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Cultivating Innovation: The Role of Mentoring in the Innovation Process

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CULTIVATING INNOVATION: THE ROLE OF MENTORING IN THE INNOVATION PROCESS

By

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A DISSERTATION

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CULTIVATING INNOVATION: THE ROLE OF MENTORING IN THE INNOVATION PROCESS

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Organizations are seeking ways to become more innovative as a response to increased global competitiveness. While innovation is clearly important, many strategies have been attempted with this goal but no clear method has proved successful. This study shows that firms who are considered to have innovation as one of their core competencies utilize mentoring to facilitate and cultivate innovation. Utilizing a qualitative, case study approach, interviews were conducted with key stakeholders at four major U.S. companies considered to be among the most innovative in the world. The transcripts, archival data, and popular magazine and newspaper articles were included in the content analysis. Findings support that mentoring is a key aspect of creating and sustaining a culture of innovation at large U.S. corporations.
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CHAPTER I

INTRODUCTION

BACKGROUND

Creativity is no longer enough. For decades the focus on creativity has given rise to countless books and speakers advocating “thinking outside the box” or hiring IDEO to get the extra edge. The notion of creativity involves a wonderful, freeing process where ideas are not bounded by experiences or paradigms and new connections come together—all the synapses are firing to do something NEW. “New and Improved” often grabs the customer’s attention, but if the perceived value of the change fails to yield either higher revenues or a new customer base, it may not have been worth the company's R&D, design, marketing, and sales expenditures.

Innovation is the answer. Innovation is the intersection of creativity and capitalism, creating value through new ideas, new markets, and new combinations (Schumpeter, 1942). Myriad books and articles have been written about increasing innovation at both the individual and organizational level through more resources, more communication, and more connectivity. Studies have identified many constructs present in innovative climates, such as job satisfaction, organizational commitment, trust, confidence, and learning.

While innovation is clearly important, another line of research has considered the role of mentoring, albeit not in the context of innovation. Mentoring has been a hot topic over the last 20 years for many reasons. Business people ascend the ladder with more agility when someone above offers guidance, companies know that mentoring programs increase
retention and employee satisfaction, and managers enjoy giving back and watching their protégés flourish (Scandura & Pellegrini, 2007). Academia has provided practitioners hundreds of books and thousands of articles on why mentoring is beneficial, why to implement formal programs, and how to encourage informal pairings.

Very little attention, however, has been given to whether, how, and why mentoring plays a role in developing creative thinkers, as most career mentoring tends to focus on rising through corporate ranks and dealing with political issues within organizations. Despite the scholarly and applied attention paid to the importance of both innovation and mentoring for business, these topics have almost exclusively been examined as non-overlapping issues. Yet, there are reasons to believe that mentoring and innovation do in fact overlap, and they do so in important ways. In this dissertation, I explore the role that mentoring plays in innovation, examining those relationships in case studies of four corporations known for innovation.

Based on my research, I contend that mentoring plays a pivotal role in the process of innovation. Further, I show that organizations that are considered to have innovation as one of their core competencies utilize mentoring to facilitate and cultivate innovation. Through reviews of the literatures of key constructs commonly researched in the separate areas of mentoring and innovation, I will demonstrate the heretofore unexamined theoretical linkages which led me to making the connections that are studied in this dissertation. I then explore the research questions under examination and delineate the contents of the subsequent chapters.
MENTORING LITERATURE

Mentoring and Job Satisfaction

One of the most consistent findings in mentoring research is that mentoring increases protégé job satisfaction (Allen, Eby, Poteet, Lima, & Lentz, 2004; Brown, Zablah, & Bellenger, 2008; Chao, Walz, & Gardner, 1992; Fagenson, 1989; Noe, Greenberger, & Wang, 2002; Scandura & Williams, 2004). Job satisfaction is a function of the discrepancy between what an individual expects from his or her job and what he or she receives (Locke, 1969). Allen, Eby, Poteet, Lima & Lentz (2004) have demonstrated that a robust relationship exists between mentoring and job satisfaction in a meta-analysis of the literature. Researchers have hypothesized that mentoring enables employees to cope with job stressors and uncertainty in the work environment, leading to increased job satisfaction (Lankau, Carlson, & Nielson, 2006).

