Doctor of Business Administration (DBA)

1-1-2013

Unique Factors for Motivating Engineers: A Motivation Meta Theory Approach

Kenneth R. Browne
George Fox University

This research is a product of the Doctor of Management (DMgt) program at George Fox University. Find out more about the program.

Unique Factors for Motivating Engineers: A Motivation Meta Theory Approach

Kenneth R Browne

11925 SW Settler Way

Beaverton, OR 97008

503.806.2026

kenbrowne@gmail.com

Submitted to the School of Business

George Fox University

In partial fulfillment of the requirements

For the degree of

Doctor of Management

Dr. Paul Shelton, Ph.D., Committee Chair

Dr. Craig Johnson, Ph. D., Committee Member

Dr. Dan Mertens, Ph. D., Committee Member, U of Central OK

November 5, 2013

Unique Factors for Motivating Engineers:

A Motivation Meta Theory Approach

by

Ken Browne

has been approved as a
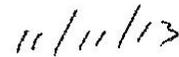
Dissertation for the Doctor of Management degree

At George Fox University College of Business

Approval Signatures:

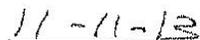_____   _11 / 11 / 13_
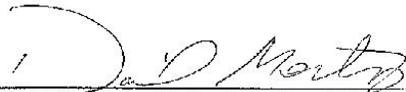Paul Shelton, PhD, Committee Chair   Date

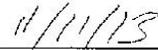_____   _11 - 11 - 13_
Craig Johnson, PhD, Committee Member   Date

_____   _11 / 11 / 13_
Daniel Mertens, PhD, Committee Member   Date

Abstract

According to the U.S. Congress Joint Economic Committee, the United States is not producing enough engineers to meet the growing needs of employers (as cited in Von Bergen, 2012). While engineers represent an important role in American industry, engineers are leaving the profession or are unsatisfied with their work (Stabbert, 2010) while engineer output per hour and per engineer is declining (Bureau of Labor and Statistics, 2012). As a potential remedy to this injurious industry trend, application of motivation theories can improve employee retention (Ramlall, 2004), detect and correct morale problems (Herzberg, 2003), detect an engineer's development needs (Shoura & Singh, 1998), and have shown effects in "predicting, understanding, and influencing choice, affect and performance" (Latham & Pinder, 2005, p. 493) of workers. As little meaningful research has been performed to determine if engineers are motivated differently from their peer knowledge workers, most organizations take a one size fits all approach to employee motivation. In this dissertation, data will be collected and analyzed relative to the importance of individual motivational factors in order to determine if engineers have unique motivating factors when compared to their peer knowledge workers. A comprehensive evaluation of motivation factors, utilizing the meta-theory of motivation, shall be used in order to evaluate motivation factors from a wide variety of theoretical perspectives.

 Keywords: integrative motivation theory, engineer, motivation to work, meta-theory of motivation

Dedication

Acknowledgements

Definition of Terms

Engineer: "An engineer is a person having at least one of the following qualifications: a) a college or university B.S. from an accredited engineering program or an advanced degree from such a program; b) membership in a recognized engineering society at a professional level; c) registration or licensure as an engineer by a government agency; or d) current or recent employment in a job classification requiring engineering work at a professional level" (Davis, 1996, p. 97).

Knowledge Worker: Drucker (1977) suggests that knowledge workers are individuals that apply their knowledge in order to add value to a firm's services and products. Drucker suggests that these workers include, among others "accountants, engineers, social workers, nurses, computer experts of all kinds, teachers and researchers" (1977, p. 271). For purposes of this dissertation, knowledge workers should be considered as those that work primarily with information, information technology, research, technical design, information provisioning, process implementation, and those utilizing unique technical knowledge in order to add value to their firm's services and products.

Motivation: "Work motivation is a set of energetic forces that originate both within as well as beyond an individual's being, to initiate work-related behavior and to determine its form, direction, intensity, and duration" (Pinder, 1998, p. 27). Additionally, motivation can be defined as the amount of energy an individual is willing, given intrinsic and extrinsic factors, to expend in order to perform a function.

Table of Contents

List of Tables

List of Figures

Chapter 1

Introduction

With over 1.5 million engineers employed in the United States (Bureau of Labor and Statistics, 2012), engineers represent a strategically important group within American industry. Drucker (1977) suggests that engineers, as a subset of knowledge workers, are the individuals that add to a firm's services and products. Drucker (2002) also suggests that knowledge workers are the fastest growing group of workers in developing nations, and that it is an economic imperative to raise the productivity of knowledge workers. Drucker (1992) states "developed economies face economic stagnation if they do not raise the productivity of knowledge and service workers" (p. 108). While representing an important group of knowledge workers, many engineers are leaving the profession or are unsatisfied in their work environment (Stabbert, 2010). Additionally, according to the Bureau of Labor Statistics (2012), from the year 2008 to 2009, engineering services output per hour declined by 5.4%, while the total output per engineer declined by 11.9%. During this same period, per unit costs for engineering services increased by 10.4% (Bureau of Labor and Statistics, 2012). According to the U.S. Congress Joint Economic Committee, the United States is not producing enough engineers to meet the growing needs of employers (as cited in Von Bergen, 2012).

Herzberg (2003) suggests that managers that do not provide every motivational opportunity to employees are not meeting the requirements of managing adults. There

are many reasons that motivation theory can be utilized to offset the negative industry

trends relative to engineers. Ramlall (2004) suggests that while many organizations have

implemented employee retention practices, they are rarely based upon sound motivation

theory, and therefore their efficacy is questionable. Application of employee motivation

theory can detect employee morale and employee attitude problems (Herzberg, 1974) and

offer solutions to rectifying those problems. Shoura and Singh (1998) found that

motivation theory can be utilized to determine if engineering management has struck a

balance between the engineer's need for development and the overall goals of the

organization. Motivation theory can also be used to predict the job performance of

scientists and engineers (Keller, 1997) as well as other employees (Tett & Burnett, 2003).

Motivational theories relative to traits have shown effects in "predicting, understanding,

and influencing choice, affect and performance" (Latham & Pinder, 2005, p. 493) of

workers.

Engineers have been found to posses unique personality and personal values that

are different from those of other occupations (L. Cohen & Derrick, 1970). Industry

managers report that engineers often appear to behave differently from their counterparts

relative to motivation (Badawy, 1971) and suggest that engineers have different

motivation style differences when compared to their scientist counterparts. Burney

(2000) found that there are specific suggestions to follow when managing engineers

which could be different from their peer workers. Couger and McIntyre (1987), utilizing

job core theory, found that there isn't a significant difference in motivational norms of

knowledge engineers and software engineers. Others (French, 1966) suggest that it may

not be possible to motivate engineers and scientists at all. In light of this conflicting

evidence, managers of workers within firms often apply the same motivational tactics to engineers as other workers. It would be advantageous to optimize individual work motivation factors, if any, for engineers in order to better predict, understand, and influence their choices, effects and performance.

Research Purpose and Scope

While it is important to optimally motivate engineers in the workplace, little comprehensive research has been performed to determine if engineers possess unique individual motivational factor needs when compared to their counterpart knowledge workers. This study seeks to determine if there are unique motivational sources that "energize," or motivate engineers in the workplace when compared to other knowledge workers within their organization. Hypotheses that will be tested are:

H$_1$: There is a significant difference in motivation sources between engineers and general knowledge workers.

H$_2$: There is a significant difference in motivation sources between male and female workers.

H$_3$: There is a significant difference in motivation sources relative to tenure with the firm.

H4: There is a significant difference in motivation sources relative to the age of the worker.

Chapter 2

Literature Review

This research is focused upon finding how engineers may be uniquely energized, or motivated, to be productive in the workplace when compared to their peer knowledge workers. The purpose of the literature review is fivefold: the description of engineers, the introduction and sampling of motivation theory, the applicability of motivation theory, a review of the exigent studies of engineers and motivation, and to produce the foundation of the methods that will be utilized to study the motivational source differences, if any, between knowledge workers and engineers.

It is important to note that the hypotheses tested in this research are very broad in nature. Asking what factors may be unique relative to motivation encompasses many characteristics of motivation. A plethora of motivation theory exists, and each theory measures fairly unique dependent variables relative to motivation. Landy and Becker (1987) suggest that the use of motivation theories to describe individual motivation is like several blind scientists trying to individually describe an elephant by touching different parts of the elephant. Each scientist may describe the elephant as a trunk, tail, ear or knee. Each scientist would be correct, but could not come up with a full description of the elephant independently. As such, the literature review includes a broad spectrum of exigent motivation theory which will provide the foundation of a comprehensive evaluation of motivating factors.

Engineers

According to the Accreditation Board for Engineering and Technology (ABET), engineering "is the profession in which a knowledge of the mathematical and natural sciences gained by study, experience, and practice is applied with judgment to develop ways to utilize economically the materials and forces of nature for the benefit of mankind" (ABET, 2012). Accordingly, engineering technology is defined as "the part of the technological field that requires the application of scientific and engineering knowledge and methods combined with technical skills in support of engineering activities; it lies in the occupational spectrum between the craftsman and the engineer at the end of the spectrum closest to the engineer" (ABET, 2012). According to Michael Davis (1996, p. 97), the standard definition of an engineer is:

> An engineer is a person having at least one of the following qualifications: a) a college or university B.S. from an accredited engineering program or an advanced degree from such a program; b) membership in a recognized engineering society at a professional level; c) registration or licensure as an engineer by a government agency; or d) current or recent employment in a job classification requiring engineering work at a professional level.

There exists reason to suggest that engineers may have different motivating factors when compared to their peer knowledge workers due to their unique personality characteristics. Engineers are more conscientious and emotionally stable than the general population (Dai, 2003; Van Der Molen, Schmidt, & Kruisman, 2007). Further, it was found that engineers are extremely extraverted and more autonomous than a national comparison group, while scoring low in agreeableness (Van Der Molen, et al., 2007). Others have found that engineering students differed from students that were pursuing

non-engineering degrees by being more tough-minded, orderly, and conventional (Kline & Lapham, 1992). As an example, by being more tough-minded, orderly, and conventional, it could be hypothesized that engineers are more susceptible to expectancy of reward, as outlined by Vroom (1963), or equity motivation theory as proposed by Adams (1965), when compared to other professional groups.

Motivation

"Work motivation is a set of energetic forces that originate both within as well as beyond an individual's being, to initiate work-related behavior and to determine its form, direction, intensity, and duration" (Pinder, 1998, p. 27). Additionally, motivation can be defined as the amount of energy an individual is willing, given intrinsic and extrinsic factors, to expend in order to perform a function. Managers seek to alter extrinsic factors and adjust work relative to intrinsic factors in order to optimize employee motivation. Motivation research has been of interest to managers because it offers guidance on how to optimize the value of the work performed by employees. The proper motivation of employees is valuable to the firm in terms of employee retention, productivity, and job involvement (Ramlall, 2004).

In order to improve the effort from employees, managers must provide a conducive environment for employees to develop, improve self-esteem, and become engaged participants in the organization (Dean-Arnold, 1988). Many theories of motivation are available for workplace application within the exigent literature.

Motivation Theory

The characteristics of motivation have been studied through a variety of frameworks (Barbuto & Scholl, 1998), including psychosocial, expectancy, need-based, intrinsic, social identity, goal setting, self-concept, as well as perhaps developmental. Each group of theories has to some extent efficacy in studying some component of motivational behavior. Latham and Pinder (2005) suggest that motivation theory be grouped into the frameworks of needs, traits, values, context, person-context fit, cognition, and affect/emotion. According to Landy and Becker (1987) each group of motivation theories have general strengths in their ability to measure specific dependent variables. Need and equity based theories are good at understanding affective consequences of work, while reinforcement and goal theory are suitable to better understanding work behaviors. Expectancy theory might be appropriate for predicting a worker's choice between alternatives. There is a plethora of individual motivation theories, but there is no single theory that can explain all behavior relative to motivation. It is the researcher's responsibility to select the motivation theory that best suits the dependent variable being studied (1987). However, when an organization is asking for a full picture of the motivational factors "at play" relative to their workers, the organization may need to utilize several different theories of motivation in order to better predict, understand, and influence their worker's choices, effects and performance.

Another factor that is predictive of theories utilized in organizations is the ability of the theory to provide prescriptive findings for the practicing manager. For instance, Maslow's hierarchy of human needs has proven problematic in terms of being prescriptively applied within organizations (Schneider & Clayton, 1973), while Herzberg's two factor theory offers robust prescriptive methodologies to improve

motivational methods in the workplace as it relates to his theory (Herzberg, 2003). There

are many approaches to motivation theory. As it is not economical to outline all the

exigent motivation theories, it is important to demonstrate the variety of theories

available through an examination of some of the more influential classical and recent

theories available in the next section of this paper. Exigent within the research,

motivation theory can be classified as needs based, goal setting, reinforcement, equity,

self concept, extrinsic/intrinsic, or expectancy theory.

   Needs theories of motivation. According to Ramlall (2004), "need theories

attempt to pinpoint internal factors that energize behavior" (p. 53). Integrative within this

taxonomy is meeting the needs of the worker relative to job satisfaction, job enrichment,

making the job challenging, optimizing job design, and the firm's effect on the worker's

cognitive growth (Landy & Becker, 1987). In summary, needs based theories suggest

that motivation occurs through the process of workers meeting their needs, whether that

is through striving to meet their needs, or by having their needs met through workplace

environmental factors. It is suggested that striving for meeting needs, or having needs

met, motivates the employee to be productive. Needs based motivation theories are

based upon the premise that humans exist in a state of unsatisfied needs, and that they are

willing to expend energy and effort in order to satisfy those needs as depicted in Figure 6.

