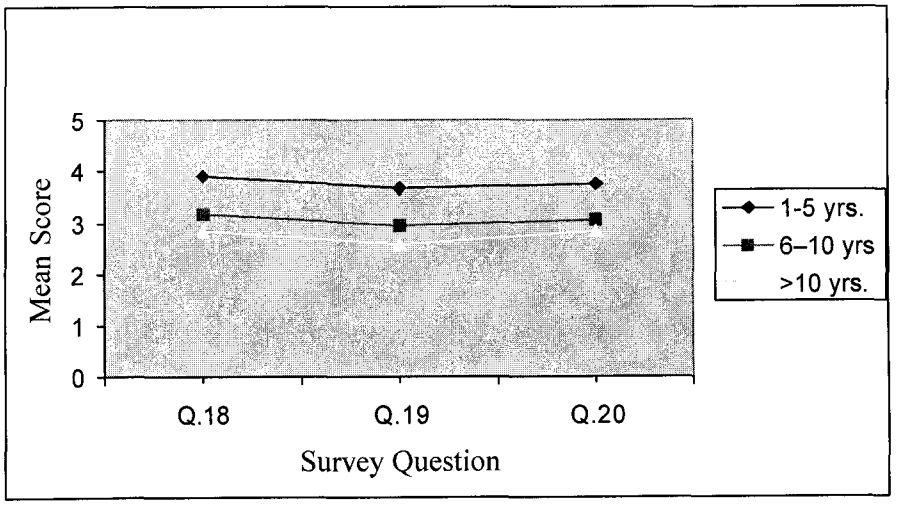


Figure H42. Vision mean scores by years in company.

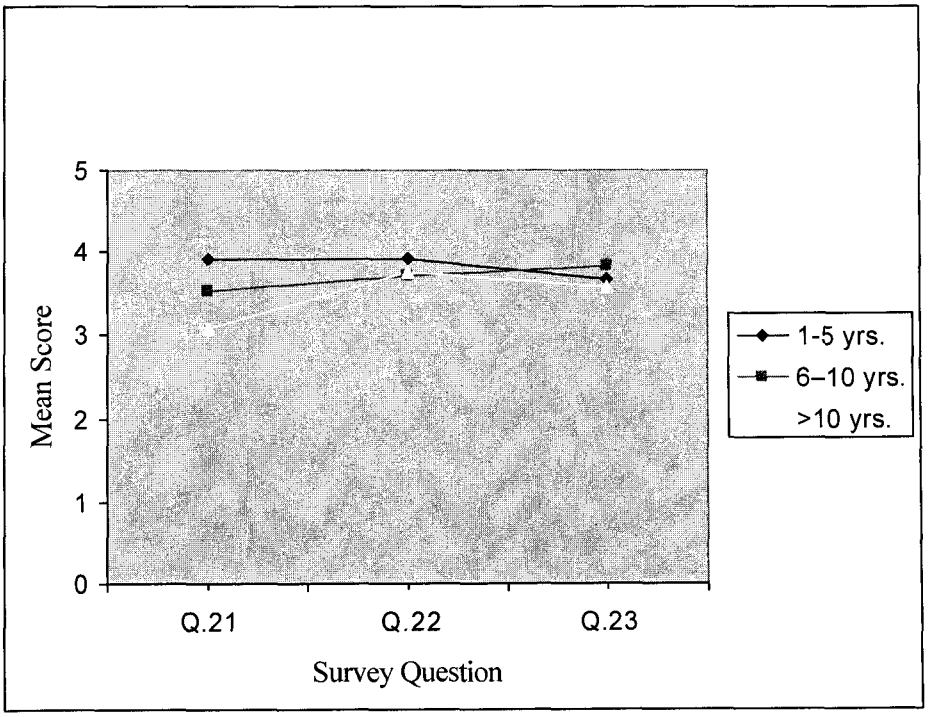


Figure H43. Communication mean scores by years in company.

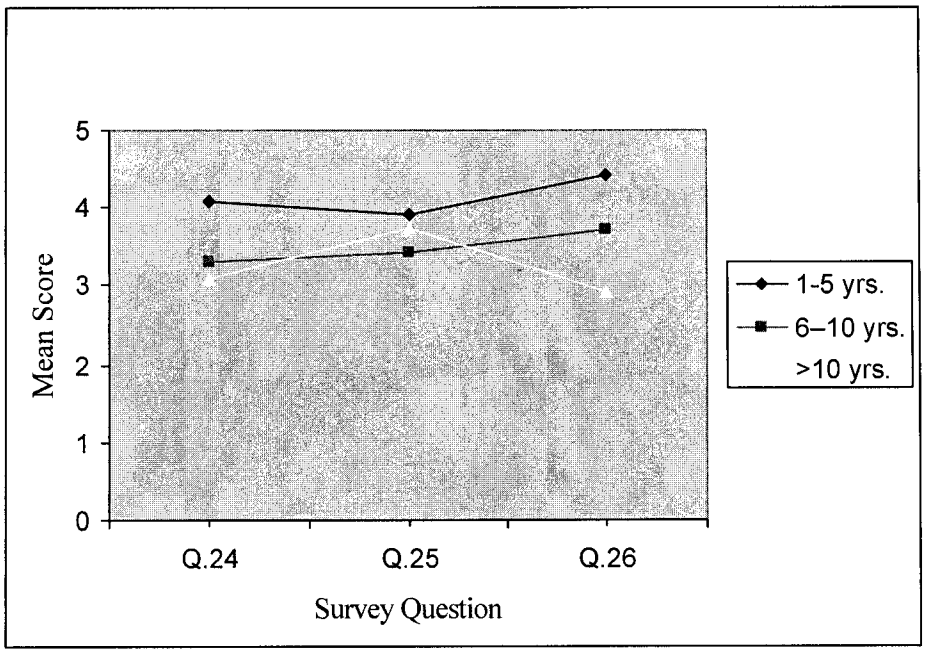


Figure H44. Accountability mean scores by years in company.

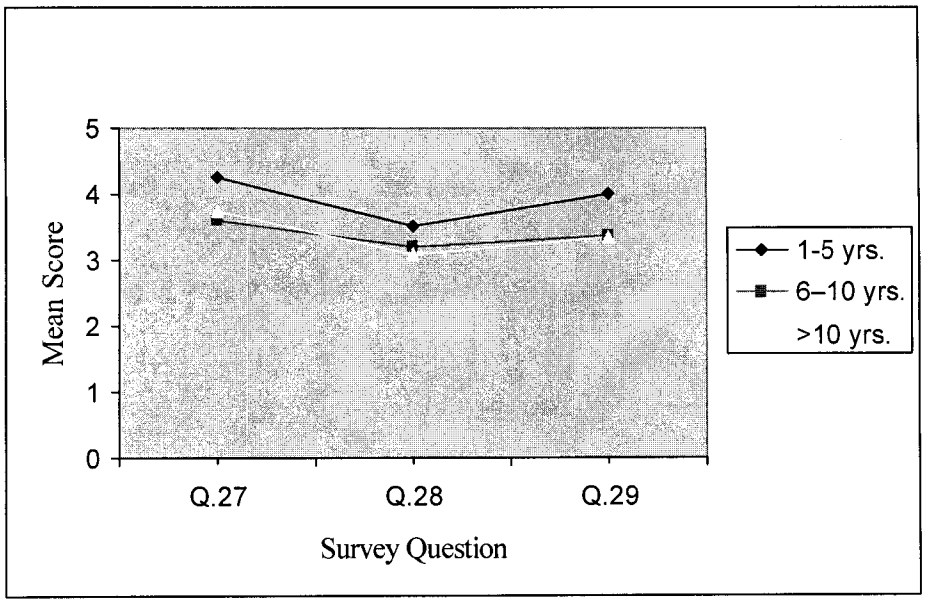


Figure H45. Courage mean scores by years in company.