An early study by Fagenson (1989) sought to determine if mentoring played a role in career outcomes, such as job satisfaction, mobility, and promotion rates at a large health care company. There were significant differences between protégés and their non-mentored counterparts. Those with mentors reported being significantly more satisfied with their jobs and careers, having more career opportunities, and enjoying a higher rate of promotion.

Protégés regularly report higher job satisfaction than their non-mentored counterparts (Egan & Song, 2008; Gordon, 2000; Siebert, 1999). Mentoring also seems to have significant positive effects on organizational commitment (Egan & Song, 2008; Noe, Greenberger, & Wang, 2002), career success, competence, affiliation, autonomy,
achievement, self-esteem, retention (Noe, Greenberger, & Wang, 2002), person-organization fit, and performance (Egan & Song, 2008).

Similar findings of the positive effects of mentoring on job satisfaction have also been found in informal mentoring relationships, as protégés reported significantly higher job satisfaction and salaries than their non-mentored coworkers (Chao, Walz, & Gardner, 1992).

The mentor’s leadership style is another area current research has begun to take into account. A recent study reported that mentoring by transformational leaders who are in supervisory roles led to higher reported levels of job satisfaction and organizational commitment (Scandura & Williams, 2004). I will explore mentoring and leadership later in this chapter.

Mentoring and Organizational Commitment

Researchers often couple job satisfaction with the organizational commitment construct in the mentoring literature. Organizational commitment is commonly defined as an individual’s identification with an organization and his/her commitment to maintaining membership to pursue the organization’s goals (Brashear, Boles, Bellenger, & Barksdale, 2006). This concept is of key importance to the human resource functions of a company because of the strong negative relationship between organizational commitment and turnover intention (Brashear, Boles, Bellenger, & Barksdale, 2006; Koberg, Boss, & Goodman, 1998). Many aspects of mentoring relationships increase organizational commitment, including career guidance, coaching, motivation, sponsorship, and trust (Brown, Zablah, & Bellenger, 2008; McManus & Russell, 1997; Ragins, Cotton, &
Miller, 2000; Scandura, 1997). Mentoring may also have lasting positive effects as high-quality mentoring relationships have been found to be related to organizational commitment months after the mentoring program ended (Donaldson, Ensher, & Grant-Vallone, 2000).

Mentoring and Self-Esteem

Mentoring has been shown to be important for protégé self-esteem. Within the psychology literature, Rosenberg’s (1965) definition is the most frequently cited. Self-esteem is described as a favorable or unfavorable attitude toward the self (Rosenberg, 1965, p. 15). While the construct is often used in reference to self-worth, narrower concepts like self-confidence are used to imply a sense of self-esteem (Kipnes & Lane, 1962).

Kram (1983, 1985) suggested that mentoring may assist in improving protégé’s self-confidence. Many researchers have noted that the increased social support and other psychosocial benefits received through mentoring may help boost protégé confidence in their professional roles (Koberg, Boss & Goodman, 1998; Olian, Carroll, & Giannantonian, 1993) compared to nonmentored counterparts (Turban & Doughtery, 1994). The mentor facilitates development of the protégé’s independence, decision-making skills, and problem-solving skills, increasing career mobility by providing psychological support and positive reinforcement to increase self-confidence in the protégé (Gordon, 2000). Lankau & Scandura (2002) found that mentoring decreased role ambiguity and increased learning, both contributing to subordinate confidence.
Mentoring and Learning

With the constant changes in technology and the adaptation of skills as a necessary component to remaining current with best practices, an employee’s developmental needs are increasingly dependent on learning through sharing resources and knowledge transfer (Tannenbaum and Yukl, 1992). Rosow and Zager (1988) contend that the creation of a learning environment yields an “evolution in training,” where continuous learning is built into the organizational culture and each employee’s job description. Lankau and Scandura (2002) have argued that the presence of functions that mentoring provides, such as psychosocial support and coaching, are antecedents to protégé learning. Researchers have discussed individual-level outcomes, as mentoring benefits organizations as protégés improve competencies (Clutterback, 2004; Lankau & Scandura, 2002), as well as societal benefits, such as the importance of mentoring programs to enable learning for the Indian software industry to remain competitive (Dayasindhu, 2002).