Needs based theories were some of the earliest theories of motivation to be introduced

and focused upon increasing the productivity and effort of the worker. Needs based

theories include Maslow's (1943) hierarchy of human needs, Alderfer's (1969) ERG

theory, McGregor's (1960) theory X and theory Y, Herzberg's two factor theory

(Herzberg, Mausner, & Snyderman, 1959), Murray's (1938) psychogenic needs,

McClellands's (1975) theory of needs, and the theory of work adjustment (Rounds,

Henly, Dawis, Lofquist, & Weiss, 1981).
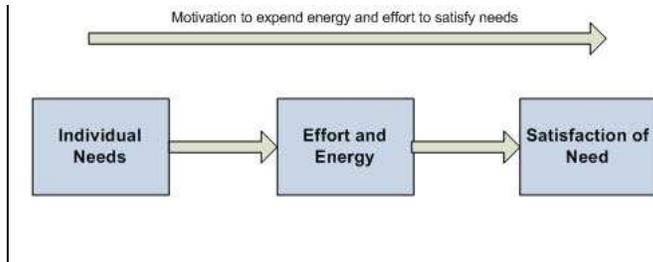
Figure 1. Premise of needs based theories

The premise of needs based theories suggest that if a need is identified and

frustration about not acquiring that need is experienced, resultant energy will be

expended by an individual to satisfy that need. One of the primary weaknesses of needs

based theories is the process of quantifying how much needs frustration affects the

productivity of an individual in the workplace. Additionally, if needs are met by the

workplace, needs based theories primary premise suggests that a worker is no longer

motivated because their need is now met. Alderfer (1969), in order to address this

problem, suggests that individual needs are changing, and that it is the manager's

responsibility to understand those changing needs and adapt environment and jobs to

energize the individual. Alderfer also believes that after a need is met, it may become

even more important to the individual. Herzberg (1974) suggests that needs are based

upon a two factor theory: categories of needs that if not met are dissatisfiers, while

another category of needs, if met, are satisfiers. Satisfiers will energize a worker to be

productive, while dissatisfiers, if not met, can only dissatisfy. A satisfied employee,

according to Herzberg, is productive.

Needs based theories are important and highly developed within the exigent literature relative to motivation, and can be a valuable tool in evaluating the unique "energizing" needs that may be motivating engineers when compared to their peer knowledge workers. Each of the seven needs theories included in this literature review has unique strengths and weaknesses, and can serve to provide insight into the differences between engineers and their peer knowledge workers.

Maslow's hierarchy of human needs. Maslow's (1943) theory of human motivation was an early needs based theory that was developed upon the premise of clinical observation and experience. Because Maslow's motivation theory was based upon observation, it was proposed that the relatively subjective nature of the theory should be received as a suggested conceptual framework for future research that must be validated, expanded upon, or discredited by future research.

According to Maslow, individual wants or needs result in a drive or motivation to satisfy those wants or needs. This drive results in behavior or action on the part of the individual towards attainment of the needs or wants of the individual. However, Maslow suggested that the human being is never fully satisfied, and as needs are satisfied, others come into focus, and therefore, needs-based motivation never ends. In other words, humans are perpetually in a state of wanting and needing, and will take action to attain needs once prior needs are met. Maslow believed that individuals were commonly in a state of having their needs met, but also could be in a state of having unsatisfied needs at the same time. As a result, Maslow arranged human needs into a hierarchical format whereby lower needs should be at least met to some degree before higher level needs begin to motivate the individual to act in order to achieve the next level of need.

According to Maslow the need levels, from lowest to highest; include physiological, safety, love, esteem, and self-actualization as shown in Figure 2.
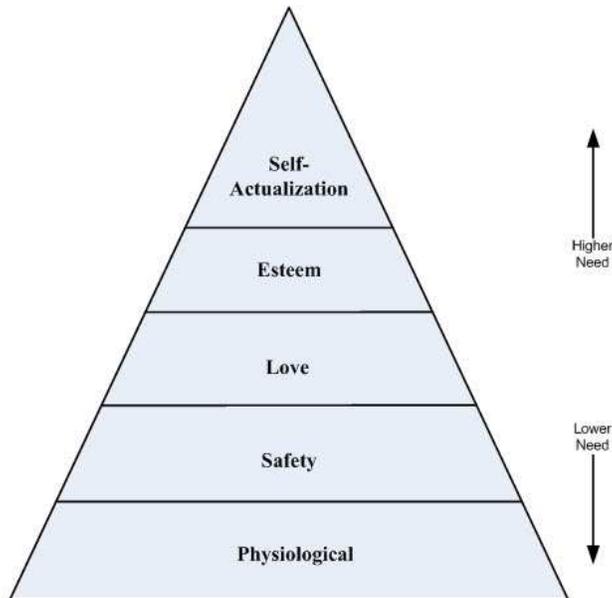
Figure 2. Maslows's Hierarchy of Human Needs

Within his hierarchy of human needs theory, Maslow (1943) maintained that after an acceptable level of economic security was secured, the individual would begin to focus on the higher goals, including love, self and public esteem, and in rare cases, self-actualization.

While there exist numerous measurement difficulties involved in empirically validating or disproving Maslow's theory, there is considerable consensus that there is little support for the hierarchical nature of Maslow's needs (Rauschenberger, Schmitt, & Hunter, 1980; Schneider & Clayton, 1973; Wahba & Bridwell, 1976). A recent study suggests that individuals usually achieve basic needs before other higher order needs are met, but that it is not necessary to attain lower needs first (Tay & Diener, 2011). Tay and

Diener concluded that motivation to achieve needs is not based upon the order of needs,

and that well-being is often derived from working on a number of needs simultaneously.

The fifth level of Maslow's hierarchy has been particularly difficult to measure and

provide prescriptive actions for managers (Groves, 1975). It has also been suggested that

Maslow's theory is ethnocentric, applying only to the attitudes and values of the United

States (Hofstede, 1984).

Regardless of the difficulties presented by Maslow's hierarchy of human needs,

the theory continues to be used extensively for research, and has experienced a

resurgence of interest at the turn of the 21st century, albeit for limited and narrow scopes

of research.

Alderfer's ERG theory. Building upon, refining, and supporting Maslow's

(1943) hierarchy of human needs theory, Alderfer's (1969) ERG theory reduces

Maslow's five needs into three groups including existence, relatedness, and growth, or E-

R-G. The existence group is composed of basic material needs, such as physiological and

safety needs, as well as food, shelter, water, clean air, pay, and benefits. This group was

previously composed of Maslow's physiological and safety needs. The relatedness group

consists of the importance of interpersonal relationships, including the social

relationships with family, friends and co-workers. This group consists of Maslow's

external portion of the esteem need, as well as social need. The growth group consists of

an individual's intrinsic orientation for personal development, including the desire to be

productive, creative, or to perform interesting work. This is the most difficult group to

categorize, measure and explain, as it consists of Maslow's internal esteem category and

the need for self-actualization.

Alderfer's ERG theory also differs from Maslow's theory in that Alderfer asserts that the different levels of need are often pursued simultaneously, while Maslow suggests that once lower needs are met, an individual will focus on the next higher level of actualization. While Maslow's hierarchical nature of needs suggests that a lesser need is usually satisfied before there is focus on the next higher need, there is little support for the hierarchical nature of Maslow's needs (Rauschenberger, et al., 1980; Schneider & Clayton, 1973; Wahba & Bridwell, 1976). An often used argument against the hierarchical nature of needs is that of the starving artist. A starving artist is ignoring lower level needs for food and shelter in order to realize a higher order need.

Another unique feature of Alderfer's ERG theory is that an individual may pursue many different levels of needs simultaneously. An example of this may be a workers motivation to be promoted. The need identified, promotion, would help satisfy the needs of existence (pay), relatedness (larger group in social network), and growth (self esteem). Further, Alderfer suggests that there are relationships of desire for needs between the levels of needs that are met from each group. If a need in one group changes, it may trigger a higher or lower desire for needs in another group. Alderfer (1969) proposed the following:

P1: The less existence needs are satisfied, the more they will be desired.

P2: The less relatedness needs are satisfied, the more existence needs will be desired.

P3: The more existence needs are satisfied, the more relatedness needs will be desired.

P4: The less relatedness needs are satisfied, the more they will be desired.

P5: The less growth needs are satisfied, the more relatedness needs will be desired.

P6: The more relatedness needs are satisfied, the more growth needs will be desired.

P7: The more growth needs are satisfied, the more they will be desired.

Alderfer's proposition suggests that there is interchangeability between needs. Relying upon Alderfer's propositions, a manager may seek to improve his worker's motivation for growth by increasing relatedness satisfaction (proposition six). The seven propositions are important factors to consider when comparing different workers, such as engineers and knowledge workers. If a group of workers reports low relatedness satisfaction when compared to another group, then according to ERG theory, the desire for growth will be less for the first group. This can help explain unique differences between worker groups such as engineers and knowledge workers.

The strength of ERG theory is the flexible and dynamic nature of the theory, and the recognition that each individual is different, and that individual needs change frequently. While ERG theory is widely accepted as a valid component of measuring of employee motivation, it possesses difficulty in being empirically evaluated (Rauschenberger, et al., 1980). The flexible and dynamic nature of the theory is the source of the difficulties of empirically evaluating and validating the full premise of the theory. Despite this considerable difficulty, ERG theory is accepted by many organizations as a rational component of evaluating employee motivation.

McGregor's theory X, theory Y. As a result of examining the behavior of individuals at work, McGregor (1960) developed two theories of worker motivation. Because McGregor did not want to bias readers of his theories with specific naming of the two theories, he referred to them simply as theory X and theory Y.

Theory X (McGregor, 1960) assumes that employees dislike work and will avoid work whenever possible. Because of the individual's distaste for work, workers must be threatened and controlled in order for management to receive the appropriate level of work. The theory assumes that the average worker prefers to be directed, does not like responsibility, is unambiguous, and focuses on security above all other needs. It also assumes that workers will perform from the fear of punishment or by rewards of benefits and money. As a result of these assumptions, management must carefully manage, direct and supervise workers.

Theory Y (McGregor, 1960) assumes that the level of physical and mental effort expended by the worker is as natural as rest or play. Given that the worker is committed to the goals of the organization, the worker will be self-directed and not require control and threats of punishment. Additionally, theory Y assumes that if a job is satisfying, the worker will become committed to the organization.   Given the proper leadership and environment, theory Y also asserts that the worker will not only assume responsibility, but will seek responsibility. By including a large portion of the organization, creativity, imagination and ingenuity can be used by workers to more effectively solve work problems. McGregor asserts that management acceptance of the assumptions of theory Y would result in higher productivity from the worker.

McGregor's (1960) theory Y is the foundation of the proposed motivation for workers to be productive and effective, and has achieved a high degree of recognition from organizational behavior theorists (Miner, 2002) and is a classic in terms of management principles. However, according to Miner, there are no direct tests of McGregor's theory Y, and that McGregor never conducted research to prove or disprove the theory. Additionally, McGregor did not attempt to make his variables operational in order to invite the empirical evaluation of his theory. Therefore, it is not possible to test the primary assertions of the theory directly. However, in breaking down the assumptions, the use of other theories, including participatory management, job enlargement, and performance appraisal, has indirectly supported theory Y. The broad nature of the assertions of McGregor is intuitively appealing, and is generally accepted by behavioral scientists today, but remain nearly impossible to test.

While McGregor's (1960) theory X and theory Y possesses great weaknesses, it is important to note that there is acceptance of the notion of participative management, employee empowerment, and goal setting. Therefore, it can be advantageous to understand how the desire of engineers for different leadership styles can vary from that of their peer knowledge workers.

***Herzberg's two factor theory*.** Herzberg's two factor theory (Herzberg, et al., 1959) theorized that specific job factors exist that relate to job attitudes, and that the job factors could be categorized as satisfiers or dissatisfiers. Herzberg, Mausner and Snyderman's findings originated from studies conducted on the attitudes of engineers and accountants toward their jobs, factors associated with these attitudes, and their effects on work performance. As a result, Herzberg et al. suggest that the factors, attitudes, and

effects (F–A–E) should be studied as a unit, not as individual elements. Through further

empirical studies, Herzberg et al. identified and classified specific job factors into two

groups: motivators and hygienes. As a result of the studies, it was concluded that

motivator factors result in job satisfaction and that hygiene factors result in job

dissatisfaction. From the study, motivators included achievement (43% of responses),

recognition (33% of responses), the work itself (26% of responses), responsibility (22%

of responses), and growth or advancement (20% of responses). Hygiene factors, which

result in job dissatisfaction, included company policy and administration (35% of

responses), technical and people skills of supervisor (20% of responses), salary and other

material forms of compensation (18% of responses), and working conditions (11% of

responses).

　　　According to Herzberg et al. (1959), satisfiers are intrinsically based, and

motivation emanates from the desire or need of workers to achieve to the highest levels

possible, which is consistent with Maslow's (1943) self-actualization need. Herzberg et

al. suggest that satisfiers thrive in a Theory Y (McGregor, 1960) culture and lead to

positive job attitudes and superior job performance because they satisfy the individual's

need for self-actualization in the workplace. The company can only facilitate this process

by allowing workers to perform tasks in a work environment that will enhance their

ability to achieve towards self-actualization.

　　　Alternatively, Herzberg et al. (1959) suggest that dissatisfaction emanates from

extrinsic factors. Factors that are classified as dissatisfiers only meet the needs of

workers in order to avoid relatively disagreeable or threatening situations or unfavorable

physical environments. Importantly, dissatisfiers are not a part of the job itself, but a part

of the physical job environment. Referring to these factors as hygienes, Herzberg suggests that the satisfaction of hygiene factors can only lead to the prevention of job dissatisfaction. Additionally, hygienes cannot improve worker satisfaction nor motivate workers to improve achievement. Importantly, without the presence of enough satisfiers, workers will require greater satisfaction of hygiene factors such as pay, physical environment, or job perks. Herzberg (2003) suggests that the cost of replacing satisfiers with hygiene factors will increase incrementally as the presence of satisfiers decrease.

Historically, Herzberg's two factor theory has been criticized for Herzberg's (1959) claim that hygiene factors can only lead to the prevention of job dissatisfaction, and that hygienes cannot improve worker satisfaction. Many studies that have sought to validate the Herzberg research and claims relative to hygiene factors through different instrumentation were either unsuccessful or achieved mixed results (Brenner, Carmack, & Weinstein, 1971; Graen, 1966a, 1966b; Soliman, 1970). In summary, critics contend that motivator effects on motivation depend on how well hygiene factors are met, and that both hygiene and motivator factors affect both satisfaction and dissatisfaction, contrary to the claims of Herzberg.

A particular strength of Herzberg's (1959) two factor theory is that it was developed for application within organizations. Clearly, the theory has a work-based context, coupled with needs that are identifiable within the workplace, and has a clear method of implementation and confirmation of results (Herzberg, 2003). Additionally, the motivation hygiene theory has been institutionalized and is included as one of the eleven most influential motivational theories in use today (Miner, 2002).

Murray's psychogenic needs. According to Murray (1938), individuals possess primary needs that are biologically based. These needs include water, food, air, sex and the avoidance of pain, as well as secondary needs that originate from biological needs or are part of our human nature.   Murray asserts that there are a total of 20 psychogenic needs, including abasement, achievement, affiliation, aggression, autonomy, counteraction, defendance, deference, dominance, exhibition, harm avoidance, infavoidance, nurturance, order, play, rejection, sentience, sex, succorance and understanding. While secondary needs are not less important than primary needs, Murray suggests that secondary needs arise after primary needs are met. Murray believes that an individual only experiences a small subset of the 20 psychogenic needs at any given time and that an individual may not experience the need for all 20 of the secondary needs during their entire life.