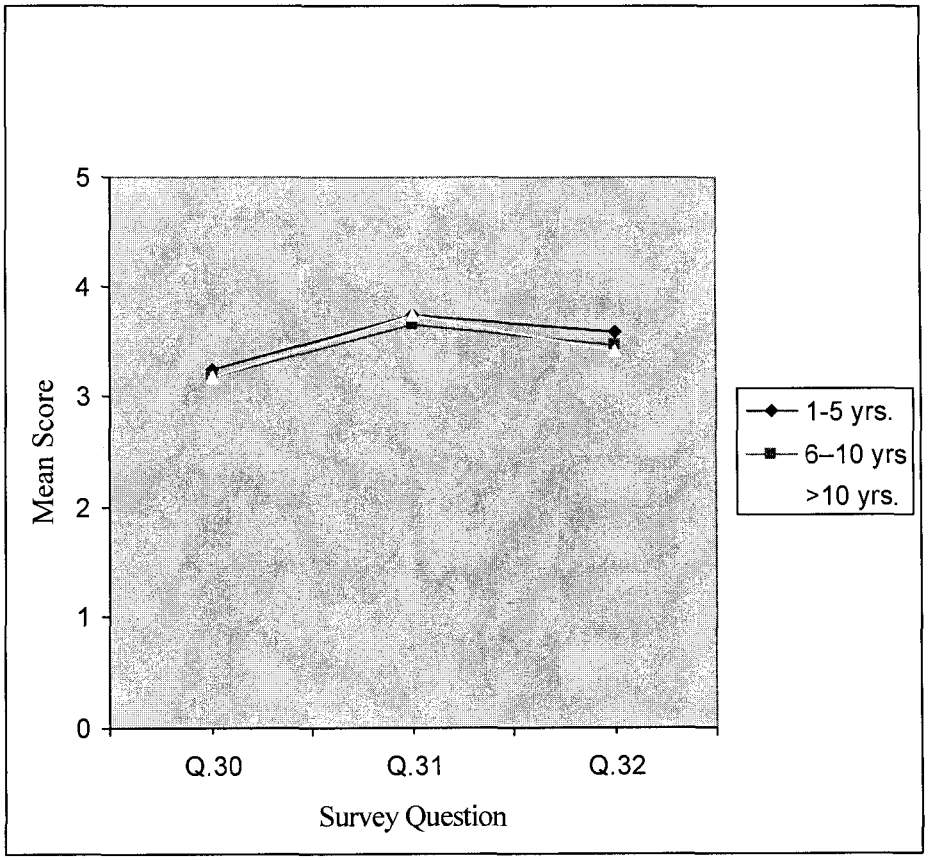


Figure H46. Identification commitment mean scores by years in company.

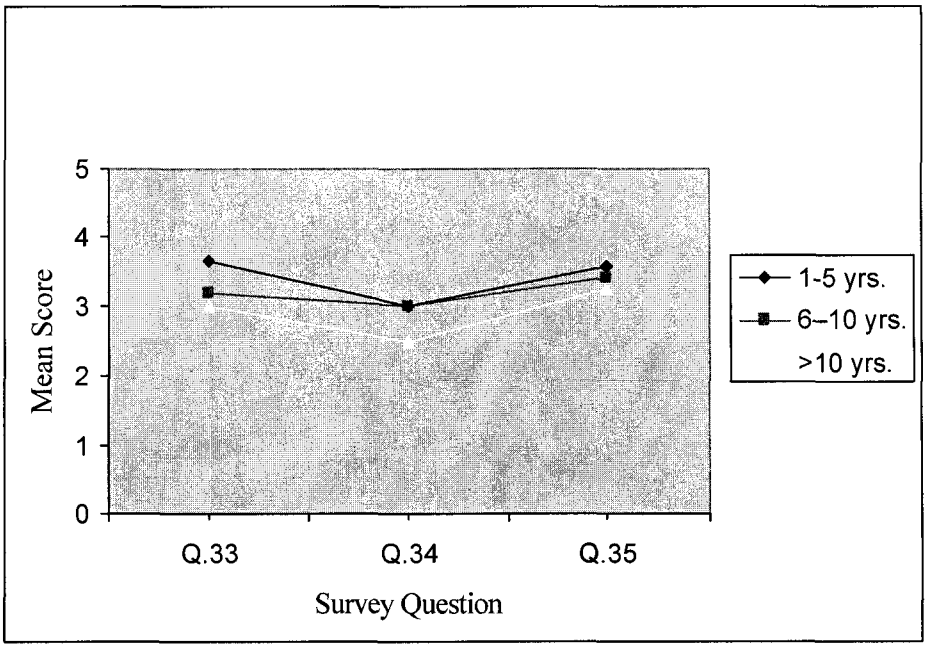


Figure H47. Compliance commitment mean scores by years in company.

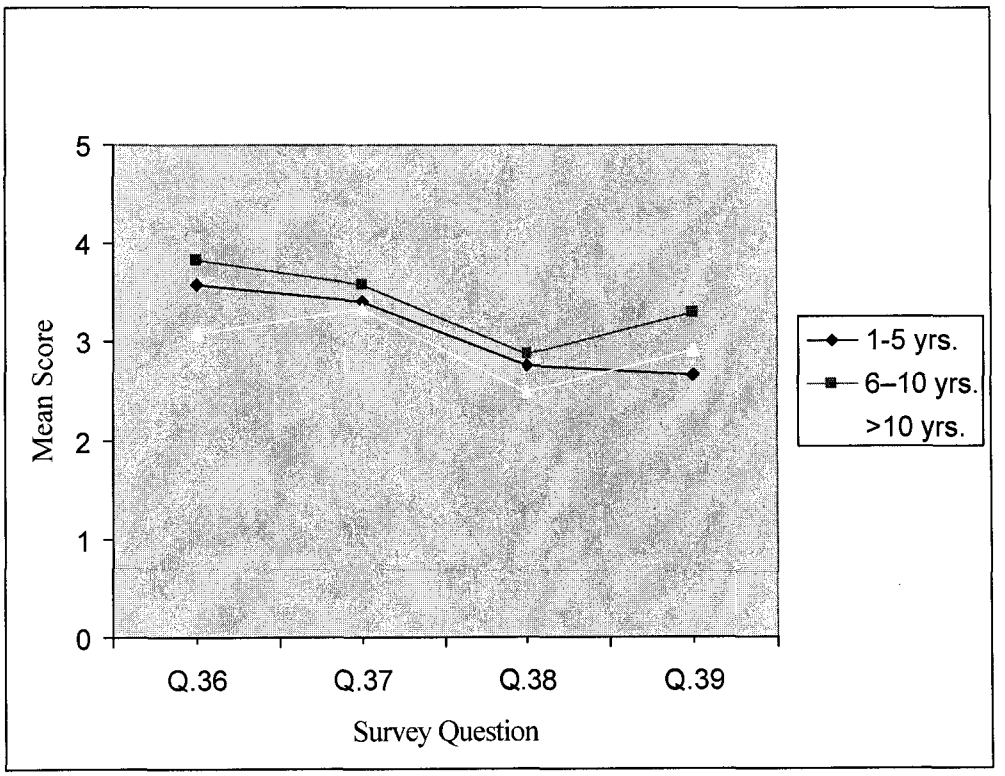


Figure H48. Intent to leave mean scores by years in company.