Learning expectations are also a key component to the relationship. Godshalk and Sosik (2003) found that mentors and protégés with similarly high levels of learning goal orientations were associated with the protégés reporting the highest levels of psychosocial support and higher levels of career development. This is an important concept as both parties have to be committed to the protégé’s goals in order for all of the learning benefits of mentoring to be imparted.

Even in virtual classroom situations, mentors play a key role in a student's learning. In his 2001 book, Roger Schank wrote extensive case studies examining how many top institutions (IBM, GE, Harvard) are developing e-learning capabilities. His chapter on
Columbia University goes into great detail on the role of the mentor in the e-classes in software and economics. “Mentoring is a critical process in these courses. Each student needs advice, encouragement, and criticism in order to move from novice to expert,” (p. 200).

Learning is a benefit to both parties in the mentoring relationship as protégé’s individual learning increases and mentors gain more experience (Scandura, Tejeda, Werther, & Lankau, 1996). Peer mentoring has also been discussed as an example of a process for collaborative learning (Mavrinac, 2005).

Mentoring and Trust

Trust is considered both an antecedent to a mentoring relationship (Koberg, Boss, & Goodman, 1998), an early part of bonding (Kram, 1985), and a key component to mentoring relationships (Ragins & Cotton, 1999). “A mentor is an individual whom a protégé can trust to have his or her best interests at heart…whose perspective and judgment a protégé values and trusts implicitly” (Missirian, 1982, p. 66). The concept of trust is often used to measure mentor functions and roles (Ragins & Cotton, 1999; Ragins & McFarlin, 1990). A recent school-based study reported that mutual trust and fidelity were cited by every student as distinguishing features of a mentor (Liang, Spencer, Brogan, & Corral, 2008). Young and Perrewe (2000) found that mentors and protégés have more trust in each other when expectations of levels or behaviors related to social support are met. The mentor must offer shows of trusting the protégé in order for mutual trust to develop, thus allowing functional mentoring to occur. A good illustration of this are the results from a recent study where higher levels of mentor self-disclosure lead to
increased protégé self-disclosure, which related to positive job outcomes and feelings of psychosocial support (Wanberg, Welsh, & Kammeyer-Mueller, 2007).

Mentoring and Leadership

Leadership literature has included many studies on mentoring, both in developing leaders as well as on the types of leaders that make the best mentors. Allen, Poteet, Russell, and Dobbins (1997) found that mentoring enhances the leadership skills of the mentors. One must also assume that most protégés would be attracted to a mentor with leadership skills as that person is more likely to be visible within the organization. The mentor gains additional leadership skills through each protégé a mentor has over his or her career. He or she will have also developed a number of followers who understand and trust their mentor. It follows that leadership is a key construct in the emerging mentoring literature.

Transformational leadership has received the most attention because the results of working with a transformational leader are consistent with known benefits from mentoring (Godshalk & Sosik, 1998; Sosik, Godshalk, & Yammarino, 2004; Scandura & Schriesheim, 1994). The strong emotions expressed about the purity of transformational leadership is clear, for example: “Transformational leaders transform or change followers by using personal resources, such as time, knowledge, and experience. They are involved in ‘serving as a coach, teacher, and mentor,’” (Yukl, 1989, p. 211). Furthermore, Bass and Avolio (1993, p. 3) state that, “Transformational leaders motivate others to do more than they originally intended and often more than they thought possible.”

Bass & Avolio (1994) identify the Four I’s of transformational leadership: idealized influence (demonstrating role modeling behaviors), inspiration motivation (spreading
enthusiasm), intellectual stimulation (challenges paradigms, offers and inspires new approaches), and individualized consideration (guidance in skill development, coaching and advising). Mentors who are transformational leaders have been found to be especially effective in developing and inspiring protégés (Godshalk & Sosik, 1998; Scandura & Schriesheim, 1994) and transformational leaders who are in supervisory roles led to their protégés reporting higher levels of job satisfaction and organizational commitment than those with mentors who were not considered to have qualities of transformational leaders. Peer mentoring has also been discussed as an example of a learning process that is in harmony with the values-based transformational leadership (Mavrinac, 2005).