While believing that the individual's needs are largely unconscious, Murray (1938) asserts that these needs largely influence and drive human behavior. Murray also assumes that the human is constantly in a state of disequilibrium, which explains what needs are and why humans possess them. Murray suggests that needs arise from two different processes: reactive and proactive. Reactive needs are the result of external events, such as the need for harm avoidance when an individual is being attacked. External environmental pressures act upon the individual and motivate the individual to expend effort or act. Proactive needs arise from within the individual spontaneously, such as the desire for affection from a new acquaintance. Proactive needs that arise from within the individual also motivate the person to expend effort or act.

Murray (1960) believes that needs have different characteristics in terms of urgency, which he describes as prepotency. If one need has a higher level of prepotency, or urgency, it will take precedence over another less urgent need. For example, if an individual is at a restaurant because he or she is hungry, and suddenly there is a fire in the restaurant, the need for harm avoidance will take precedence over hunger at that time. Similar to Alderfer's (1969) ERG theory, Murray believes that satisfying one need can act in satisfying another need.

Unique to Murray's theory is the inclusion of "press," which arises from an individual's experiences in childhood that shapes and activates unique needs later in life. Theorizing that there is a significant interaction between press and needs, Murray (1960) suggests that both environmental and press serve to compel behavior in adults. This interaction, referred to by Murray as "thema," is unified within the individual in order to create a person's feeling of coherence, order, and unity. Unlike Maslow's theory, Murray suggests that individuals have spontaneous and ever-changing needs that do not include order or hierarchical sequence.

Murray's suggestion that each individual possesses unique and ever-changing needs is an important factor in evaluating differences between groups. Engineers may possess different needs altogether different from those of their peer knowledge workers. These needs, for example, may be the result of a thema that requires more autonomy or need for achievement at the expense of deference.

McClelland's theory of needs. Building upon three of Murray's (1938) needs, including achievement, affiliation, and power, McClelland (1975) suggests that all

individuals are motivated by these three needs in some manner, and that one is usually

dominant. The needs are acquired and formed over time by life experiences and the

cultural background of the individual. Like Alderfer (1969) and Murray (1938),

McClelland asserts that individual needs may change over time through personal growth,

environmental factors, and experience.

According to McClelland (1975), the individual need for power can be grouped

into two categories of individuals. The first category is individuals with a high need for

personal power that wish to direct and influence others. The second category consists of

individuals with a high need for institutional power whom enjoy organizing the efforts of

other in order to achieve the goals of the organization. High power oriented individuals

also enjoy competition and seek status positions within the organization. While high

power individuals seek leadership roles, they often do not possess adequate flexibility

and people centered skills.

McClelland (1975) asserts that individuals with a high need for affiliation desire

strong peer relationships, safety, and teamwork. These individuals want to be liked and

accepted, and tend to conform to the social norms of the organization or group. High

affiliation need individuals also prefer cooperation as opposed to competition.

McClelland also asserts that high affiliation need individuals undermine the objectivity

and decision-making capability of managers.

According to McClelland (1975), individuals with a high need for achievement

possess a strong desire to achieve, succeed and excel. Individuals with this type of need

will often set goals that are achievable and realistic. The achievement oriented individual

will tend to work alone or with other achievers, and they do not seek recognition, as the completion or achievement of their work is their final reward. Importantly, achievement oriented individuals do not perform well when confronted with unrealistic goals.

McClelland (McClelland, 1975) suggests that his theory is more useful than Maslow's and Alderfer's theories, as there is a wealth of empirical evidence that supports his theory. While Alderfer's and Maslow's theories were more description in nature, McClelland's theory provided a mix of descriptive and prescriptive elements, provisioning management with actionable tasks that could improve the productivity of workers. Management, McClelland asserts, can facilitate positive organizational behavior through training and by matching jobs to the motivational needs trichotomy of the worker. McClelland (1975) asserts that each adult is motivated within the framework of recognizing the orientation of the individual, then providing the environmental factors that will provide them with the ideal mix of each of their three needs.

While McClelland's needs theory demonstrates validity in many areas, McClelland's theory has also been criticized for its poor prediction power relative to entrepreneurial behaviors (Kapp, Smith-Hunter, & Yonkers, 2003). Additionally, McClelland's needs theory has been largely discredited relative to application in cultures other than that of the United States. Specifically, achievement is viewed differently in cultures outside of the United States, specifically failure to achieve.

The importance of McClelland's needs theory can provide valuable insight into the comparing the differences between engineers and their peer knowledge workers, if any. Given that there are differences relative to McClelland's (1975) needs theory

framework, actionable, prescriptive guidelines may be suggested to managers of engineers.

Theory of work adjustment. The theory of work adjustment (Dawis & Lofquist, 1984) suggests that a good fit between the individual worker's abilities and the role they play within the organization and work performed will result in employee satisfaction. It is asserted that if reinforcers are present that address the individual values and abilities of the employee through improving and tailoring the work and organizational role to the employee, the employee will be more satisfied and productive (Gustafson & Mumford, 1995). Reinforcers are addressed by tailoring the work to the six key values of the worker: achievement, comfort, status, altruism, safety and autonomy (Rounds, et al., 1981) as depicted in Figure 3. Numerous recent studies have found elements of work adjustment to be significant to worker satisfaction or productivity (Edwards, Scully, & Brtek, 2000; Gustafson & Mumford, 1995; Houkes, Janssen, DeJonge, & Nijhuis, 2001; Norde & Fox, 1996; Wright & Cordery, 1999).
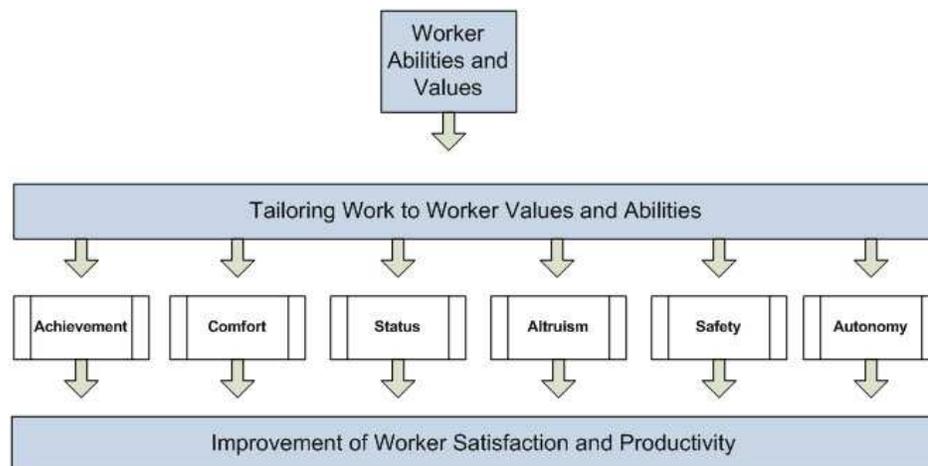
Figure 3. Theory of Work Adjustment

As a result, the degree of satisfaction of the employee with the work environment and reinforcers is asserted to be able to predict the satisfaction of the employee and the employer (Rounds, et al., 1981). It is acknowledged that there are other factors that may be present that infringe on the predictability of worker satisfaction, including the worker growing out of the job through skills improvement, a lack of flexibility, the worker picking the wrong career, or the worker possessing more attractive employment options.

Work adjustment and job fit have been linked to many positive attributes of employee behavior. Job fit has been associated with higher performance of the worker (Caldwell & O'Reilly, 1990), organizational commitment (Meglino, Ravlin, & Adkins, 1989), work attitudes (Smart, Elton, & McLaughlin, 1986), applicant preferences and behaviors (Rynes, Bretz, & Gerhart, 1991) and health and adaptation of workers (Moos, 1987). These studies suggest that work adjustment and job fit result in better worker motivation, workers being attracted to an organization, the worker being evaluated more favorably by an organization's leadership, and above all, better worker productivity.

Evaluating engineers as compared to their peer knowledge workers relative to their sensitivity to job fit can offer insight into the potentially unique factors that may uniquely energize these two groups to be productive and motivated in the workplace.

Expectancy Theory

Also known as valence-instrumentality-expectancy theory, expectancy theory examines the relationship between the level of worker effort to the level of performance, then the level of performance against rewards, and finally examines the rewards against

the personal goals of the worker (V. H. Vroom, 1963). These stages are referred to as

expectancy, instrumentality, and valence respectively. Vroom suggests that these stages

are incorporated into a series of relationships and are referred to as individual effort,

individual performance, organizational awards, and personal goals as depicted in Figure

4. Expectancy theory suggests that the end reward is the only factor in a worker's

decision relative to the choice before them. Expectancy theory examines the cognitive

choice processes that a worker engages in coming to the decision to behave one way or

another based upon effort adjustment, performance, and reward.
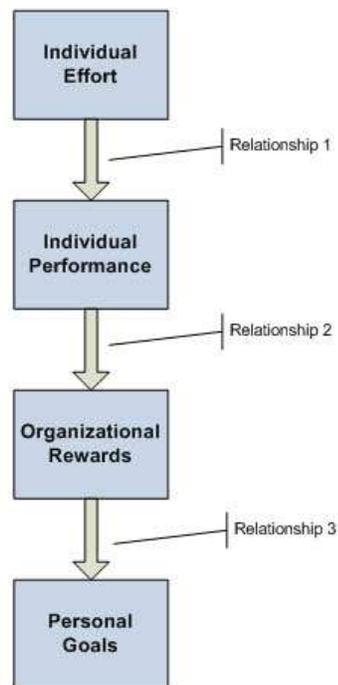
Figure 4. Expectancy theory relationships

According to Vroom (1963), the first relationship suggests that changes in levels

of effort have consequent changes in performance. If a worker inputs enough effort,

improvements in performance will be realized. The second relationship suggests that a

specific amount of performance will receive the appropriate and wanted reward. The

third relationship implies that motivational value is derived from the correspondence between personal goals and the firm's rewards. Linking the relationships, motivation to increase effort is linked to the firm's goals given that the firm's goals correlate to the individual's goals. The core element of the theory requires firms to have rewards solidly linked to performance, and that the rewards are deserved and wanted by the worker.

Vroom's (1964) expectancy theory fits in an important niche of motivation theory. Expectancy theory attempts to explain why workers make individual choices in the workplace. Expectancy theory also attempts to empirically measure the motivational power of a given choice through three key variables: valence, expectancy and instrumentality. Valence is the degree to which an individual feels that the reward fulfills their preferences, needs, goals and motivation strengths. Valence, or reward, can be expressed either in avoiding a negative consequence (negative valence) or achieving a desired consequence (positive valence). Instrumentality is the trust, or certainty that if the task is achieved, that the reward will actually be received by the individual. If an individual has been promised a reward, but is uncertain as to whether the promise will be kept, there is less motivational value in the offered reward. Expectancy is how certain an individual feels about being able to accomplish, or attain a goal given their existing skills, confidence, and external support.

Vroom (1964) suggests that the relationship between expectancy, instrumentality, and valence can be expressed as a mathematical function, and can predict the motivational power of a given decision choice. Vroom proposed the following function:

Motivational Power = Expectancy x Instrumentality x Valence

With the given formula, if an individual believes they can achieve the result, believes they will be rewarded, and they value the outcome, there will be motivational power. If an individual believes that a result can be achieved, but that either they won't be given the reward, or that they don't value the reward, the results would be no motivational power. Expectancy theory is an important theory in evaluating differences between engineers and their peer knowledge workers, in that expectancy theory can suggest differences in how much these groups value rewards, how deeply they believe the promise of rewards, and how confident they are of achieving outcomes.

Reinforcement Theory

According to Skinner (1958), behavior and decision making of workers is at times automatic, reflexive, or involuntary in nature, and is a result of external forces that have influenced their satisfactory decision making in the past.   Habits are formed through decisions that have been made satisfactorily, and that have been re-applied to similar circumstances several times. Given that the result of the decision continues to be satisfactory, a habit is formed relative to the behavior of the individual (1958). As a result, in order to motivate an individual, the decision making process must be influenced at the time of the initial cognitive process. In simple terminology, reinforcement theory can be summarized as rewarded behaviors will be repeated, punished behavior will not be repeated or produce erratic behavior, and ignored behavior will not be repeated as referenced in Figure 5 (Landy & Becker, 1987).
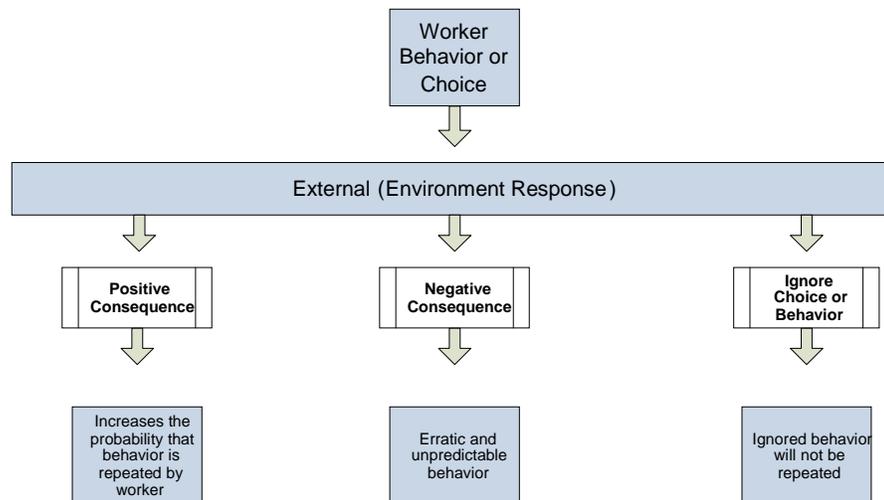
Figure·5. Reinforcement Theory

Reinforcement theory (Skinner, 1958) is valuable to leadership in that it provides an intuitive mechanism to address and modify individual behaviors in the organization. Workers can be conditioned, through external organizational stimuli, to behave in a way that is beneficial to the firm. Rewards and punishment, consistently applied over time, Skinner suggests, will modify worker behavior. Reinforcement theory is easily and extensively applied within the workplace. A four stage implementation process is suggested, including identifying desired behavior, measurement of desired behavior, providing reinforcements for that behavior, and longitudinal assessment of behavior change. Repeated satisfactory responses to worker choice or behavior may move the behavioral response to the habit stage, whereby further positive or negative consequences are no longer required.

While reinforcement theory is intuitive, practical and easily implemented, the theory cannot answer motivational questions relative to behavior initiation, doesn't address differences in sensitivities to reinforcement at the individual level, and

experiences de-sensitivity of the individual to similar reinforcements over time.