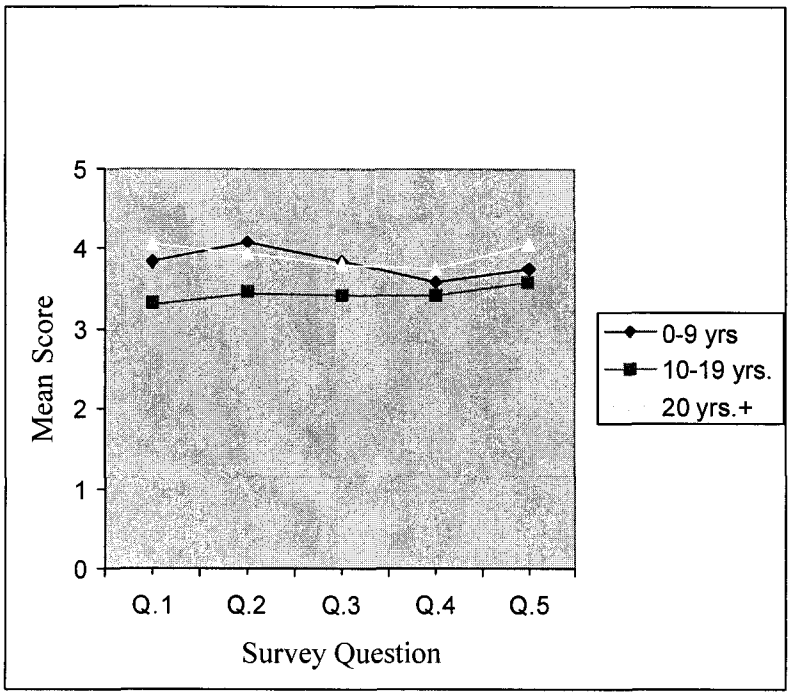


Figure H49. Team building mean scores by years of engineering experience.

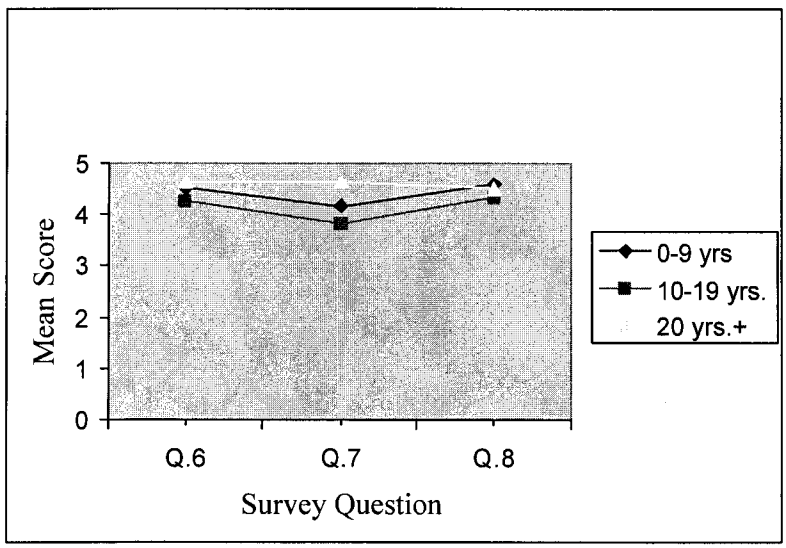


Figure H50. Expertise mean scores by years of engineering experience.

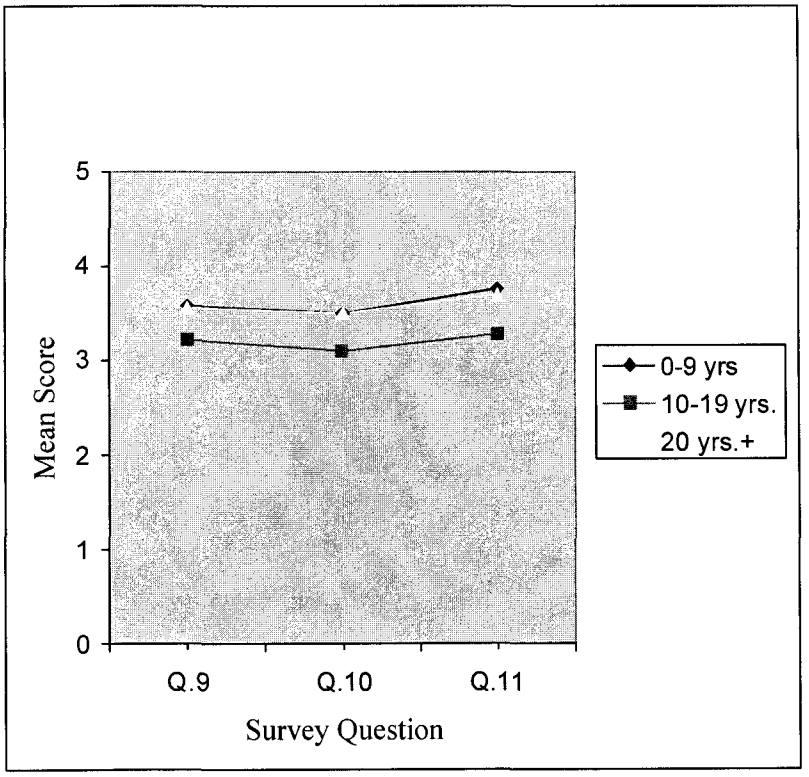


Figure H51. Initiative mean scores by years of engineering experience.

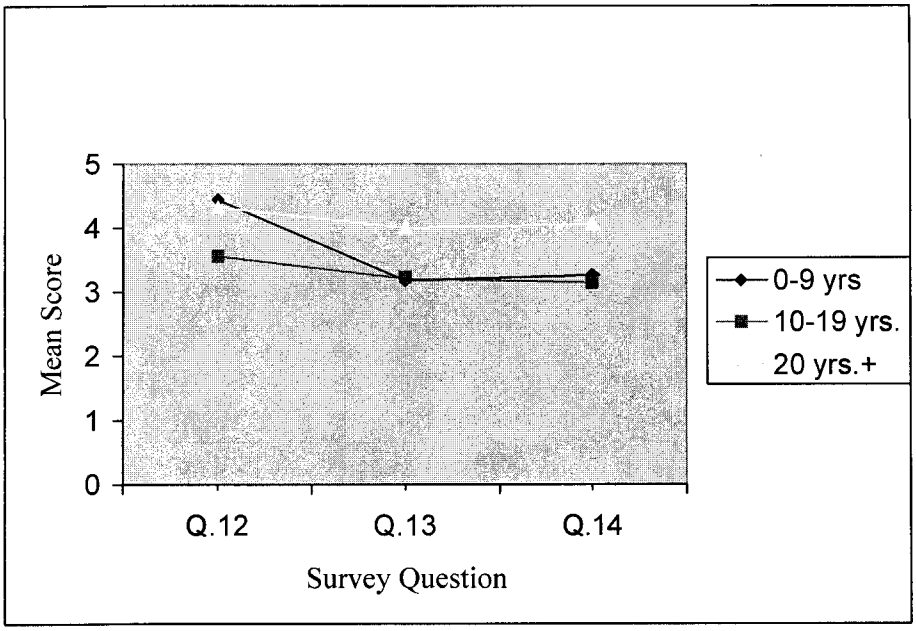


Figure H52. Persistence mean scores by years of engineering experience.

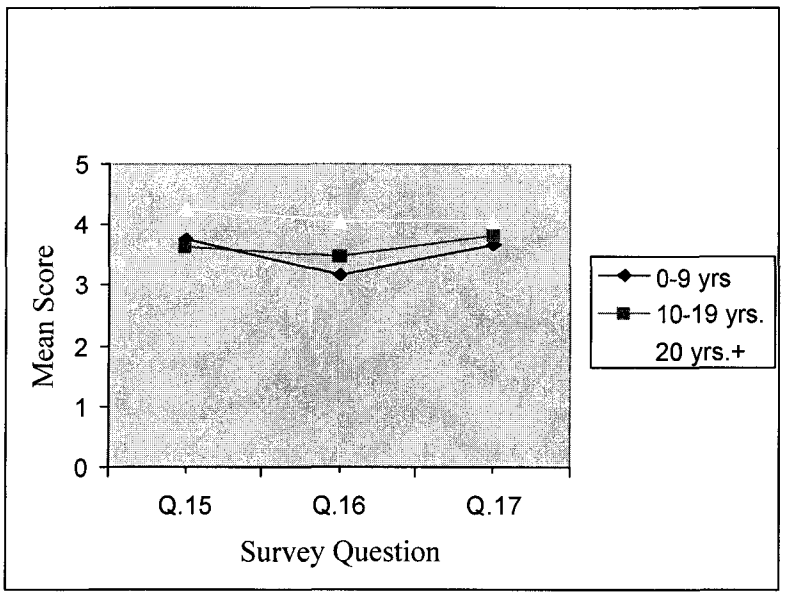


Figure H53. Integrity mean scores by years of engineering experience.