In addition to the attention given to transformational leaders as strong mentors, charismatic leadership is also being explored as another style which seems to create excellent mentors (Conger & Hunt, 1999; Shamir, B., House, R., & Arthur, M., 1993).

Mentoring and Organizational Climate

Organizational climate is the interaction between individuals in the organization, situations in the environment, and the culture itself, including the perceptions, values and assumptions of that culture (Moran & Volkweln, 1992, p. 40). Many researchers stress the importance of a positive climate in order to encourage mentoring (Clutterbuck, 2004; Orth, Wilkenson, & Benfari, 1987) through the organization by supporting and rewarding mentoring behavior. A climate that supports mentoring has to be perceived as an environment of growth where ideas are shared candidly, freely, and openly (Orth, Wilkenson, & Benfari, 1987). This concept may be especially important in developing mentoring relationships for women and ethnic minorities. Noe (1988) hypothesizes that
organizational climates where individual development and pro-social behavior are supported and where managers are rewarded for the successes of their protégés may increase the mentoring opportunities available to women. Rusaw (1994) conducted a study on the advancement opportunities for women managers in the federal government. She made strong suggestions, positing that a supportive organizational climate that promotes mentoring is one of the few ways for women to learn how to get ahead.

In summary, mentoring provides many benefits for the protégé and mentor as well as the organization. Although largely disconnected from the mentoring literature, there are many points of overlap and parallels between the benefits of mentoring and the context in which innovation occurs.
INNOVATION LITERATURE

Innovation and Job Satisfaction

Job satisfaction is an important precursor for innovation. Locke (1976) hypothesized that job roles, which include challenging tasks, including novel problem solving, have a positive impact on general job satisfaction. The literature has offered support to the argument that managers must promote management styles that support job satisfaction for innovation to occur (Ananaba, 1981, Joynt, 1977). Brazeal (1993) concluded her study about intrepreneurial innovative ventures with a warning to organizations about the importance of keeping the unique entrepreneurially-minded corporate employees committed to the organization. She argues that innovative people have to be satisfied with the jobs in order to stay innovative.

Nerkar, Gunther McGrath, and MacMillan (1996) identified different aspects of job satisfaction and found that each contributed to innovative output, both individually and collectively. The three areas of job satisfaction described were instrumental satisfaction (being content with the work itself), social satisfaction (pleasure in working relationships and interactions), and egocentric satisfaction (contentment with the individual’s belief in his or her personal benefits derived from being involved).

Joynt (1977) developed a series of models for innovation which conclusively linked innovation and job satisfaction. She considered the job satisfaction model to be the most interesting, offering many suggestions for ways to maintain high levels of job satisfaction as it relates to innovative output. Her recommendations include that the employee develop good relationships with departments other than his or her own, cooperative or
social orientations of management, the necessity for the employee to receive consistent and regular feedback, that decisions are made through majority rule, that the emphasis on formal goals be removed, that there is good communication between and among levels of hierarchy, and that employees are able to be involved during the entire lifespan of innovative projects (Joynt, 1977, p. 431).

Innovation and Organizational Commitment

Tichy and Devanna (1986) cited organizational commitment as the most important factor in an organization’s ability to perform innovatively. The employee’s perception of his or her value to the firm has a strong positive correlation with the employee’s commitment to the organization and performance, innovative or otherwise (Eisenberger, Fasolo, & Davis-LaMastro, 1990; Mathieu & Zajac, 1990). In a mixed-methods study of the effects of a culture that emphasizes budget and other financial controls on marketing and production managers, Subramaniam and Lokman (2003) found that in organizations that promote an innovative culture, decreasing budget emphasis leads to higher organizational commitment. In other words, formalized practices, such as regular financial reporting, can decrease organizational commitment which has a negative effect on the amount of innovative output in departments that focus on creativity and freedom of ideas.

Innovation and Trust

Trust is necessary to create a work environment that facilitates innovation. Trust increases cooperation and opens communication (Webber, 2002). Firms that shared information with employees increased trust in management, which increased subordinate's reported likelihood of sharing their own ideas (Ferrante, 2006). High levels
of interpersonal trust have been found to increase subordinate learning and sharing information within teams (Koskinen, Pihlanto, & Vanharanta, 2003). By improving cross-functional communication and the quality of information exchanges (Gupta & Wilemon, 1990), employees reported feeling increased trust in management and the organization. This led to reports of taking more risks and feeling more comfortable asking for help (Jassawalla & Sashittal, 1998), which may increase innovation.