Reinforcement theory offers the mechanism to control behavior once the behavior has

been initiated, but cannot answer the question as to why behavior is initiated (Skinner,

1958).   Reinforcement theory does not agree with other theories, such as self concept, as

self concept notes that each individual is oriented differently relative to their response to

consequences. Self concept asserts that some individuals, categorized as internal self-

concept, care little for external acceptance of their behaviors, as they are almost

exclusively focused on their internal ideal self, not external behavioral acceptance

(Leonard, Beauvais, & Scholl, 1999).

Reinforcement theory differs from needs based theories in that reinforcement

theory focuses on behaviors, or choices, of individuals rather than the personal states of

workers. Reinforcement theory is intuitive, as it simply implies that behavior can be

shaped by providing external stimuli. However, reinforcement theory has been criticized

for treating each individual the same in terms of the worker's sensitivity to reward and

punishment. Additionally, the efficacy of reward and punishment often change over

time, specifically after the goal of the reward or punishment has been initially met by the

worker. Last, reinforcement theory is difficult to apply in modifying complex human

behaviors, such as a worker demonstrating poor work quality while worrying about a

critically ill parent.

Similar to other motivation theories, reinforcement theory measures specific

independent variables that are relative to the study of motivation. Primarily,

reinforcement theory helps the researcher to better understand the individual's response

to behavioral reinforcers in the workplace. As such, this independent variable set relative

to motivation can be valuable in assessing an important component of the motivational

differences between groups of individuals, such as engineers and their peer knowledge

workers.

Equity Theory

According to Adams (1965), individuals continually compare and contrast their

job inputs and outputs to those of others. Individuals act in order to correct or eliminate

inequities relative to other workers with respect to inputs and outputs. When the

individual acts, they are motivated by a need to correct the inequity. Equity is dependent

on the comparison a person makes between his or her reward/investment ratio with the

ratio of others considered to be in a similar situation (1965). In terms of worker

motivation to act, if people feel that they are inequitably rewarded, they may be

dissatisfied, reduce the quantity or quality of output, or leave the organization. If people

perceive the rewards as equitable, they will most likely continue the same level of output.

If people believe the rewards are greater than what is perceived as equitable, they may

work harder, however, it is also possible that some may distort their value and discount

the rewards.

The conceptualization of organizational justice has further developed upon the

basis of equity theory (Greenberg, 1990). Fundamentally, organizational justice involves

individual's developed beliefs about his or her contribution provided to the employer

compared to their consideration (tangible and intangible compensation and benefits). The

workers form attitudes relative to their perceived ratio of contribution and consideration

versus the contribution and consideration provided others in the organization.

Organizational justice posits that when there is fairness in terms of equal consideration for contribution across the organization, individual outcomes of the organization are accepted by the workers (1990). When employees perceive that they are treated unfairly, they have lower organizational commitment, are more likely to leave the firm (1990), and experience fear, anger, hopelessness, sadness, excitement, rage, irritation, shame, embarrassment, guilt, dread and cynicism relative to the organization (Harlos & Pinder, 1999). Research has shown that worker perception of fairness affects the dependent variables of theft (Greenburg, 2002), self sacrificing decisions (Turillo, Folger, Lavelle, Umphrees, & Gee, 2002), revenge (Trip & Bies, 2002), sabotage (Ambrose, 2002), and workplace retaliation (Skarlicki & Folger, 1997).

Equity theory possesses weaknesses that have been pointed out by researchers. Specifically, much of the research conducted on equity theory has been in a laboratory type setting (Huseman, Hatfield, & Miles, 1987), casting doubt on successful application in real work environments. Additionally, some assert that individuals may perceive inequity at the level of the entire organization, not just on an individual, person to person basis (Carrell & Dittrich, 1978).

Equity theory can be useful in evaluating the differences in employee motivation in terms of comparing sensitivity to equity themes. Given that different groups of employees, such as engineers, may possess a significant difference in sensitivity to equity related motivators when compared to peer knowledge workers, equity theory could be instructive in evaluating motivational differences between engineers and their peer knowledge workers.

Goal Setting Theory

Developed within the discipline of industrial/organizational psychology over a 25 year process involving 400 field and laboratory experiments, goal setting theory suggests that specific, high goals for individuals motivates them to higher levels of task performance (Locke & Latham, 1990, 2006). It is suggested that goal setting theory is "the underlying explanation of all major theories of work motivation" (Lunenburg, 2011, p. 1) such as expectancy theory (V. H. Vroom, 1963), Maslow's hierarchical theory of motivation (Maslow, 1943), Herzberg's two factory theory (Herzberg, 1974), and social cognitive theory (Bandura, 1986). Locke and Latham (2006) suggest that high goals, as opposed to easy, vague or abstract goals, produce optimal levels of task performance. If an individual possesses commitment to the goal, the goal is consistent with the individual's values, and the individual possesses the requisite skills to execute the task, and in the absence of conflicting goals, there is a significant relationship between the level of challenge in the goal and task performance. Goal setting theory suggests that an individual is in a state of discontent in their existing situation, and that achievement of the goal will help satisfy their desires (2006) and foster further motivation. Alternatively, not meeting the goal can lead to frustration and lower motivation (Lunenburg, 2011) as depicted in Figure 6.
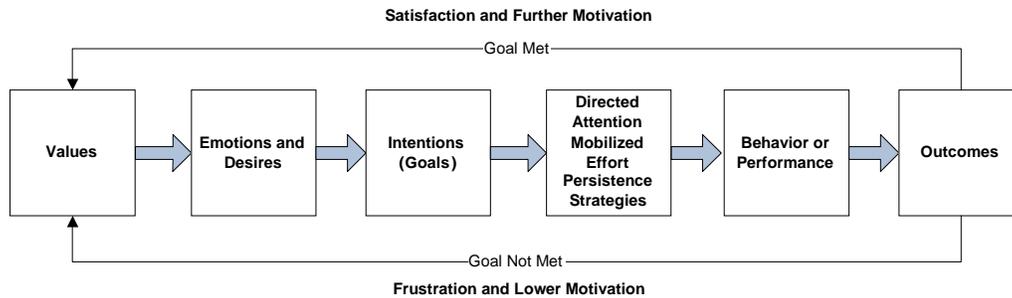
Figure 6. Goal setting theory model (*Lunenburg,2011*)

Locke and Latham (2006) suggest that there are four primary mechanisms or mediators relative to the relationship between performance and goals. First, high goals result in more effort and persistence than those that are less difficult or vague. Second, goals focus the attention of the individual on the task and reduce attention on non-important activities. Third, high goals not only incorporate the use of the individual's existing skill sets, but may also trigger the memories of old skills, as well as trigger the development of new skills. Last, through self-efficacy (Bandura, 1977), goals often mediate other motivating factors, such as personality traits, decision making participation, autonomy in the job, feedback, and monetary incentives (Lunenburg, 2011).

Goal setting theory is widely accepted and has a high level of internal and external validity as demonstrated in laboratory and real world environments, in several cultures, over longitudinal studies, and at the individual, group and organization level (Locke & Latham, 1990). Goal setting theory can be useful in the comparison of groups, such as engineers and their peer knowledge workers, through comparing sensitivity to goal setting attributes.

Extrinsic and Intrinsic Motivation

DeCharmes (1968) suggests that intrinsically motivated behavior arises from an individual in the absence of outside influence. Extrinsically motivated behavior arises from an individual as a result of outside influence. DeCharmes states that intrinsically motivated behavior can be categorized into two different categories: seeking out challenging situations and the process of overcoming challenges. Others (Katz & Kahn, 1978) categorize intrinsic and extrinsic motivation into the categories of legal compliance, external rewards, and internalized motivation. Further, Katz and Kahn suggest that internalized motivation is made up of self expression and internalized values. Self expression is strictly a function of role performance, while internalized values are values that have been garnered from a group or organization's goals, and then transferred to the individual's value system. Etzioni (1975) supports Katz and Kahn's assertions relative to internalized motivation.

A key factor relative to intrinsic and extrinsic motivation is that various motivation theories make some distinctions between the two sources of motivation, such as self concept theory (Leonard, et al., 1999) and self determination theory (Deci, 1992). However, other theories such as expectancy (Victor H. Vroom, 1964), goal setting (Locke & Latham, 1990), and reinforcement theory (Skinner, 1958) do not. This is viewed as a major weakness of important cognitive theories of motivation such as expectancy, goal setting and reinforcement theory (Deci, 1992). This is consistent with Landy and Becker's (1987) assertions that each motivation theory has its special ability to measure one or more dependent variables. In this case, cognitive theories measure

only cognitive processes, not the worker's initial tendencies to accept and expend effort during and after cognitive decisions.

It is suggested that motivating an individual is not a unitary function: motivation arises as an internal choice, or through control. Research suggests that while workers can experience the same motivation level to complete a task through control as they can through internal choice, tasks that are completed via internal choice are completed with qualitatively better results, especially if the task is complex (Deci, 1992). Intrinsic and extrinsic motivation theory suggests that a full understanding of motivating factors in research should address tendencies of the individual to be energized by tasks, both from internal and external stimuli, in addition to the cognitive functions of the worker deciding to expend effort.

Self-Concept Theory

Leonard et al. (1999) suggest that there are other sources of motivation, based upon self-concept, that influence the motivational behavior of individuals. Leonard, et al. believe that there are three types of attributes that are used in the perception of task process, including traits, values and competencies. Relative to these attributes, the individual possesses frames of reference to these attributes in terms of the ideal self, perceived self and a set of social identities. The perceived self is the understanding that an individual has about their respective traits, values and competencies. The ideal self is the understanding of what traits, values and competencies that an individual would prefer to possess. Social identification is the individual's perception of which social groups or social identifications that an individual believes that they belong relative to traits, values

and competencies. Individuals then expend varying degrees of effort based upon the

alignment of their dominant source of motivation and the task.

Foundational to the understanding of an individual's self-concept is the

understanding of traits, values and competencies. According to Cattell (1965), traits are

individual behaviors that arise without external stimuli, are consistently perceived by

others as being unique to that individual, and result in the individual being labeled by

others as possessing that trait. Behaviors that are consistently shown by individual can

lead to that individual being labeled by others according to that behavior, such as being

lazy, liberal, well organized, or ambitious.

Values are a conceptual roadmap that individuals possess that define how that

individual feels relative to what behaviors should be practiced when confronted with

specific events, challenges, or tasks (Schwartz & Bilsky, 1990). Schwartz and Bilsky

suggest that the individual's ideal beliefs relative to what behaviors should be practiced

are ordered in terms of importance, and they sustain those beliefs through action,

communication, and at times, inaction.

Competencies are the perception that an individual believes about their

knowledge, skills, abilities and talents (Leonard, et al., 1999). While the individual

beliefs may or may not have merit, they are important in that individuals may seek out

work that fits their perceived competencies. Examples of perceived competencies such

as "I am good at math," or "I am an excellent judge of character" energize the

individual's interest and effort relative to related tasks.

According to Leonard et al. (1999), individuals react to motivational stimuli that influences their perceptions of their perceived self, ideal self, and social identities. It is suggested that individuals act in order to maintain or improve their perceptions of the perceived self and social identities. The motivation to act is based upon two types of individuals: external and internal self-concept-based. The external self-concept based individual is most likely to respond to, and conform to, the role desires and needs of the organizational setting, and is energized to act by improving his or her status and recognition. The internal self-concept-based individual is inward centered, creating an ideal self competency goal, and energized acts towards achievement of that goal improves the perceived self in the direction of the ideal self.

As an individual's self-concept develops, the individual becomes motivated, or energized, to improve and maintain their understanding of themselves. Engaging in activities through varying degrees of effort with resultant feedback affirms the individual's self-concept. Importantly, when tasks and feedback are in alignment with the individual's self-concept, it is suggested that the level of effort, or motivation, increases (Leonard, et al., 1999).

Integrative Motivational Theory

Researchers (Klein, 1989; Leonard, et al., 1999) suggest that there exists a wide variety of motivation theory that is difficult for practitioners to understand and apply in practical work settings. The disordered state of exigent motivation theories and their respective strengths in measuring specific independent variables relative to motivation leaves researchers struggling to find a suitable tool for measuring and understanding

overall motivation in organizations. Per Landy and Becker (1987), each single theory

can be useful in measuring only one or two independent variables relative to motivation.

As such, researchers were left trying to describe overall motivation through examining

small parts of motivation utilizing individual motivation theories. Like the blind

scientists attempting to describe the overall picture of an elephant by examining a trunk,

tail, or ears of an elephant, no single theory could examine the majority of the elephant

(motivation) all at once. As a result, Landy and Becker (1987) requested that a meta-

theory of motivation be conceived that would assist in bringing together existing theories

into a conceptual middle theory to provide a more comprehensive theory for examining

overall motivation.

In response to Landy and Becker's (1987) call for a meta-theory of motivation,

Leonard et al. (1999) introduced the integrative motivation theory. The theory

incorporates numerous traditional theories of motivation, and combines them with the

theory of self-concept. Referred to as a meta-theory, or middle theory as proposed by

Landy and Becker (1987), Leonard et al. argue that the integrative motivation theory

incorporates some of each of 14 different tradition theories of motivation (Table 1) while

utilizing self-concept models. Ryan (2010) states the purpose of the integrative theory is

"the integrative understanding of a number of motivational theories, and by moving away

from the specifics of a particular theory, the model allows for a better practical

understanding of the concept of motivation as a multi-dimensional, complex

phenomenon" (p. 1568).

Table 1

Integrative typology of motivation sources (Barbuto & Scholl, 1998).

	Sources of Motivation					
Theorist	Intrinsic Process	Instrumental	External Self-concept	Internal Self-concept	Goal Internalization	Theory
Alderfer (1969)	Existense		Relatedness	Growth		ERG
Maslow (1954)	Physiological	Safety	Love	Esteem	Self-actualization	Hierarchy of Human Needs
Herzberg (1968)		Satisfiers	Satisfiers	Motivators		Two Factor Theory
Bandura (1986)	Sensory Intrinsic. Physiological	Extrinsic		Personal Standards		Social Cognitive
Katz & Kahn (1978)		Legal Compliance	Membership Approval	Role Performance	Internalized Values	Open System Theory
Etzioni (1975)		Calculative/Alienative	Social Moral		Pure Moral	Control and Commitment
Deco (1975)	Task Pleasure	Extrinisic	Interpersonal	Overcoming Challenges	Outcome Valence	Self-Determination Theory
Piaget (1972)	Preoperational	Concrete	Formal	Full-Formal	Post-Formal	Stage Theory Cognitive Development
Kohlberg (1976)	Heteronomous	Instrumental	Interpersonal	Social System	Principled	Cognitive Development
Kegan (1982)	Inpulsive	Imperial	Interpersonal	Institutional	Inter-individual	Constructive Development
Loevinger (1976)	Impulsive	Opportunistic	Conformist	Conscientious	Autonomous	Ego Development
McClelland (1961)		Power	Affiliation	Achievement		McClelland'sTheory of Needs
Murray 1964)	Intrinsic Pleasure	Power	Affiliation	Achievement		Psychogenic Needs
Barnard (1983)		Material Inducements	Social Inducements			Attribution Theory

Through the integrative taxonomy of the differing theories, Leonard et al. (1999) suggest that individuals possess five unique sources of motivation: intrinsic process, extrinsic/instrumental, external self-concept, internal self-concept, and goal internalization.