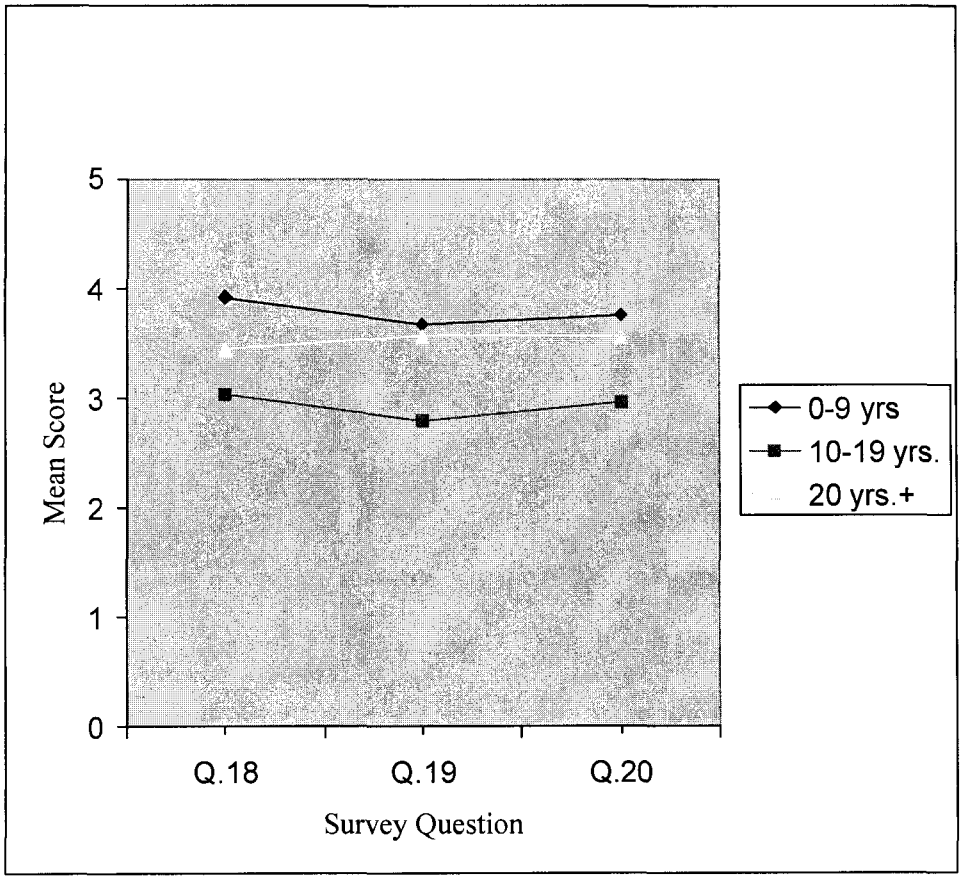


Figure H54. Vision mean scores by years of engineering experience.

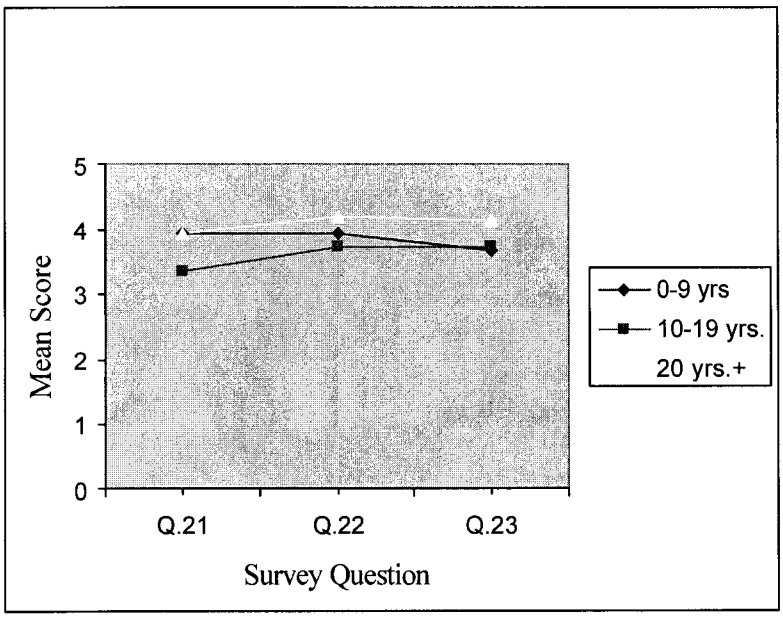


Figure H55. Communication mean scores by years of engineering experience.

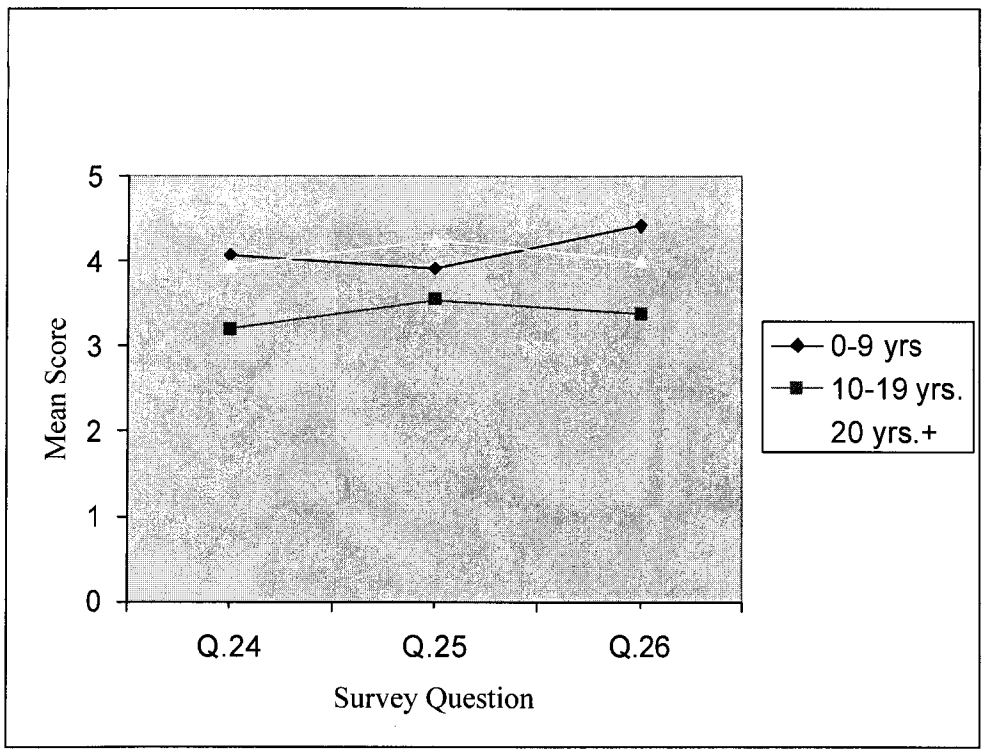


Figure H56. Accountability mean scores by years of engineering experience.

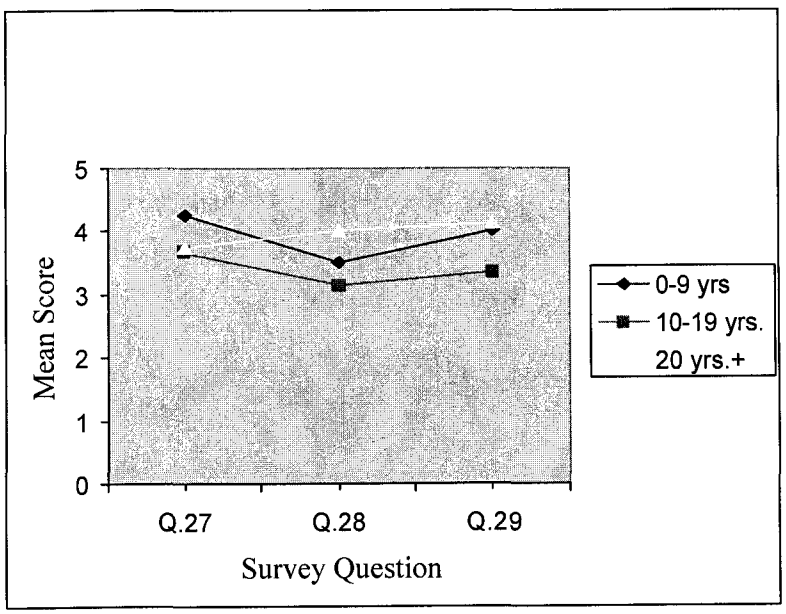


Figure H57. Courage mean scores by years of engineering experience.