Innovation and Self-Esteem

Having confidence in an employee’s ability to create breakthroughs is important both for the inventor and for management (Mascitelli, 2000). Lefebvre and Lefebvre (1992) contend that proactive and risk-taking behaviors are necessary antecedents to innovation that leaders with a transformational leadership style can support in the workplace to increase innovative output.

Innovation and Learning

Researchers have cited the need for a knowledgeable workforce to develop innovations. This suggests that investing in staff training to support learning will increase the knowledge base of employees (Romijn & Albaladejo, 2002). Cohen and Levinthal (1989) concur, recommending increasing R&D investments to support the individual and organizational learning necessary to create the new knowledge access and internalization needed to develop innovation.

Through interaction with a wide variety of people, including customers, employees from other departments, suppliers, and organizations, high quality learning is increased about unmet market needs, strategic opportunities, and technologies (Landry, Amara, &
In the case of radical innovation, cross-departmental communication is especially important for learning and understanding to occur (Akgun, Byrne, Keskin, Lynn, & Imamoglu, 2005). Radical and novel innovation is also enhanced through the acquisition and use of advanced technologies which increase learning and accelerate both innovation and the ability to solve a wider range of problems (Wuyts, Dutta, & Stremersch, 2004).

Innovation and Leadership

Early studies suggest that participative or collaborative leadership styles are needed to sustain innovation in organizations (Kanter, 1983; Pelz & Andrews, 1966). Since then, the focus has shifted to transformational leadership as the best means of creating and promoting innovation. As discussed in the mentoring section, transformational leadership supports the development of reciprocal trust, an antecedent to quality supervisor-subordinate relations (Scott & Bruce, 1994).

This class of relationship has been found to allow for increased levels of subordinate autonomy (Graen & Scandura, 1987) which may lead to increased innovation (Scott & Bruce, 1994). Niehoff, Enz, and Grover (1990) contend that all aspects of transformational leadership support innovation in the workplace.

Bass and Avolio (1994) offer several examples of ways in which transformational leaders stimulate innovation. They report that transformational leaders “focus on the continuous development of individual skills (that is, individualized consideration) (which) is critical to team performance, particularly with teams working at the boundaries of innovation,” (p. 58). These leaders cultivate innovation through one-on-one relationships:
“Individually considerate leaders…provide opportunities that support growth and
development, risk-taking, and innovation based on individual needs and capabilities,” (p.
75). Because of these strong, trusting relationships, “transformational leaders stimulate
their followers’ efforts to be innovative and creative by questioning assumptions,
reframing problems, and approaching old situations in new ways” (p. 3).
Transformational leadership is often cited as a catalyst for successful innovation
compared to transactional leadership (Dess & Picken, 2000).

Innovation and Organizational Climate

Kanter (1983) has suggested that specific elements have to be present to create a climate
needed for innovation. Researchers have suggested management’s support and
encouragement of risk, support for new ideas, and developing people as essentials for an
innovative context (Kanter, 1983; Susanj, 2000). Other constructs that are often cited as
facilitating innovation include tolerance of failure, trust, open discussion, moderate
conflict, freedom, challenge, harmony, and participative decision-making (Susanj, 2000).
Teamwork and lateral communication as functions of an organizational climate have
been found to facilitate innovations in human resources (Nicholson, Rees, & Brooks-
Rooney, 1990). The interactive aspects of organizational climate have been reported to
increase employee innovation through the social exchange between the individual and the
organization (Eisenberger, Fasolo, & Davis-LaMastro, 1990). Scott and Bruce (1994)
found that an innovative climate increases individual innovation but not necessarily team-
level innovation. Finally, the negative attributes of an organizational climate have a
strong effect on innovation. For example, politics in an organization may lead to feelings
of lack of support for innovation. Parker, Dipboye, and Jackson (1995) argue that a politically charged organizational climate often is the cause of failures in innovation due to lack of resource support.