Individuals dominated by intrinsic process motivation will expend effort in work or exhibit specific behaviors for the fun of the experience. The work alone is the reward to the individual when they are intrinsic process motivated. If the work isn't fun, it is difficult to engage the worker effectively.

Individuals dominated by instrumental motivation are concerned about extrinsic, tangible reward for the effort that they place into the task. Extrinsic rewards, in this case, could include inducements such as promotion, pay, or bonuses.

Individuals dominated by external self-concept based motivation are concerned about the approval and recognition of their traits, values and competency. Once receiving the recognition of a specific reference group, the individual seeks approval from the reference group, and then moves to gaining status in the same group.

Individuals dominated by internal self-concept based motivation set individual goals that they believe will move them towards their ideal self. The individual then works toward that goal by developing competencies that do not necessarily coincide with reference group direction and influence. They are motivated to develop their own competencies which will move them closer to the ideal self.

Individuals dominated by goal internalization based motivation incorporate the goals of the collective group because they believe the goals are consistent with their personal value systems. Now believing in the cause, the worker is motivated to expend effort towards the goal of the organization.

Leonard et al. (1999) suggest that the integrative motivation theory has practical value for managers. With an understanding of the dominant motivation sources of workers, or what energizes workers to be productive, inducements to perform can be designed that will elicit individual effort based upon the individual's preferred source of motivation. As an example, offers of pay and bonuses to an instrumental motivation dominant worker will improve effort, however, the same offer to an individual with a

dominant intrinsic process source of motivation will not. The integrative theory of

motivation will enable precise targeting of motivational factors to individual workers

(Table 2).

Table 2

Sources of Motivation and Inducement Systems (Leonard, Beauvais, and Scholl, 1999)

	Inducement System			
Sources of Motivation	Reward System	Task System	Managerial System	Social System
Extrinsic/instrumental	X		X	X
Intrinsic/process		X		X
Value-based/goal internalization		X	X	
Self-concept-based: internal		X	X	
Self-concept-based: external	X		X	X

The integrative motivation theory (Leonard, et al., 1999) has also had a validated

survey instrument developed by Barbuto and Scholl (1998). The survey instrument was

later tested, refined and validated by Ryan (2010; 2011).

Applicability of Motivation Theories

According to Landy and Becker (1987), there existed no single over arching

theory of motivation at the time that could be applied to the study of motivation. They

contend that there were a plethora of different theories that are each individually suited to

measure specific independent variables better than others. A sample is included in Table

3. According to Landy and Becker (1987), it is inherent upon the researcher to select the

theory of motivation that best suits the problem that is posed. They concluded by

suggesting that the combination of parts of existing theories into larger middle-range

theories was needed. By combining and synthesizing theories, new single theories could

evaluate several dependent variables at one time. Since 1987, the integrative motivation

theory (Leonard, et al., 1999) was introduced.

Table 3

Hypothetical approach X variable matrix (Landy & Becker, 1987)

Dependent Variable	**Motivational approach**				
	Need	Reinforcement	Equity	Expectancy	Goal
Choice			X	X	X
Effort	X	X	X		
Satisfaction	X		X		
Performance		X	X		
Withdrawal		X	X	X	

The purpose of this research is to determine, at a broad level, motivating factors

that are unique to engineers when compared to their peer knowledge workers. Due to the

broadness of the research question, it would benefit the research to incorporate as many

theories as possible in order to gain the best overall picture of what energizes, or

motivates, the two groups to be productive. Unfortunately, incorporating many

individual theories into a broad study introduces challenges, including unwieldy survey

instruments from many theories, conflicting evidence of motivation, and how prescriptive

advice, perhaps conflicting, should be applied. However, the use of the integrative

motivation theory (Leonard, et al., 1999) allows for the use of a single theory that can

evaluate motivation from a broad spectrum of theories, while utilizing a single survey

instrument and a single set of prescriptive motivation inducement systems for

management.

Previous Research

Among the exigent literature there exist studies of motivation relative to engineers, with some comparisons of engineers to other workers. Each study incorporates a single needs based motivation theory in its study of engineers and motivation. These studies utilized Maslow's hierarchy of human needs (1943), elements of the theory of work adjustment (Dawis & Lofquist, 1984), Herzberg's two factor theory (1959), and elements of Alderfer's ERG theory (1969). Two studies compared engineers to other peer workers.

The first study comparing engineers to scientists (Badawy, 1971), based upon Herzberg's two factor theory of needs, concluded that there were motivational differences between engineers and scientists, suggesting that engineers are more concerned with Herzberg's hygiene factors than scientists. Badawy concluded that scientists were more focused on Herzberg's motivator factors, such as recognition, self-selection of tasks, and professional growth. Important within the prescriptive nature of this study was the suggestion that groups of professionals possess unique needs, and should not be bunched together in terms of motivation. Firms should strive to provide differing motivational techniques between professional groups, such as concluded within this study of engineers and scientists.

The second study concluded that there were no differences between knowledge engineers and software engineers (Couger & McIntyre, 1987). Other research studied groups of engineers utilizing needs based theories, but did not compare them to other

groups to determine if engineers possess unique motivating factors (Burney, 2000; French, 1966; Shoura & Singh, 1998) when compared to their peer worker groups.

What has not crisply materialized from the research is a broad examination of the motivational differences between engineers and their peer knowledge workers. Returning to Landy and Becker's (1987) reference to blind scientists examining parts of an elephant, the exigent research has examined the differences between engineers and their peer workers in a narrow scope of individual needs based theories. Additionally, the statistical power of these studies is low as defined by Ferguson and Ketchen (1999).

Need for Further Research

The literature review identifies existing studies that have attempted to determine how engineers are motivated. All of the studies incorporate one needs based theory of motivation, including job core theory, Maslow's hierarchy of human needs, or Alderfer's ERG theory. Landy and Becker (1987) suggest that utilizing single theories to examine overall motivation is likened to a single blind scientist (motivation theory) examining a part of an elephant, and attempting to conclude the overall makeup of the elephant. Of course, each blind scientist could describe the elephant as a trunk, tail, tusks or other part of the elephant. A meta-theory of motivation, which incorporates many different theories of motivation, could provide a more complete picture of the elephant (in this case, engineers). Such theory exists. Additionally, none of these studies attempts to determine the differences in motivating factors between engineers and their peer knowledge workers. There is also a need for application of more broad frameworks of motivation theory, as well as other concepts, such as extrinsic and intrinsic classification, and the use

of self-concept. Accompanying a broad motivation theory framework could also provide

a prescriptive framework for energizing engineers to be productive. The integrative

motivation theory provides this prescriptive framework, and associates that framework to

a broad application of motivation theory. This prescriptive framework could provide

practical value when incorporated by managers of engineers.

Chapter 3

Methodology

Research Design

In order to determine whether engineers have unique factors that motivate them when compared to other knowledge workers, this study utilized an online survey instrument that will was distributed to 1,501 employees of a single United States Fortune 10 company. The subjects of the study contained 611 engineers and 809 general knowledge workers. The survey instrument, based upon the integrative theory of motivation, is made up of 28 questions from the Measure of Motivational Sources (James C. Ryan, 2011) (Appendix A). Response to the survey was optional. Upon completion of the survey and data collection, the data was analyzed utilizing the one way ANOVA technique to evaluate the significance, if any, between the motivational factor means of the two groups.

Hypotheses

Surveying 1,501 employees of a single Fortune 10 company in the United States utilizing the Measurement of Motivation Sources (James C. Ryan, 2011) instrument , this research tested the following hypotheses:

H$_1$: There is a significant difference in motivation sources between engineers and general knowledge workers.

H$_2$: There is a significant difference in motivation sources between male and female workers.

H$_3$: There is a significant difference in motivation sources relative to tenure with the firm.

H4: There is a significant difference in motivation sources relative to the age of the worker.

Population

The participants identified for the study included 1,501 employees of a United States Fortune 10 company. The population was made up of men and women whom work in a variety of roles that support complex communication systems design, delivery and project management duties. Of the population, 611 have titles related to engineering, while the other 809 have titles related to non-engineering knowledge workers. Of the population, over 45 of the employees reside and work overseas. The entire population reports into a single division of the firm, and is subject to a single set of HR practices. All individual responses acquired during this research will be kept strictly anonymous.

Sampling Method

In order to help control for differences in external motivators from several different firms, a purposive sampling of a single large corporation was selected. The purposive sampling was also selected because of the researcher's access to the group. The study included a sampling of 1,501 employees, made up of 611 respondents that have titles related to engineering, while the other 809 have titles related to non-engineering knowledge workers. The size of the population provides some assurance that enough respondent data will be collected to ensure an acceptable level of statistical power (N1=70, N2=70) to reject the null hypothesis, if indicated (Ferguson & Ketchen, 1999).

Instrumentation

For purposes of this research, the Measurement of Motivation Sources (James C. Ryan, 2011) was used. The MMS is an instrument designed to empirically measure against the integrative theory of motivation, and is an adaptation of the Motivation Sources Inventory (Barbuto & Scholl, 1998). Containing 28 questions (Appendix A) on a seven point Likert scale anchored by 1: Strongly disagree to 7: Strongly agree, the survey shall be provisioned as a hosted online survey instrument to be provided to participants. The MMS has two particular strengths: it has a relatively small number of questions and collects motivational information known to be related to 14 different theories of motivation.

Scoring of the MMS categorizes each of the 28 questions into one of five factor categories: intrinsic process, extrinsic/instrumental, external self-concept, internal self-

concept, and goal internalization. Factor one questions include questions one through six

and are related to extrinsic/instrumental motivation. Factor two questions include

questions seven through 12, and are related to external self-concept. Factor three

questions include questions 13 through 18, and are related to intrinsic process. Factor

four questions include questions 19 through 24, and are related to internal self concept.

Factor five questions include questions 25 through 28, and are related to goal

internalization. Scores from each question within the factor groups are averaged and

compared. The highest factor score will determine the individual's dominant source of

motivation.

Additionally, the survey collected the following data:

1)   The recipient shall self-select whether they are an engineer or a knowledge

worker.

2)   Current position title.

3)   Years in current position.

4)   Age

5)   Email address. The email address was used by the survey application to

ensure that no individual participant will respond to the survey twice. The email

address was discarded at the end of the active survey period.

6)   Gender

Instrument Validity

The simple factor structure of the subscales does not possess any items that cross

load on other factors above .40 (James C. Ryan, 2011). Subscales of the MMS show

acceptable internal reliability, as exhibited in Table 3. According to Nunnally and

Bernstein (1994), alpha values greater than .70 generally indicate that an instrument is

valid. Cumulative variance by the un-rotated solution is 48.9%. Rotated sums of squares

loading for the five factors resulted in variance at 12, 9.7, 9.2, 9.1, and 8.9%. The

instrument has been validated outside of the context of the United States.

Table 4
Internal Reliability of the MMI (Ryan, 2011)

Motivation Source	Alpha coefficient	Cronbach alpha
Instrumental	0.84	
External self-concept	0.77	
iIntrinsic process	0.71	
Internal self-concept	0.71	
Goal internalization		0.71

Data Collection

Selected survey recipients were identified through the firm's online employee

directory. Corporate email addresses were gathered from the corporate directory of

active employees, and names were not associated with the email addresses. The survey

was delivered to the recipients through an email invitation that linked the user to an

online survey application that was securely hosted. The survey application was iSurvey.

iSurvey is an industry recognized provider of hosted, complex, and secure online survey

applications. After the recipient received the email invitation, they were asked to select a

link that took them to a browser based survey, and advised if a completed survey was

submitted, they would be entered into a drawing for a Samsung Galaxy Tab 2 tablet. The

survey application identified the participant by the unique invitation URL designation so

that no recipient can take the survey more than once. The survey was sent to all

recipients on the first day of the data collection process, and reminders were sent to those

that had not responded every three weeks. The researcher reviewed the number of

cumulative responses on the iSurvey platform until the number of complete responses

reached a minimum of 70 per two categories. Once respondents completed the survey,

they were not able to enter new survey responses, and they were not able to modify their

existing responses. Reminders stopped after sufficient responses were received (N1 = 70,

N2 = 70).

The data collected resided on the iSurvey application hosted server until sufficient

survey responses are received. The data was then transferred to the researcher for

analysis.

Data Analysis

The independent T-test technique was utilized to test the general hypothesis that

the group mean factor responses of knowledge workers compared to engineers should

have no significance for hypotheses one and two (H_{1-2}). The t test is utilized to test the

null hypothesis relative to the observed differences between two means (Patten, 2005).

The independent t test was utilized to compare the means of engineers and non engineers

for the five subscales of the Measurement of Motivation Sources (James C. Ryan, 2011).

The independent t test was also utilized to compare the means of male and female scores

for the five subscales of the Measurement of Motivation Sources. The statistical software

package SPSS version 20.0 was used to analyze the collected data.

One way ANOVA tests are able to compare more than two means against the independent variable, and can act in rejecting the null hypothesis (Patten, 2005). One way ANOVA tests were utilized to compare motivational factors between tenure groupings (0-5, 6-10, 11-15, 16-20, 21-25, 25-30), as well as major age groupings (age 21 – 25, 26 – 30, 31 – 35, 36 – 40, 41 – 45, 46 – 50, 51 – 55, 56 – 60, 61 – 77, >75) in order to test hypotheses three and four (H_{3-4}).

Limitations

This research includes utilizing the Measurement of Motivation Sources (James C. Ryan, 2011) survey instrument on a purposive sample of 1,501 employees of a single Fortune 10 communications company in the United States. Therefore, the results of this research may not be generalizable to the general population of engineers. The engineers included in this research are mostly network engineers that develop, design and implement complex communications networks. Therefore the results of this research may not be generalized to all other types of engineers.

Additionally, this research found no significant differences in motivational sources between tenure groups and age groups. However, the sampling sizes for the ANOVA tests were small between the many groups, and therefore satisfactory power results cannot be drawn from the research.