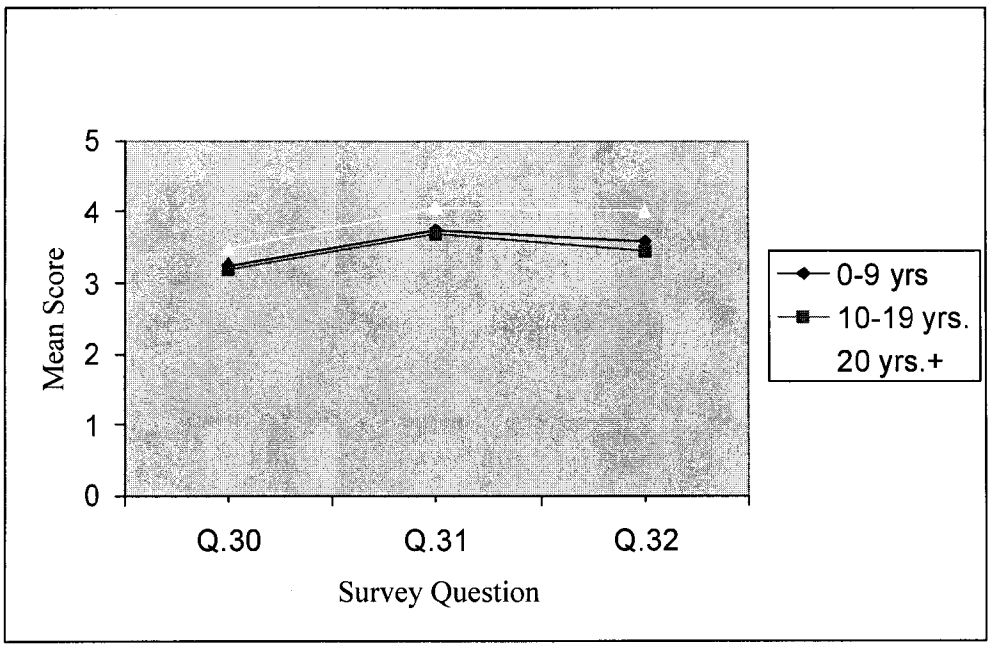


Figure H58. Identification commitment mean scores by years of engineering experience.

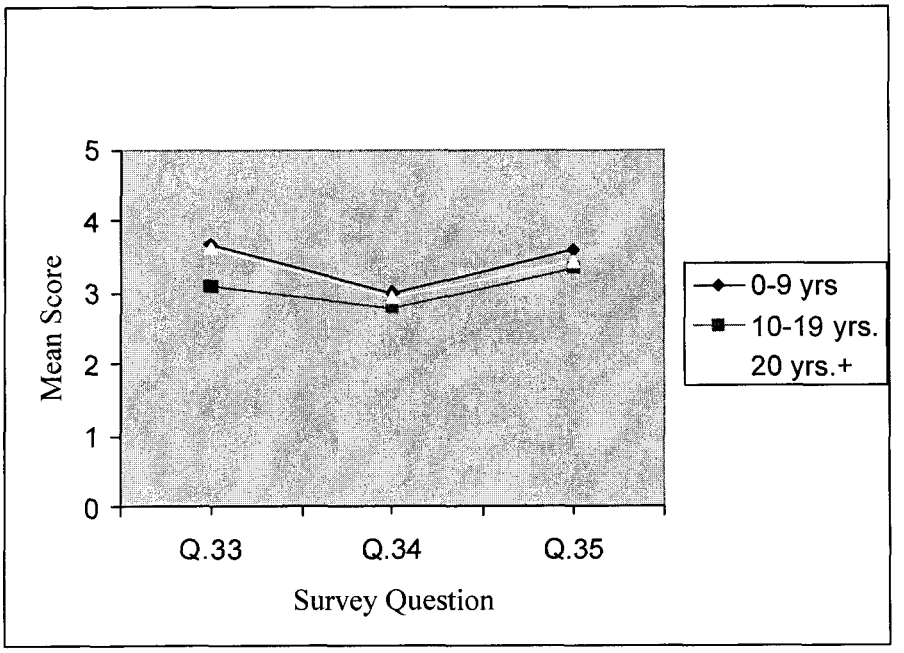


Figure H59. Compliance commitment mean scores by years of engineering experience.

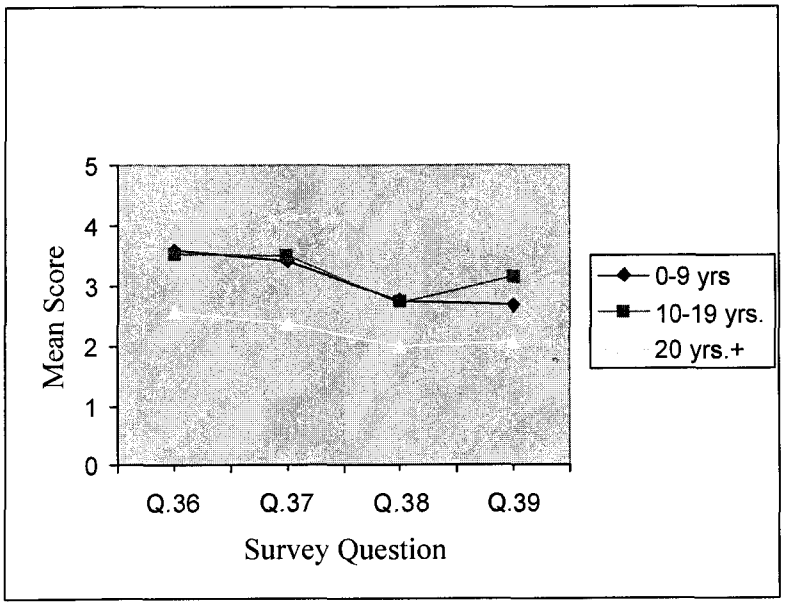


Figure H60. Intent to leave mean scores by years of engineering experience.

Appendix I

Graphical Representation of the Mean Scores for Comparative Groups

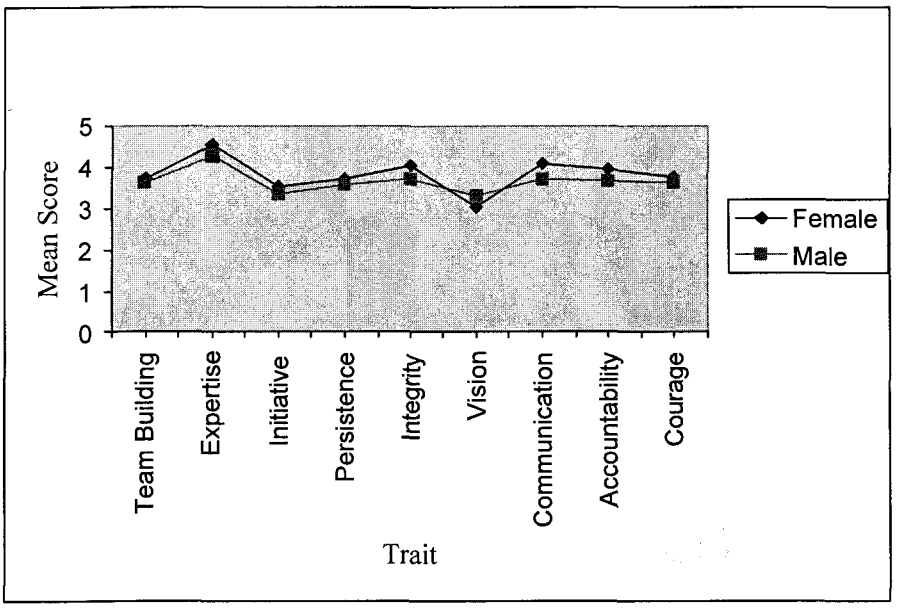


Figure 11. Traits mean scores by gender.