ALMOST MENTORING AND INNOVATION

Thus, although almost never considered within the same studies, mentoring and innovation have many points of overlap. The very limited extant literature on the interconnections between the two areas is suggestive but not definitive. Mentoring enhances protégés’ personal learning, which may increase confidence, this has been found to support risk-taking (Lankau & Scandura, 2002). Wanberg, Welsh, and Hezlett (2003) reported that protégé performance can be improved by mentoring through influencing learning, socialization, and commitment. These functions have been given as precursors to employee reports of increased risk-taking and feeling more comfortable asking for help (Jassawalla & Sashittal, 1998), which are common activities in the innovation process. These sentiments are consistent with the contention of Lefebvre and Lefebvre (1992) that proactive and risk-taking behaviors are necessary antecedents to innovation.

Researchers have also reported that mentoring performed by transformational leaders results in protégés with higher levels of creativity and enhanced confidence in their abilities to make important contributions to the organization (Shamir, House, & Arthur, 1993; Sosik & Godshalk, 2000). Dayasindhu (2002) discussed the importance of mentoring programs to enable learning: “Productivity, innovation, and growth of new organizational innovation (was) enhanced by…specialized information,” (p. 554). Citing
mentoring as a way to increase knowledge transfer, he posits “knowledge transfer leads to innovation that can assist organizations moving up the value chain by offering sophisticated services and products” (Ibid.).

RESEARCH QUESTION

Based on these preliminary linkages, I propose that a strong relationship exists between the presence and promotion of mentoring and innovative output. The central research question is:

What role does mentoring play in the innovation process? Based on that question, this study will explore and assess how mentoring is used to create the climate for innovation as well as supporting its existence. Thus, several subquestions will be addressed in trying to understand the main question, including:

- How do the people championing innovation view the role of mentoring?
- How and why is mentoring useful for innovation?
- How is formal mentoring or mentoring training utilized at the most innovative companies?
- How do mentors and protégés find each other to work on innovative projects?
- How do firm factors such as size of organization, product offerings, and type of industry affect how, when, and why mentoring relationships are developed or nurtured?
Through interviews with executives and innovators, the central question of what role mentoring plays in the innovation process will be examined from multiple perspectives. Both mentors and protégés from different departments representing several levels of the firm will be included in the study, as well as executives responsible for innovation initiatives and human resource personnel. Through in-depth case studies, the two heretofore parallel areas will be linked and the importance of mentoring in the innovation process will be demonstrated.
STUDY OVERVIEW

Utilizing a qualitative, case study approach, interviews were conducted with key stakeholders at four major U.S. companies considered to be among the most innovative in the world. The transcripts, archival data, and popular magazine and newspaper articles were included in the content analysis. Four case studies are presented in this dissertation offering varying approaches to the ways in which mentoring has been utilized to create and sustain innovation.

The remainder of the dissertation is organized as follows:

Chapter II provides a review of the literature, including a description of the evolution of the definition and functions of mentoring and a primer on the terminology used in innovation research.

Chapter III describes the research methodology employed in the study.

Chapters IV through VII present the case study results, including analyses and suggestions for practice, for 3M, Procter & Gamble, IBM, and Whirlpool, respectively.

Chapter VIII then provides a summary of the findings, a cross-case analysis, conclusions, and recommendations for future research.
CHAPTER II

REVIEW OF THE LITERATURE

OVERVIEW

As evidenced by the discussion of the importance of mentoring to successfully train, develop, and retain valuable employees and the role that factors akin to those produced by mentoring play in providing climates where innovation occurs, the role of mentoring in the innovation process is an overlooked area of study that may yield excellent returns. That is, a culture that promotes mentoring increases the organizational learning and allows for innovation to flourish, making the climate itself a competitive advantage.