This research, through t-test examination of differences in means, found no significant difference between gender group motivational sources. However, this research was conducted within a single Fortune 20 firm in the US, with a single culture

and management process. Therefore, these findings are not generalizable to the overall population.

Limitations also exist relative to the Measure of Motivation Sources. Samples utilized to validate the instrument were not diverse enough to generalize applicability to all populations, specifically international use (James C. Ryan, 2011). It is also noted that the scale is dependent on the validity of the underlying theory of motivation as outlined by Leonard et al. (1999).

Chapter 4

Results

The primary thrust of the research conducted is to determine whether engineers possess unique motivational factors that energize them to be productive when compared to their peer knowledge workers. Most of the exigent research relative to motivation and engineers has utilized a single motivation theory construct in order to provide guidance to managers when faced with energizing engineers to be productive (Badawy, 1971; Burney, 2000; Couger & McIntyre, 1987; French, 1966; Shoura & Singh, 1998). However, these studies failed to utilize multiple theories in order to gain a holistic, multi-theory view of the engineer. Additionally, factors such as small samples and not comparing engineers to their peer workers provide little guidance on whether a manager should seek to manage engineers differently than their peer knowledge worker.

This research utilized a single, quantitative survey instrument: Ryan's (2011) measurement of motivation sources. Data was gathered for the five subscales of the instrument, and an independent samples T-test was utilized for testing hypotheses one and two (H_{1-2}), followed by an analysis of variance (ANOVA) to determine if there exists a significant difference in means between age and tenure groups (H_{3-4}).

The residual of this results section will summarize (1) the research questions posed, (2) data collection and coding, (3) demographic data, (4) descriptive statistics, and (5) hypothesis testing results.

Research Questions

While it is important to optimally motivate engineers in the workplace, little comprehensive research has been performed to determine if engineers possess unique individual motivational factor needs when compared to their counterpart knowledge workers. This study seeks to determine if there are unique motivational sources that "energize," or motivate engineers in the workplace when compared to other knowledge workers within their organization.   Hypotheses that were tested and initial results are:

H$_1$: There is a significant difference in motivation sources between engineers and general knowledge workers. This research found that there exists significantly different motivation sources between engineers and their peer knowledge workers.

H$_2$: There is a significant difference in motivation sources between male and female workers. This research found no differences between male and female sources of motivation.

H$_3$: There is a significant difference in motivation sources relative to tenure with the firm. This research found no differences between tenure group sources of motivation.

H4: There is a significant difference in motivation sources relative to the age of the worker. This research found no differences between age group sources of motivation.

Data Collection and Coding

Engineers and their peer knowledge workers were selected to participate in the research through being employees of a Fortune 10 communications company and being

within a division of the company that focuses on engineering and process development. Any employee within this organization of 1,501 employees was eligible to respond to the optional survey. Each individual was emailed a request to participate in the survey that was hosted on an iSurvey application survey in the AT&T host domain. Data collected from the survey included demographic information and the completion of Ryan's (2011) measure of motivation sources survey instrument.

Once the survey was complete, data was exported from the iSurvey host system to a Microsoft Excel 2007 spreadsheet on the researcher's security enabled laptop computer. Data was cleaned by removing responses that did not have all of the measure of motivation instrument data fields included. A total of 310 survey responses were received, equaling a 20.6% response rate. A total of 66 responses, or 21.2%, were removed due to missing or incomplete data, leaving a total of 244 complete responses. The remaining 244 responses, representing 16.2% of the population studied, were used for final data analysis.

Demographic Information

Referencing Table 5, male and female respondents were 55.7% and 44.3% respectively, with the vast majority of men being between the ages of 41 to 60 (81.6%). Women also had a high distribution within the 41 to 60 age group (79.6%).

Table 5

Summary of Participant Gender and Age Statistics (N=244)

Gender/Age	n	%
Male	136	55.7%
26-30	1	0.7%
31-35	6	4.4%
36-40	9	6.6%
41-45	25	18.4%
46-50	31	22.8%
51-55	32	23.5%
56-60	23	16.9%
61-75	9	6.6%
Female	108	44.3%
21-25	3	2.8%
26-30	3	2.8%
31-35	4	3.7%
36-40	9	8.3%
41-45	15	13.9%
46-50	20	18.5%
51-55	30	27.8%
56-60	18	16.7%
61-75	5	4.6%
>75	1	0.9%

Referencing Figure 7, total respondent age groupings histogram, the majority of participants are over the age of 40 (85.6%), with the age group of 51 to 55 being the largest group (25.4%).
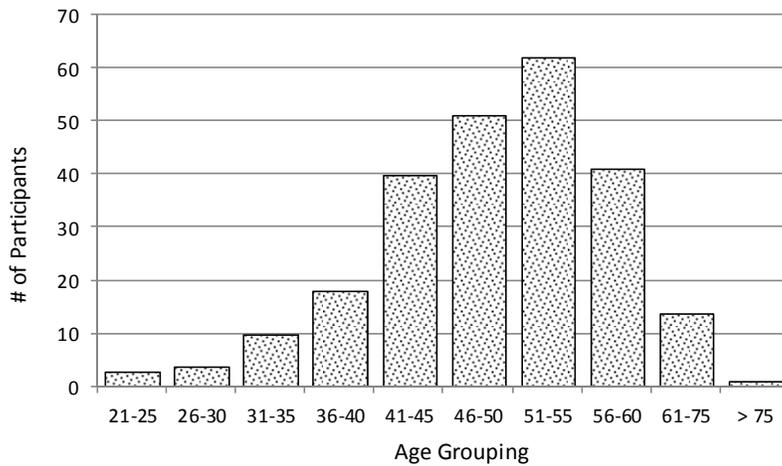
Figure 7. Age Grouping Chart for Participant Respondents (n=244)

Referencing Table 6, total engineer and non-engineer responses were 84 and 160

respectively. Engineers made up more than a third of respondents (34.4%), while non-

engineers made up 65.6% of respondents.

Table 6

Summary of Participant Job and Gender *(n=244)*

Engineer/Gender	N	%
Engineer	84	34.4%
Male	73	86.9%
Female	11	13.1%
Non-Engineer	160	65.6%
Male	63	39.4%
Female	97	60.6%

The tenure groupings for respondents include three quarters of all participants

having 10 years or less of employment with the firm in Table 7.

Table 7

Summary of Tenure Groupings of Participants *(n=244)*

Years of Tenure	n	%
1 to 5	114	46.7%
6 to 10	69	28.3%
11 to 15	38	15.6%
16 to 20	11	4.5%
21 to 25	12	4.9%

Data Analysis and Instrument Reliability

An existing instrument was utilized in this research: The Measurement of

Motivation Sources (MMS) (James C. Ryan, 2011). This instrument is designed to

measure an individual's unique motivational sources relative to the Integrative

Motivation Theory as proposed by Leonard et al. (1999). The MMS incorporates a total

of 28 item survey (Appendix A). The MMS scoring utilizes sets of questions that

empirically measures which of the five sources of motivation are dominant in an

individual, as well as determining the power of each of the five relative to each other in

importance. The first series of questions (questions 1 – 6) measure instrumental

motivation as defined by Leonard et al. (1999). The second set of questions (7 – 12)

measure external self-concept sources. The third set of questions (questions 13 – 18)

measure intrinsic process motivation sources. The fourth set of questions (questions 19 –

24) measure internal self-concept. The last four questions (questions 25 – 28) measure

goal internalization motivation. Scoring of the instrument includes summing each set of

questions, and dividing the sum by the number of questions in the question category

(external self-concept/6, instrumental motivation/6, intrinsic process/6, internal self-

concept/6, goal internalization/4). The highest score in any of the five categories

indicates an individual's dominant source of motivation.

The MMS instrument has been validated and possesses sufficient reliability

(James C. Ryan, 2011). The simple factor structure of the subscales does not possess any

items that cross load on other factors above .40 (James C. Ryan, 2011). Subscales of the

MMS show acceptable internal reliability, as exhibited in Table 8. According to

Nunnally and Bernstein (1994), alpha values greater than .70 generally indicate that an

instrument is valid. Cumulative variance by the un-rotated solution is 48.9%. Rotated

sums of squares loading for the five factors resulted in variance at 12, 9.7, 9.2, 9.1, and

8.9%. The instrument has been validated outside of the context of the United States.

Table 8

Internal Reliability of the MMI (Ryan, 2011)

Motivation Source	Alpha coefficient	Cronbach alpha
Instrumental	0.84	
External self-concept	0.77	
iIntrinsic process	0.71	
Internal self-concept	0.71	
Goal internalization		0.71

Descriptive Statistics

The descriptive statistics for all of the participant responses relative to the instrumental motivation, external self concept, intrinsic process, internal self-concept, and goal internalization scales of the Measurement of Motivations Sources (James C. Ryan, 2011) are shown in Table 9.

Table 9

Summary of Means, Standard Deviation, Minimums, and Maximums for Scores on the Measurement of Motivation Sources Scale (n=244)

	M	SD	Min	Max
Instrumental motivation	3.84	1.06	1.33	6.83
External self concept	4.1	1	1.16	6.66
Intrinsic process	4.65	0.79	2.33	6.66
Internal self-concept	6.27	0.5	4.16	7
Goal internalization	5.14	1.01	1	7

The distribution of participant's dominant source of motivation includes a heavy weight for the Measurement of Motivation Sources internal self-concept source (making up 87.2% of all respondents). Many individuals possess a strong secondary source of

motivation, as shown in Table 10, where 50% of secondary sources of motivation are

goal internalization.

Table 10

Measurement of Motivation Sources Participant Dominant Sources of
Motivation Distribution *(n=244)*

	Dominant		Secondary	
Source	n	%	n	%
Instrumental motivation	6	2.5%	18	7%
External self concept	5	2.0%	25	10%
Intrinsic process	6	2.5%	50	20%
Internal self-concept	213	87.3%	29	12%
Goal internalization	14	5.7%	122	50%

Research Hypothesis Results

Engineer and non-engineer group means, standard deviations and means

differences are in Table 11.

Table 11

*Summary of Means and Standard Deviations for Scores on the Measure of
Motivation Sources Instrument by Engineer, Non-engineer (n=244)*

	Engineer			Non-Engineer			Mean Difference
MMS Subscale	*n*	M	SD	*n*	M	SD	
Instrumental motivation	84	3.62	1.02	160	3.95	1.06	-0.33
External self concept	84	4.20	1.02	160	4.10	1	0.10
Intrinsic process	84	4.65	0.77	160	4.65	0.79	0.00
Internal self-concept	84	6.3	0.52	160	6.26	0.5	0.04
Goal internalization	84	5.19	1.03	160	5.11	1.01	0.08

Independent T-tests were conducted to determine if there exists a significant

difference between means of the sources of motivation in order to answer hypotheses one

and two (H_{1-2}). Relative to hypotheses one, which seeks to determine if there exists a difference in motivation sources between engineers and non engineers, T-test results between the five dominant sources of motivation mean scores of engineers and non-engineers are in Table 12. The Levene's test was applied, and equal variances were assumed (sig > .05 for all variables). The test revealed a statistically significant difference between engineers and non-engineers relative to instrumental motivation efficacy (t = -2.33, df = 176.1, p < .05). The effect size (d) was .31. Using Cohen's (1988) conventions, this is a small effect. Therefore the null hypothesis was rejected and the alternative proposal accepted.

Table 12

Independent Samples T-Test Between Engineers and Non-Engineers
Based Upon Means of Five Subscales of the Measure of Motivation
Sources (n=244)

| Source of Motivation | Levene's Test | | T-test for Equality of Means | | | | | 95% Conf Intvl of Difference | |
	F	Sig	t	df	Sig (2-tailed)	Mean Dif	Std. Error Dif	Lower	Upper
Instrumental motivation	0.174	0.677	-2.298	242	**0.022**	-0.327	0.142	-0.607	-0.046
External self concept	0.021	0.885	0.06	242	0.953	0.008	0.135	-0.259	0.275
Intrinsic process	0.113	0.737	0.033	0.242	0.974	0.003	0.107	-0.208	0.215
Internal self-concept	0.383	0.537	0.57	0.242	0.569	0.038	0.068	0.095	0.173
Goal internalization	0.102	0.749	0.578	0.242	0.564	0.079	0.137	-0.19	0.349

An independent samples T-test was conducted in order to determine if there exists a significant difference in motivation sources between male and female participants in the survey (H_2). The Levene's test was applied, and equal variances were assumed (sig > .05 for all variables). The test did not reveal any statistically significant differences between male and female participant responses (Table 13). Therefore, the null hypothesis was not rejected.

Table 13

Independent Samples T-Test Between Male and Female Respondents
Based Upon Means of Five Subscales of the Measure of Motivation
Sources (n=244)

Source of Motivation	Levene's Test		T-test for Equality of Means					95% Conf Intvl of Difference	
	F	Sig	t	df	Sig (2-tailed)	Mean Dif	Std. Error Dif	Lower	Upper
Instrumental motivation	0.388	0.534	-2.49	242	0.804	-0.034	0.137	-0.305	0.237
External self concept	0.253	0.615	1.075	242	0.284	0.139	0.129	-0.115	0.394
Intrinsic process	0.083	0.773	-0.071	242	0.944	-0.007	0.103	-0.21	0.195
Internal self-concept	0.032	0.858	-1.955	242	**0.052**	-0.126	0.064	-0.254	0.0009
Goal internalization	0.537	0.464	-0.05	242	0.96	-0.006	0.131	-0.265	0.251

A one-way ANOVA test was conducted to determine if there were significant differences in the MMS motivation scales between tenure groups (H_3). The Levene's test was applied, and equal variances were assumed (sig > .05 for all variables). The test did not reveal any statistically significant differences between tenure group participant responses (Table 14). Therefore, the null hypothesis was not rejected.

Table 14

One-way ANOVA Means Testing Between Tenure Groupings Within Motivation Sources *(n=244)*

Between Groups	Sum of Squares	df	Mean Square	F	Sig
Instrumental motivation	2.629	4	0.657	0.574	0.682
External self concept	7.856	4	1.964	1.974	0.099
Intrinsic process	3.658	4	0.914	1.44	0.22
Internal self-concept	0.802	4	0.2	0.778	0.541
Goal internalization	5.321	4	1.33	1.295	0.273

A one-way ANOVA test was conducted to determine if there were significant differences in the MMS motivation scales between age groups (H_4). The Levene's test was applied, and equal variances were assumed (sig > .05 for all variables). The test did not reveal any statistically significant differences between tenure group participant responses (Table 15). Therefore, the null hypothesis was not rejected.