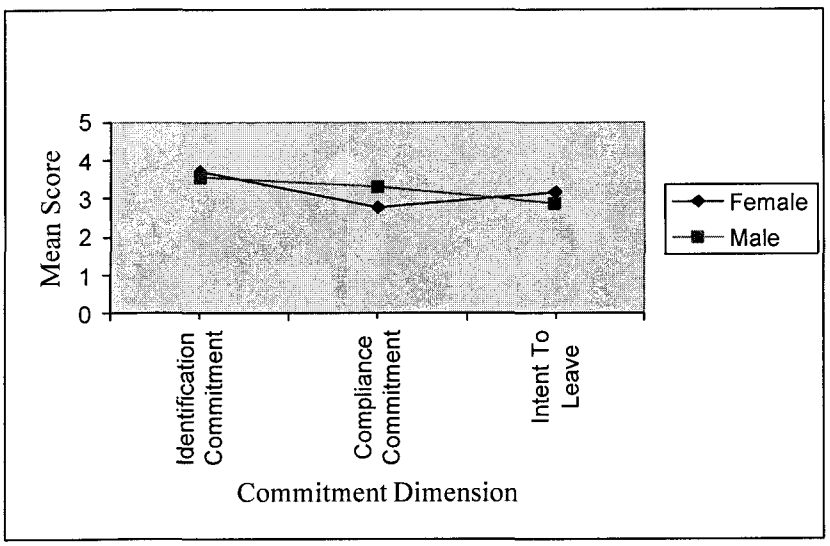


Figure I2. Commitment mean scores by gender.

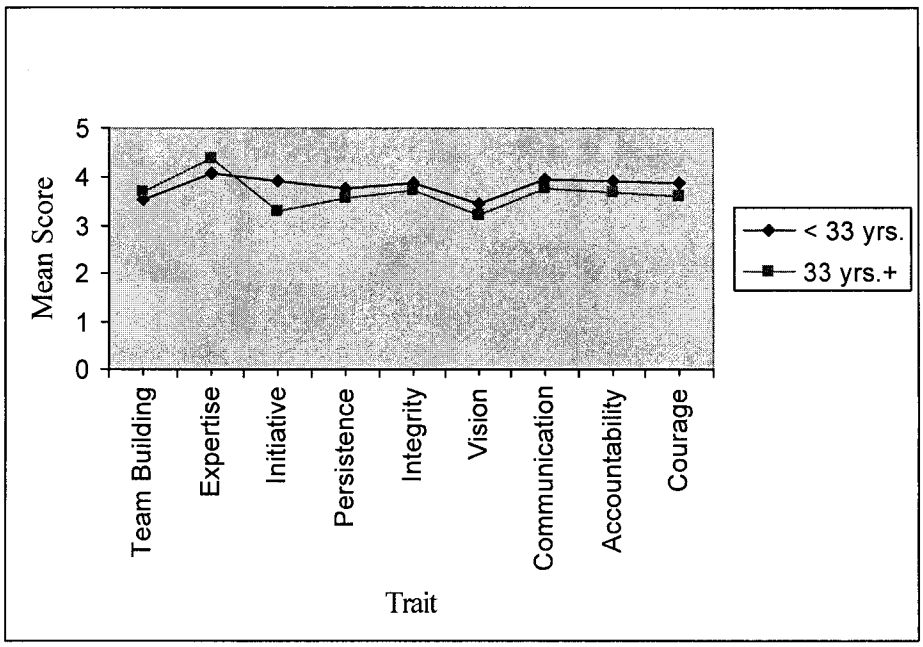


Figure I3. Traits mean scores by age.

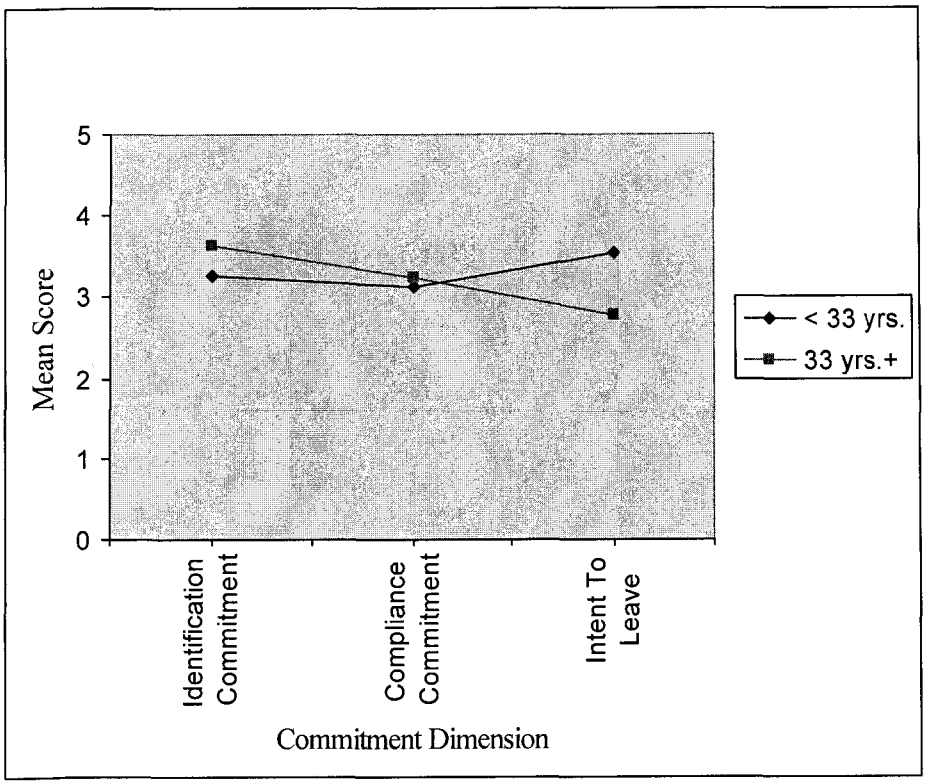


Figure I4. Commitment mean scores by age.

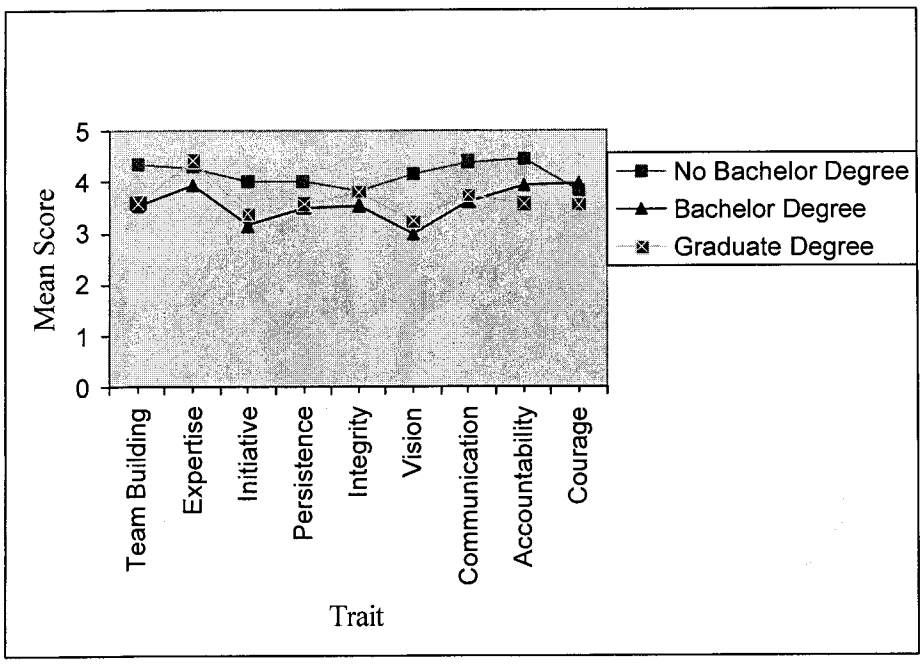


Figure I5. Traits mean scores by level of education.