This chapter provides an overview of the evolution of the definitions and functions researched within the mentoring literature and an overview of the study of innovation constructs. I will also explore the very small area of overlap where mentoring and innovation have briefly been studied together. This discussion sets the stage for the case studies of the unique approaches to mentoring for cultivating innovation used by four of the world’s most innovative companies.
PART I

MENTORING

The traditional view of mentoring in the management literature tends to focus on career and professional development while the educational literature is centered on developmental issues and personal growth. The origins of the concept of a “mentor” stem from Greek mythology (Hamilton, 1942), and offer the Gestalt perspective of the role of mentoring in personal development, spanning from childhood through adulthood. Mentoring is an intentional process, an insightful process, a nurturing process, and a supportive protective process (Anderson & Shannon, 1988). I begin by illustrating the use of the mentoring concept in the literature and refining the definition of mentoring utilized in this study.

Definition of Mentoring

The notion of having an adult to look to for guidance as one comes of age is a common theme in adolescence. “In most cultures, wiser or more experienced persons have played significant and respected roles in guiding the personal and professional decisions of those younger and less experienced” (Redmond, 1990). In the seminal work by Levinson, Darrow, Klein, Levinson, and McKee (1978), the concept of the “Dream” is introduced as the vision one has for his or her ideal life and career; mentors act to “support and

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1 Based on Homer’s poem “The Odyssey” in which the hero must leave his family to fight in the Trojan War and has to find proper care for his son, Telemachus. Odysseus asks his friend Mentor to watch and protect his son, and over time, Mentor performs all of the roles attributed to mentoring—guide, supporter, coach—as Telemachus goes on a journey to find his father and himself, with Mentor accompanying him every step of the way.
facilitate the realization of the Dream” (p. 98). Identified as one of the most important and complex relationships, mentoring involves an older, experienced person who chooses a younger novice as his protégé. The mentor’s goals focus on preparing the protégé for life: aiding in attaining specific skills and developing intellectual abilities; offering advice, support, and constructive criticism; and serving as a role model. Levinson et al. (1978) also include organizational dimensions by stating that a mentor acts as a host and guide in socializing within the firm with the goal of weaving his protégé into the folds of the organization. Thus, the assumption is that the mentor works within the same firm as the protégé. The mentor teaches the protégé how to operate within the organization, introduces him to key players, and shares his experiences of having success within that environment. To Levinson and colleagues, the mentor is a guide, counselor, and sponsor in a single, face-to-face, two-party relationship focused on individual development.

Hunt and Michael (1983) viewed mentoring as a tool for career development, which mirrors the Levinson et al. notion of introducing the protégé into the organizational culture. This is a very important concept from human resource management in that turnover is a major concern for most organizations. The process of selecting a new hire weighs the benefits of organizational loyalty, enculturation, and developing skills on the job versus higher pay for a more experienced employee. Mentoring allows a company to introduce the new hires to the company, creating a social network, and makes them feel comfortable navigating through their career path, thereby reducing turnover (Brashear, Boles, Bellenger, & Barksdale, 2006; Koberg, Boss, & Goodman, 1998).

2 Levinson, et al. (1978) deals with the developmental stages of men.
Perhaps the most cited researcher in mentoring literature, Kram (1983, 1985) offered a definition of mentoring as a single, two-party, in-person, hierarchical relationship. The supervisor had influence in the firm and made an informal commitment to helping the protégé climb the ladder within that organization. Mentors are expected to have advanced knowledge and experience, which supports upward career movement (Ragins & Scandura, 1999). These definitions are consistent with Baugh and Scandura’s (1999) description of a mentor as a more experienced individual who has achieved some hierarchical success within an organization and who provides career-related support to a less experienced individual. The concept of the mentor as a senior, powerful person with a pronounced distance in status between mentor and protégé (Wanberg, Welsh, & Hezlett, 2003) has provided additional clarity to the hierarchical dimension.

Redmond (1990) offered mentoring as a verb: “The act of providing wise and friendly counsel.” Protégés can be seen as co-learners in the mentoring process, working together with mentors, instead of acting as passive recipients (Runions & Smyth, 1985).

The following sections will provide a history of the evolution of the concept and constructs of mentoring in the literature.