Table 15

One-way ANOVA Means Testing Between Age Groupings Within Motivation Sources *(n=244)*

Between Groups	Sum of Squares	df	Mean Square	F	Sig
Instrumental motivation	16.942	9	1.882	1.698	0.09
External self concept	11.531	9	1.281	1.281	0.248
Intrinsic process	5	9	0.556	0.866	0.556
Internal self-concept	1.684	9	0.187	0.721	0.689
Goal internalization	8.52	9	0.947	0.914	0.513

Conclusion

The primary thrust of this study is to determine whether engineers possess significant unique motivating factors that are different from their peer knowledge workers. The quantitative study utilized a standardized instrument with 244 respondents from a Fortune 10 communications firm in the United States. A T-Test was utilized to compare the means of scores from engineers and non-engineers. Engineers were found to have a significant difference in the motivational factor of extrinsic/instrumental motivation ($t = -2.33$, $df = 176.1$, $p < .05$). The effect size (d) was .31. There were no significant differences found for sources of motivation factors relative to gender, tenure or age.

Chapter 5

Discussion

Findings Related to the Literature

The primary thrust of this research is to determine if engineers possess unique

motivating characteristics that energize them to be productive when compared to their

peer knowledge workers. The literature review stage of this research found no studies

that compared engineers and the general group of engineer's peer knowledge workers in

terms of unique motivating factors. However, the literature review uncovered research

(Badawy, 1971) comparing motivational factors of industrial scientists and engineers,

which utilized Herzberg's (1959) two factor theory of needs. Badawy's research studied

45 industrial scientists by collecting responses on a 21 question survey, which sought to

study the importance of Herzberg's hygiene and motivation factors. Badawy concluded

that scientists place more importance on Herzberg's motivator factors than Engineers,

and that managers should seek to motivate engineers and scientist differently based upon

his findings.

This study supports Badawy's (1971) findings in terms of the benefits of

motivating engineers differently than other peer groups, as engineers were found to have

unique motivational factors (in this study) that energize them to be productive in the

workplace when compared to their peer knowledge worker group. However, when

compared to engineer's peer workers, this study concluded that engineers place

significantly less importance on financial rewards than their peer knowledge worker

group. Additionally, contrary to the findings of Badawy, this research suggests that

engineers and their peer knowledge workers possess no significant differences in terms of

Herzberg's motivators. Motivator factors including achievement, recognition,

responsibility, how interesting the work is, and growth and advancement were found, in

this study, to not differ significantly between engineers and their peer knowledge

workers.

Couger and McIntyre (1987), utilizing job core theory, performed a study

confirming the hypotheses that knowledge engineers and software engineers are similar

in factors that motivate them to be productive in the workplace. Reviewing this study, it

is difficult to state that the research conducted in this study either supports or does not

support the findings of Couger and McIntyre, as Couger and McIntyre are examining

differences between one independent variable of the research conducted in this study

(engineers).

Research Conclusions

While many conclusions can be reached from this study, the primary hypotheses

in this research is to determine if there are significant differences in motivational factors

that energize engineers to be productive when compared to their peer knowledge

workers. This study found a significant difference between the two groups relative to the

importance of instrumental motivation as defined by Leonard et al. (1999). This research

suggests that engineers place significantly less value on extrinsic/instrumental motivation

factors of motivation, and that they will demonstrate more persistence and intensity in their work than their peer knowledge workers as the likelihood of tangible rewards diminish. Engineers will be less responsive to motivators such as performance-based rewards, bonuses linked to goal attainment, or group goal attainment payments than their peer knowledge workers.

While there exists a significant difference in extrinsic/instrumental motivation factors between engineers and their peer knowledge workers, Leonard et al.'s (1999) meta-theory of motivation suggests that each individual possesses a single "dominant source of motivation that acts as a focus or lens by which they make decisions and channel behavior " (p. 988). Leonard et al. also suggest that in given situations, if two sources of motivation have conflicting behavioral conclusions, the dominant source of motivation will prevail. This study found that the extrinsic/instrumental motivation factor, in terms of dominance when compared to other motivation sources, was the least frequently used dominant source of motivation for both engineers and their peer knowledge workers (Table 10). However, Leonard et al. suggest that "individuals have different motivational source profiles in different situations or with regard to different identities" (p. 988). Therefore, at times, engineers and knowledge workers may rely on extrinsic/instrumental motivation sources as their dominant source in specific situations, even though this source is, on average, the least relied upon in most circumstances. However, engineers will rely on extrinsic/instrumental motivation sources even less frequently than their peer knowledge workers.
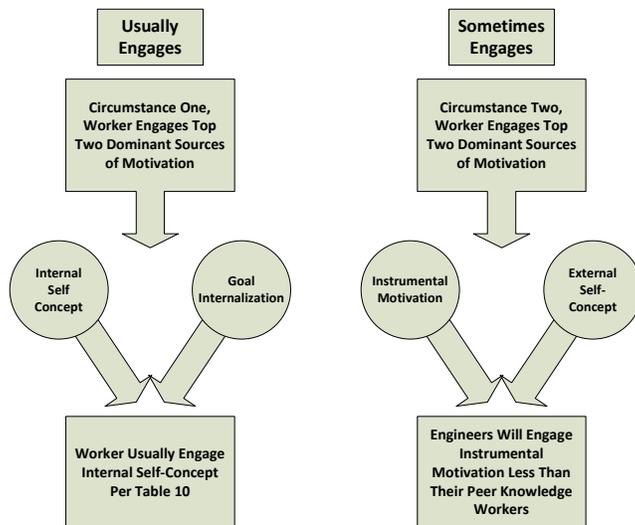
Figure 8. Engaging in Motivation Sources in Different Circumstances

Leonard et al. (1999) propose that "individuals have different motivational source profiles in different situations or with regard to different identities" (p. 988). This suggests that in given situations, individuals may demonstrate the use of extrinsic/instrumental motivation by itself or coupled with another situationally weaker source. In this example, the dominant, or possibly only, source of motivation would drive behavior that would demonstrate the significant difference between engineers and their peer knowledge workers. While the instances of dominant extrinsic/instrumental motivation situations may be rare, the frequency of this dominant state is unclear.

While motivational differences exist between engineers and their peer knowledge workers, the most important finding of this study is that there is no significant difference in the most dominant sources of motivation for both engineers and their peer knowledge workers (Table 10). Of the five sources of motivation as proposed by Leonard et al. (1999), the four most important sources of motivation were, in this study, not significantly different between engineers and their peer knowledge workers. This implies

that in a majority of situations, engineers and their peer knowledge workers will

demonstrate the same amount of persistence and intensity of effort in their work given the

same motivational environment.   So, while differences exist, they are not important

differences.

Implication of Findings

This research possesses several implications for the firms that manage engineers

within their organization.   Industry managers report that engineers often appear to

behave differently from their counterparts relative to motivation (Badawy, 1971) and

suggest that engineers have different motivation style differences when compared to their

scientist counterparts. However, this study concludes that while Badawy suggests that

engineers may often appear to behave differently from their peer knowledge workers,

there is little difference between the two groups in terms of motivation sources. Where

motivation source differences are significant, those sources are the least important to both

engineers and their peer knowledge workers. Therefore, it is less important to focus on

engineers as possessing unique motivational needs, and more important to determine the

dominant motivational sources of the engineers and acting upon them.

The broader implication of this research is the demonstration of the practicable

value of the holistic approach to measuring motivational sources through the use of

Leonard et al. (1999) meta-theory of motivation.   Previous needs based methods, such as

Herzberg's two factor theory (1959), suggest that measuring satisfaction levels of

motivators, then adjusting motivators to improve satisfaction, will improve work intensity

and persistence. However, needs based theories provide little guidance on how important

the satisfaction of the need is to the worker, and there remain questions about whether

satisfaction of a motivator will actually motivate, or just satisfy, a worker. The meta-

theory of motivation provides a roadmap for the practitioner to understand what sources

of motivation are preferred by the workers within their organization, and most notably,

how important those motivation sources are to the worker. As an example, if the

workforce was surveyed and the results suggested showed scores of 3, 3, 6, 3, 3 for the

sources of intrinsic process, instrumental, external self-concept, internal self-concept, and

goal internalization respectively, we could infer that external self-concept is very

dominant for the organization as a whole. The organization would then focus

motivational SHRM interventions on recognition programs and over-communicating with

employees relative to their achievements. Additionally, because the score for external

self-concept is significantly greater than the scores for other motivation sources, we could

infer that external self-concept is very important when compared to other sources.

The importance of the various motivational sources to the individual worker is a

key component to the practicable use of the meta-theory of motivation (Leonard, et al.,

1999). For example, in this study, we concluded that engineers place less value on

extrinsic rewards than their peer knowledge workers. If this were a needs based

approach, we may have measured the same phenomenon as lower compensation

satisfaction for peer knowledge workers when compared to engineers. Rightly, a

manager could elect to provide compensation raises to the peer knowledge workers in

order to improve the satisfaction, and therefore the productivity, of the peer knowledge

workers. However, this research suggests that the action of the manager would be

flawed, as pay raises are the least important motivating factor that can be modified,

within this group, in order to energize worker task intensity and persistence. The investment in the pay increase could have alternatively been used to motivate the workforce through investing in energizing the dominant sources of motivation: internal self-concept and goal internalization.

This study demonstrates to practitioners the use of the meta-theory of motivation (Leonard, et al., 1999) and Ryan's (2011) Measurement of Motivation Sources instrument. The study can be adopted by management in order to holistically study the unique motivating sources of their workers. Utilizing the results of the study, practitioners can then act upon the motivation sources that are most likely to energize their workers to be productive.

In summary, this research has demonstrated that engineers possess unique motivating factors; however, these motivating factors are not as important to them as other factors. Additionally, this study has demonstrated the practical application of the meta-theory of motivation (Leonard, et al., 1999) and the Measurement of Motivation Sources (James C. Ryan, 2011). Organizations can measure both the motivations sources that are preferred by their employees, as well as how important those motivation sources are to the workers. The firm can then act upon energizing employee task intensity and persistence by focusing the company's efforts on improving the motivation sources that are the most important to the worker.

Limitations, Delimitations, and Risks

This research includes utilizing the Measurement of Motivation Sources (James C. Ryan, 2011) survey instrument on a purposive sample of 1,501 employees of a single Fortune 10 communications company in the United States. Therefore, the results of this research may not be generalizable to the general population of engineers, as this research studied only a single company with a single corporate culture. The engineers included in this research are mostly network engineers that develop, design and implement complex communications networks. Therefore the results of this research may not be generalized to all other types of engineers.

Limitations also exist relative to the Measure of Motivation Sources. Samples utilized to validate the instrument were not diverse enough to generalize applicability to all populations, specifically international use (James C. Ryan, 2011). It is also noted that the scale is dependent on the validity of the underlying theory of motivation as outlined by Leonard et al. (1999).

Recommendations for Future Research

This study provides insight into the question as to whether engineers possess unique motivational factors that energize them to be productive when compared to their peer knowledge workers. The meta-theory of motivation (Leonard, et al., 1999) offers a unique view into the holistic approach of evaluating the overall dominant sources of motivation of workers, and is able to offer prescriptive interpretation of the importance of once source over another. However, Leonard et al. propose that "individuals have

different motivational source profiles in different situations or with regard to different

identities" (p. 988). Further research into the frequency of the dynamics of differing

motivation source profiles based upon situational dynamics will offer further granularity

in evaluating dominance of motivational sources. Does an individual practice their two

most dominant motivational sources 95 percent of the time, or just 50 percent of the

time? Insight into this dynamic could prove invaluable in further understanding the

importance scale of the meta-theory of motivation.

This research was conducted utilizing a single large communications company

located in the United States, with participant engineers being largely made up of network

engineers. A broader study, including multiple organizations and including many

different types of engineers would offer prescriptive guidelines to managers that are more

generally applicable to the engineering population.

Another important subject for future research would be a case analysis of the

actual study of an organization utilizing the meta-theory of motivation, prescriptive

measures then applied to improve motivation in the firm in order of importance, followed

by an evaluation of overall worker productivity. Results would then be compared to

other case studies that utilized other needs based theories, such as Herzberg's (1959) two-

factor theory.

While representing an important group of knowledge workers, many engineers

are leaving the profession or are unsatisfied in their work environment (Stabbert, 2010).

While this research focused on the dominant sources of motivation, or what "energizes"

engineers and their peer knowledge workers to productive, further study is needed to

determine the causes of engineers leaving their profession. This would require a very

broad and complex conceptual framework including factors such as barriers to re-entry

after a pause in the profession, interesting work, job conditions, compensation,

engineering leadership, ideal self orientation, job fit, job satisfaction, stress, and dominant

alternative professions among others.

According to the Bureau of Labor Statistics (2012), from the year 2008 to 2009,

engineering services output per hour declined by 5.4%, while the total output per

engineer declined by 11.9%. During this same period, per unit costs for engineering

services increased by 10.4% (Bureau of Labor and Statistics, 2012). It would be

advantageous to determine the dominant factors that are driving the loss of productivity

in engineering services. Conceptually, this research would include factors such as

engineering leadership, engineering resource scarcity, motivation to work, external

economic factors, and operations management among others.

Conclusion

This research sought to determine if engineers possess unique motivational factors

that energized them to be productive when compared to their peer knowledge workers.

The research was conducted using a quantitative study of 244 engineers and knowledge

workers utilizing the Measurement of Motivation Sources (James C. Ryan, 2011) which

measures motivation sources consistent with the meta-theory of motivation (Leonard, et

al., 1999). Engineers were found to be significantly less motivated by extrinsic rewards

than their peer knowledge workers; however, extrinsic rewards were the least important

motivational factor for both knowledge workers and engineers.

This research also found there was no significant difference in motivation sources when comparing gender, tenure, and age of participants.

References

Adams, J. S. (1965). *Inequity in social exchanges*. New York: Academic Press.

Alderfer, C. P. (1969). An empirical test of a new theory of human needs. *Organizational Behavior & Human Performance, 4*(2), 142-175.

Ambrose, M. L. (2002). Contemporary justice research: a new look at familiar questions. *Organizational Behavior & Human Decision Process, 89*, 803-812.

Badawy, M. K. (1971). Industrial scientists and engineers: Motivational style differences. *California Management Review, 14*(1), 11-16.

Bandura, A. (1977). *The exercise of control*. Stanford, CA: W.H. Freeman.

Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. Englewood Cliffs, NJ: Prentice Hall.

Barbuto, J. E., & Scholl, R. W. (1998). Motivation sources inventory: Development and validation of new scales to measure an integrative taxonomy of motivation. *Psychological Reports, 82*, 1011-1022.

Brenner, V. C., Carmack, C. W., & Weinstein, M. G. (1971). An emprical test of the motivation-hygiene theory. *Journal of Accounting Research, Autumn*, 359-366.