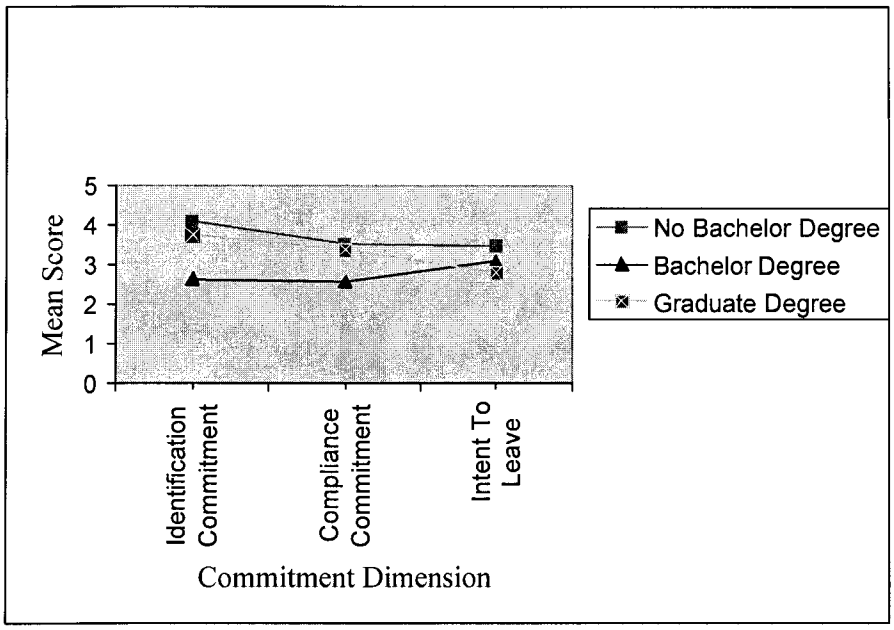


Figure I6. Commitment mean scores by level of education.

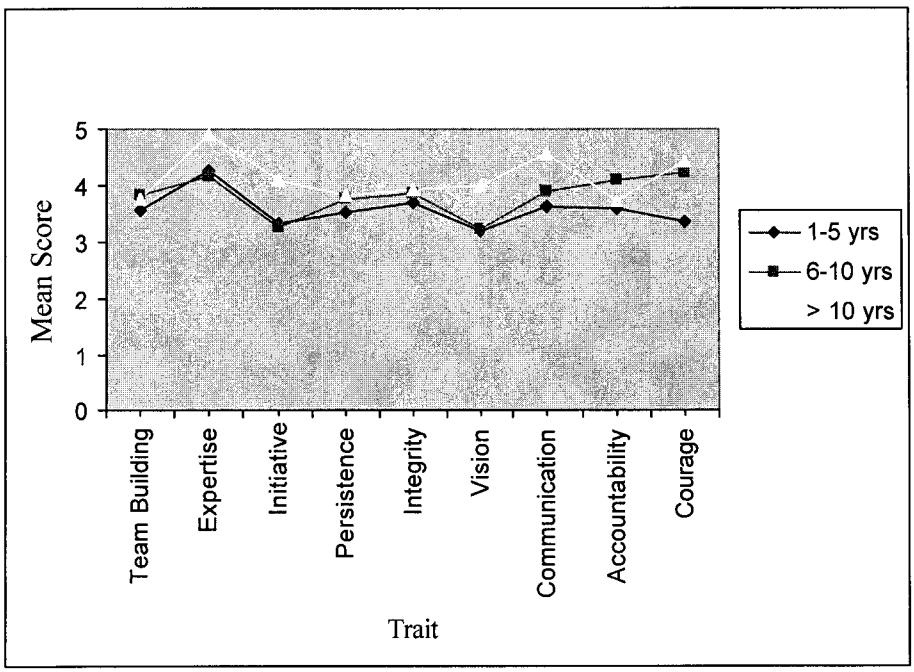


Figure 17. Traits mean score by years in company.

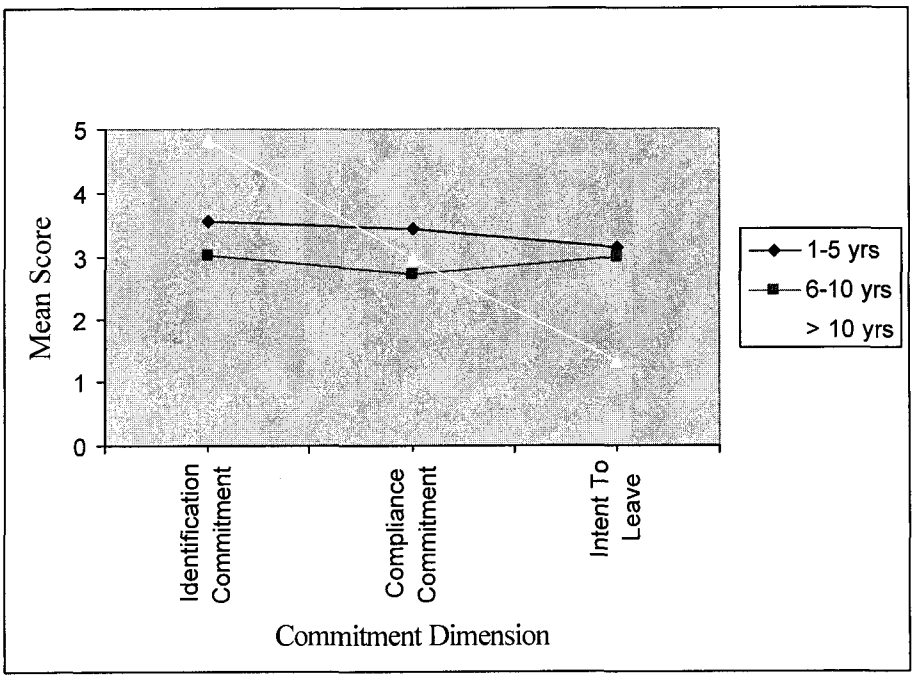


Figure I8. Commitment scores by years in company.

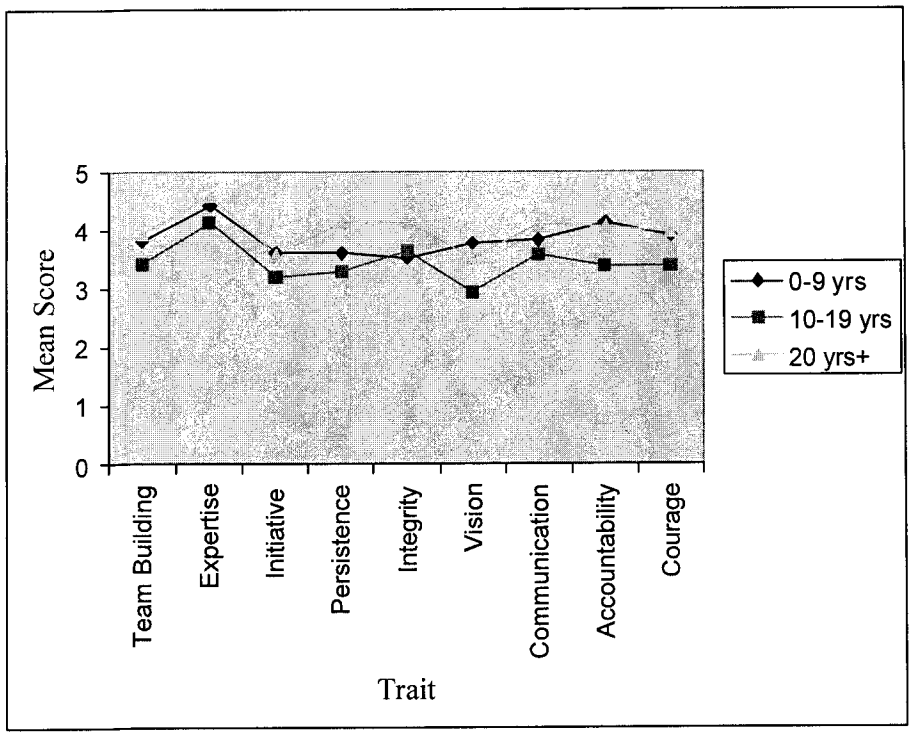


Figure 19. Traits mean scores by years of engineering experience.