Bureau of Labor and Statistics (2012). Occupational outlook handbook. Retrieved May 5, 2012: http://www.bls.gov/oco/ocos027.htm#nature

Burney, M. A. (2000). Motivating engineers. *IIE Solutions, 32*(6), 33.

Caldwell, D. F., & O'Reilly, C. A. (1990). Measuring person-job fit with a profile-comparison process. *Journal of Applied Psychology, 75*, 648-657.

Carrell, M. R., & Dittrich, J. E. (1978). Equity theory: The recent literature,

methodological considerations, and new directions. *The Academy of*

Management Review, 3(2), 202-210.

Cattell, R. B. (1965). *The scientific analysis of personality*. Baltimore, MD: Penguin.

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences*. Hillsdale, NJ:

Lawrence Earlbaum.

Cohen, L., & Derrick, T. (1970). Occupational values and stereotypes in a group of

engineers. *British Journal of Industrial Relations, 8*(1), 100-104.

Couger, J. D., & McIntyre, S. C. (1987). Motivation norms of knowledge engineers

compared to those of software engineers. *Journal of Management Information*

Systems, 4(3), 82.

Dai, X. (2003). A study on the personality characteristics of different occupational

groups. *Chinese Journal of Clinical Psychology, 10*, 252-255.

Davis, M. (1996). Defining "Engineer:" How to do it and why it matters. *Journal of*

Engineering Education, April.

Dawis, R. V., & Lofquist, L. H. (1984). *A psychological theory of work adjustment*.

Minneapolis, MN: University of Minnesota Press.

Dean-Arnold, V. (1988). Motivation: Turning theory into practice. *IM, January - February*,

21-22.

DeCharmes, R. (1968). *Personal causation: The internal affective determinants of*

behavior. New York: Academic Press.

Deci, E. L. (1992). ON THE NATURE AND FUNCTIONS OF MOTIVATION THEORIES.

Psychological Science, 3(3), 167-171.

Drucker, P. F. (1977). *People and performance: The best of Drucker on management*.

New York: Harper's College Press.

Drucker, P. F. (1992). *Managing for the future*. New York: Truman Talley Books/Dutton.

Drucker, P. F. (2002). They're not employees, they're people. *Harvard Business Review,*

80(2 (February)).

Edwards, J. R., Scully, J. A., & Brtek, M. D. (2000). The nature and outcomes of work: A

replication and extension of interdisciplinary work-design characteristics. *Journal*

of Applied Psychology, 85, 860-868.

Etzioni, A. (1975). *Comparative analysis of complex organizations* (Enlarged ed.). New

York: MacMillan Publishing Co.

Ferguson, T. D., & Ketchen, D. J. (1999). Organizational configurations and performance:

The role of statistical power in extant research. *Strategic Management Journal,*

20, 385-395.

French, E. B. (1966). Perspective: The Motivation of Scientists and Engineers. *Academy*

of Management Journal, 9(2), 152-156.

Graen, G. B. (1966a). Addendum to "an empirical test of the Herzberg two-factor

theory". *Journal of Applied Psychology, 50*(6), 551-555.

Graen, G. B. (1966b). Motivator and hygiene dimensions for research and development

engineers. *Journal of Applied Psychology, 50*(6), 563-566.

Greenberg, J. (1990). A taxonomy of organizational justice theories. *Academic Management Review, 12*, 9-22.

Greenburg, J. (2002). Who stole the money, and when? Individual and situational determinants of employee theft. *Organizational Behavior & Human Decision Process, 89*, 985-1003.

Groves, D. L. K. H. D. L. (1975). A suggested modification to Maslow's Need Hierarchy. *Social Behavior & Personality: An International Journal, 3*(1), 65.

Gustafson, S. B., & Mumford, M. D. (1995). Personal style and person environment fit: A pattern approach. *Journal of Vocational Behavior, 46*, 163-188.

Harlos, K. P., & Pinder, C. C. (1999). Patterns of organizational justice: A taxonomy of what employees regard as unjust. *Advanced Quality Organization Research, 2*, 97-126.

Herzberg, F. (1974). Motivation-hygiene profiles: Pinpointing what ails the organization. *Organizational Dynamics, 3*(2), 18-29.

Herzberg, F. (2003). One more time: How do you motivate employees? *Harvard Business Review, 81*(1), 86-86.

Herzberg, F., Mausner, B., & Snyderman, B. (1959). *The Motivation to Work*. New York: John Wiley and Sons, Inc.

Hofstede, G. (1984). The cultural relativity of the quality of life concept. *The Academy of Management Review, 9*(3), 389-398.

Houkes, I., Janssen, P. M., DeJonge, J., & Nijhuis, F. N. (2001). Specific relationships between work characteristics and intrinsic work motivation, burnout and

turnover intention: A multi-sample analysis. *European Journal of Work*

Organization Psychology, 10, 1-23.

Huseman, R. C., Hatfield, J. D., & Miles, E. W. (1987). A new perspective on equity

theory: The equity sensitivity construct. *The Academy of Management Review,*

12(2), 222-234.

Kapp, J., Smith-Hunter, A., & Yonkers, V. (2003). A psychological model of

entrepreneurial behavior. *Journal of the Academy of Business and Economics,*

4(2), 121-126.

Katz, D., & Kahn, R. L. (1978). *The social psychology of organizations* (2nd ed.). New

York: Wiley.

Keller, R. T. (1997). Job involvement and organizational commitment as longitudinal

predictors of job performance: A study of scientists and engineers. *Journal of*

Applied Psychology, 82(4), 539-545.

Klein, H. J. (1989). An integrated control theory model for work motivation. *Academy of*

Management Review, 14, 150-172.

Kline, P., & Lapham, S. (1992). Personality and faculty in British universities. *Personality*

Individual Differences, 13, 855-857.

Landy, F. J., & Becker, W. S. (1987). Motivation theory reconsidered. *Research in*

Organizational Behavior, 9, 1-38.

Latham, G. P., & Pinder, C. C. (2005). Work motivation theory and research at the dawn

of the twenty-first century. *Annual Review of Psychology, 56*(1), 485-516.

Leonard, N. H., Beauvais, L. L., & Scholl, R. W. (1999). Work motivation: The

incorporation of self-concept-based processes. *Human Relations, 52*(8), 969 -

998.

Locke, E. A., & Latham, G. P. (1990). *A theory of goal setting and task performance*.

Englewood Cliffs, NJ: Prentice-Hall.

Locke, E. A., & Latham, G. P. (2006). New directions in goal-setting theory. *Current*

Directions in Psychological Science, 15(5), 265-268.

Lunenburg, F. C. (2011). Goal-setting theory of motivation. *International Journal of*

Management , Business, and Administration, 15(1), 1-6.

Maslow, A. (1943). A theory of human motivation. *Psychology Review, 50*.

McClelland, D. C. (1975). *Power: The inner experience*. New York: Irvington Publishers.

McGregor, D. M. (1960). *The human side of enterprise.* New York: McGraw-Hill.

Meglino, B. M., Ravlin, E. C., & Adkins, C. L. (1989). A work values approach to corporate

culture: A field test of the value congruence process and its relationship to

individual outcomes. *Journal of Applied Psychology, 74*, 424-432.

Miner, J. B. (2002). *Organizational behavior: Foundations, theories, and analyses*. New

York: Oxford University Press.

Moos, R. H. (1987). Person-environment congruence in work, school and health care

settings. *Journal of Vocational Behavior, 31*, 231-247.

Murray, H. A. (1938). *Explorations in personality*. New York: Oxford University Press.

Norde, W. R., & Fox, S. (Eds.). (1996). *Handbook of organization studies*. Thousand Oaks,

CA: Sage.

Nunnally, J. C., & Bernstein, I. H. (1994). *Psychometric theory* (3rd ed.). New York:

McGraw-Hill.

Patten, M. L. (2005). *Understanding research methods* (5th ed.). Glendale, CA: Pyrczak

Publishing.

Pinder, C. C. (1998). *Work motivation in organizational behavior*. Upper Saddle River, NJ:

Prentice Hall.

Ramlall, S. (2004). A review of employee motivation theories and their implications for

employee retention within organizations. *The Journal of American Academy of

Business, September*, 52 - 63.

Rauschenberger, J., Schmitt, N., & Hunter, J. E. (1980). A test of the need hierarchy

concept by a Markov model of change in need strength. *Administrative Science

Quarterly, 25*(4), 654-670.

Rounds, J. B., Henly, G. A., Dawis, R. V., Lofquist, L. H., & Weiss, D. J. (1981). Manual for

the Minnesota Importance

Ryan, J. C. (2010). An examination of the factor structure and scale reliability of the work

motivation scale, the motivation sources inventory. *Journal of Applied

Psychology, 40*(6), 1566-1577.

Ryan, J. C. (2011). Development of a measure of work motivation for a meta-theory of

motivation. *Psychological Reports, 108*(3), 743-755.

Rynes, S. L., Bretz, R. D., & Gerhart, B. (1991). The importance of recruitment in job

choice. *Personnel Psychology, 44*, 487-512.

Schneider, B., & Clayton, A. P. (1973). Three studies of measures of need satisfaction in

organizations. *Administrative Science Quarterly, 18*(4), 489-505.

Schwartz, S. H., & Bilsky, W. (1990). Toward a theory of the universal content and

structure of values: Extensions, and cross-cultural replications. *Journal of

Personality and Social Psychology, 58*, 878-891.

Shoura, M. M., & Singh, A. (1998). Motivation parameters for engineering managers

using Maslow's theory. *Journal of Management in Engineering,

September/October*.

Skarlicki, D., & Folger, R. (1997). Retaliation in the workplace: The roles of distributive,

procedural and interactional justice. *Journal of Applied Psychology, 82*, 434-443.

Skinner, B. F. (1958). Reinforcement today. *American Psychologist, 13*(3), 94-99.

Smart, J. C., Elton, C. F., & McLaughlin, G. W. (1986). Person-environment congruence

and job satisfaction. *Journal of Vocational Behavior, 29*, 216-225.

Soliman, H. M. (1970). Motivation-hygiene theory of job attitudes: An empirical

investigation and an attempt to reconcile both the one- and the two-factor

theories of job attitudes. *Journal of Applied Psychology, 54*(5), 452-461.

Stabbert, N. J. (2010). Engineers as visionaries. *Mechanical Engineering, 132*(6), 24-29.

Tay, L., & Diener, E. (2011). Needs and subjective well-being around the world. *Journal

of Personality and Social Psychology, 101*(2), 354-365.

Tett, R. P., & Burnett, D. D. (2003). A personality trait-based interactionist model of job

performance. *Journal of Applied Psychology, 88*, 500-517.

Trip, T. M., & Bies, R. J. (2002). Poetic justice or or petty jealousy? *Organizational*

    Behavior & Human Decision Process, 89, 966-984.

Turillo, C. J., Folger, R., Lavelle, J., Umphrees, E., & Gee, J. (2002). Is virtue its own

    reward? Self-sacrificial decisions for the sake fo fairness. *Organizational Behavior*

    & Human Decision Process, 89, 839-865.

Van Der Molen, H. T., Schmidt, H. G., & Kruisman, G. (Writer) (2007). Personality

    characteristics of engineers [Article], *European Journal of Engineering Education*:

    Taylor & Francis Ltd.

Von Bergen, J. M. (2012, April 13, 2012). Does U.S. have a high-tech worker shortage?

    The Philadelphia Inquirer,

Vroom, V. H. (1963). *Work and motivation*. New York: John Wiley & Sons.

Vroom, V. H. (1964). *Work and motivation*. New York: John Wiley & Sons.

Wahba, M. A., & Bridwell, L. G. (1976). Maslow reconsidered: A review of research on

    the need hierarchy theory. *Organizational Behavior & Human Performance,*

    15(2), 212-240.

Wright, B. M., & Cordery, J. L. (1999). Production uncertainty as a contextual moderator

    of employee reactions to job design. *Journal of Applied Psychology, 84*, 456-463.

Appendix A

Survey Instrument

Measure of Motivational Sources (James C. Ryan, 2011)

1) The best aspects of any job are the financial rewards and associated financial benefits.

2) I only work for the financial reward that it provides me.

3) I really only work for the money.

4) If choosing between jobs, the most important criterion is "which one pays the most"?

5) I would readily leave any job if I were offered an alternative that pays more.

6) People should always be on the lookout for better-paid jobs.

7) When I have done a good job it is important to me that my contribution is recognized by others.

8) I work harder when I know others are evaluating my work.

9) It is important to me that my colleagues should approve of my work behavior.

10) I give my best effort when I know that it will be seen by the most influential people in an organization.

11) I work harder on a project if public recognition is attached to it.

12) I often make decisions based on what others will think.

13) If something is not enjoyable, then it is not worth doing.

14) I would rate "enjoyment" very highly among reasons why someone should do a job.

15) If choosing between two jobs, the most important criterion is "which would be more enjoyable?"

16) I would only do a job if I found it enjoyable.

17) It is important that the work I do gives me a sense of enjoyment.

18) I think being able to enjoy your work is more important than anything else.

19) It is important that I work in a job that allows me to use my skills and talents.

20) I like to do work that challenges me and gives me a sense of personal achievement.

21) Decisions I make reflect the high standards that I set for myself.

22) It is important that I work in a job that allows me to realize my potential.

23) I try to make sure that my decisions are consistent with my personal beliefs and standards of behavior.

24) It is important to me that the goals of the organization I work for are congruent with my personal goals.

25) I would find it very difficult to work for a company if I didn't agree with its missions and goals.

26) An organization's mission needs to be in agreement with my values for me to work hard.

27) When choosing an organization to work for, I look for one that supports my beliefs and values.

28) I get great personal satisfaction from doing a job well.

Appendix B

Permission To Use Measure of Motivational Sources Instrument

COMPOSE

Inbox (18,011)
Starred
Important
Sent Mail
Drafts (25)
Circles
Notes

Try now

Unable to reach Gmail. Please check your internet connection or company's network settings. Help

Search people...

◉ Kelly Martin
◉ James Ryan
◉ Amber S

James Ryan <jcryanphd@gmail.com>
to me

Dear Ken,

please accept this email as confirmation of permission of use for the instrument the Measure of Motivational Sources MMS: with the following provisions : that your use of the instrument is appropriately cited and referenced throughout your work, and that you are willing share your findings from the use of the instrument with me (the instrument author), in the spirit of the scientific community.

Best of luck with your research.

To clarify, the individual items relating to each motivational concept are listed in Table one (bolded) of the psych reports article I sent you. Factors 1 to 5 represent the motivational sources of instrumental, external-self concept, intrinsic, Internal self concept, and goal internalisation respectively.

Kind regards,
Dr James C Ryan

...