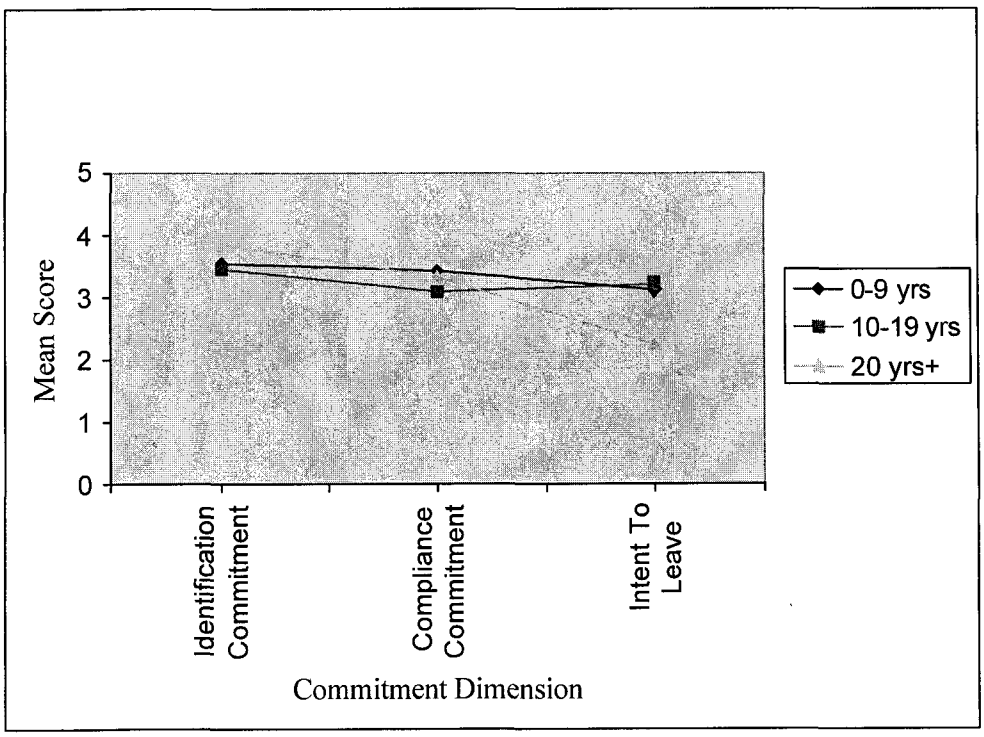


Figure I10. Commitment scores by years of engineering experience.

Appendix J

Responses to Open-Ended Questions

What do you like most about being an engineer?

Creativity, problem solving and integration.

The creative process. Using all of my experience in my job

New design and technical challenges.

Using knowledge to solve problems.

Challenging problems to solve.

Challenge of new technologies.

Using state-of-the-art devices(computers, laser printers, sound, etc) for the benefit of humanity.

Ability to explore changing & emerging technologies.

Allowed to work without constant supervision.

It is beautiful when one overcomes obstacles to put together a product that is useful to target audience.

Create new things.

Environment allows for constant learning.

Bigger role in society.

Making things work. Diversity of projects/challenges.

Solving challenging problems.

Solving difficult and complicated problems.

The satisfaction of an end-to-end design and implementation.

The creative environment. Finding new ways to things better.

What do you like the least about being an engineer?

When right decision is not made due to political issues

Schedules being developed from the top down. E.g. Given a delivery date with no input.

Stress levels in industry.

Job security for older engineers.

Poor job market. Decreasing salaries.

Too many details to keep track of – never stops changing.

Constantly changing project requirements. Being required to attend endless meetings irrelevant to my part of projects.

Sometime misunderstood by others. Hard to juggle multiple priorities. Hard to keep up with changing field.

Control my time.

Learning a technology well, sometimes pigeon holes you into doing same thing again on next project.

Reporting, communication to non-tech people.

Seeing the business make poor use of the applications that I develop.

Pressure by upper management to work unpaid overtime, while still having enough time to spend with your children.

The time required getting hardware and software after the design is complete.

What traits did the manager have that made him or her perform well as a manager?

Freedom to try/take prudent risks, trust in abilities of the engineer (let them rise to the occasion).

Experience, creativity, openness, reliability, integrity.

Combination of technical, project management & interpersonal skills.

Experience, open door policy, calmness.

Good people person i.e. well educated, listened to people, offered good suggestions, & took advice form underlings.

Own knowledge in the field is extensive.

Ability to see through difficult situations and choose simplest path.

He provides us with the recent design idea and materials.

Listens to requests and issues and takes action to the best of her ability.

Good communication and working with people.

Good communication with management & team members. Active, responsive & involved leadership.

Competence. Understanding of technical objectives and problems.

He gives us flexibility to manage ourselves.

Technical competence and very approachable personality.

Integrity, technical expertise, innovation.

How did the manager assist you in doing your job?

Leave alone after setting expectations and understanding of issues & complexity of challenges

Provided clear vision and feedback. Allowed the proper amount of freedom.

Technical direction/identifying shortages on team and lining up help.

Interface to upper management, tool procurement.

Provided fastest PC, gave reasonable schedules, provided verbal encouragement both publicly and privately.

Lends technical expertise sometimes.

By letting me run with it when I could and helping me out when I needed help.

He is a very stubborn person.

Makes sure I have access to the tools and people I need to do my job.

Regular feedback.

Promoted a creative atmosphere in team leveraging my skills where I can excel and benefit the team.

He brings up issues with upper management.

Provided technical guidance and suggests alternative to difficult problems.

Assisted in design reviews.

What traits did he or she have that made him or her a poor manager?

Good engineer is made a manager. Very different skill sets.

There are no significant negatives in my opinion. (less good thing to say about higher-level management).

Not strong enough personality to resist pressure from other engineers and upper management.

Not able to start new projects, had to be driven from above.

Does not stand up for engineers with upper level management.

Sometimes worry about immediate problems and forgetting the long term.

Does not accept suggestions from others.

Sometimes lacking technical knowledge resulted in lack of confidence for quick action dealing with issues.

He is disorganized, disinterested, and unable to make progress on more than one thing at a time.

Not delegating tasks/power/responsibilities effectively resulting in not having enough time for "managing" people.

Low expectations of engineers.

After your projects were completed, what was the reaction of the manager?

Generally very positive.

No reaction to me, but very positive to my peers and senior management.

Good job, now let us go on to the next one.

Congrats to team, some kind of pizza/donut party, post mortem, outline of next project.

Thanks-no follow-on work (contract job). Feel a poor decision to let entire team of six go instead reassigning one or two.

No positive feedback. Asks for more.

Brief congratulations and on to the next thing.

Don't know (no feedback).

Good.

Closure is always a good thing. Bonuses paid when objectives are exceeded.

He just asked us to update the paperwork and had no particular interest.

My manager had a positive attitude and praised all engineers on being part of the team to complete the project.

Positive feedback.

Good performance reviews.

Other Comments

How hard I work, and my willingness to work overtime, is tied to how well the company treats its customers, which is poorly, very poorly.

We have a matrix organization. I do not receive tasks from my manager. Response based on person that gives me tasks.