**Effective Mentoring Relationships: Commitment and Respect**

Organizations support and promote mentoring with the hopes that protégés will feel increased support and guidance within the firm. An ancillary benefit may be that the mentor feels valued in the organization, the keeper of some important skills and experiences to share with younger employees. These interactions increase organizational
commitment for both (Brown, Zablah, & Bellenger, 2008; McManus & Russell, 1997; Ragins, Cotton, & Miller, 2000; Scandura, 1997). Programs try to “facilitate a relationship that generally evolves through a natural process of selection and mutual attraction” (Crockett & Smink, 1991, p. 3). Merriam (1983) mirrors that sentiment, describing mentoring as a powerful emotional interaction involving trust and love in the relationship. The role of commitment in creating an effective mentoring relationship was identified by Boston (1976): “Interest, curiosity, eagerness, and earnestness are all important, but not sufficient either singly [sic] or together…what seems to count in the last analysis is the risk, the commitment” (p. 43). Flakus-Mosqueda and Palaich (1990) also noted the importance of commitment by both parties as more important to the success of a mentoring relationship than the matching process, training the mentor, or monitoring of mentor’s and protégé’s progress.

**Mentoring Functions**

While it is widely agreed that mentors play many roles, the literature has evolved tremendously over three decades. Kram (1983, 1985) offered mentoring functions in two distinct categories: career development (professional-level development: sponsoring, coaching, exposing, protecting, providing opportunities, etc.) and psychological support (personal level development: assist in self-efficacy through role modeling, counseling, friendship). She posited that the more functions the mentor serves, more beneficial the relationship is to the protégé. Role modeling eventually emerged as a distinct function of mentoring, separate from psychological support as Kram (1983, 1985) had earlier argued (Burke, 1984; Scandura, 1992; Scandura & Ragins, 1993; Scandura & Viator, 1994).
The Woodlands Group (1980) clearly defined three roles, with little room for overlap, an executive in a firm may play in helping the career of a subordinate. These include coaching, sponsoring, and mentoring. In coaching, a boss assists a subordinate to “meet specific growth needs” (p. 918). Focus is on career development to get the subordinate ready to be promoted, generally within the same line or division where he or she currently is working. This notion of the mentor as a coach is consistent throughout the mentoring literature (Cohen, Steele, & Ross, 1999; Kram, 1983; Levinson et al., 1978; Yukl, 1989). Orth, Wilkinson and Benfari (1987) do make a distinction in claiming that the coach must create a climate for coaching and develop his or her own skills (in observing, analyzing, interviewing, and giving feedback) to be effective. As discussed above, coaching generally involves a relationship between a manager and his direct report to develop skills that may be expected by both the manager (part of his job is to help his employees better serve him and the company) and the subordinate (seeks approval and guidance from manager, evidenced through appraisals and work quality). Orth and colleagues suggest that coaches must be trained, albeit informally, before engaging subordinates.

While coaches have a very close personal relationship with their subordinates, sponsors may have few personal interactions with their protégés. Sponsors locate and cultivate talent and suggest those individuals for opportunities in areas of the firm different than their current division or department (Woodlands Group, 1980). A VP may decide to sponsor to a new hire after hearing him make a presentation. Once she (the VP) has talked with the subordinate about his background, education, and career goals, she may
recommend him for a task force or a new project team. A sponsor may be a manager or a high-ranking executive, even perhaps someone on the same level as the employee, but has influence and credibility so that his or her recommendation means something. Protégés do not usually work for their sponsors, as the nature of sponsorship is more of an intrinsically motivated assistance rather than suggesting that one’s representative be added onto a team. When a manager is acting as a sponsor, he risks losing his best subordinate in recommending her for a new position. The sponsor acts as the public relations representative to specially chosen subordinates in the firm. The Woodland Group’s view of the mentoring role was defined much like the early examples in this chapter, and special attention was given to the fact that the protégé controls the relationship. In mentoring, there does not have to be a preexisting relationship. Although the literature assumes mentoring is bounded by organization, mentors can be from other firms in different industries or be based on a skill or hobby not tied to the job.

Another function that is often attributed to mentors is that of a role model. The function of a role model does offer the unique dynamic of modeling behavior that may not be present in the coach or sponsor relationships. As noted, early research in the field labeled the role modeling function within the domain of psychosocial support (Kram, 1983) but role modeling has since been identified as a function in itself (Burke, 1984; Scandura, 1992) and as a central part of mentoring (Anderson & Shannon, 1988; Levinson et al., 1978). Some researchers do make a distinction of where a role model may not be a mentor: “A role-model is defined as one whose life and experiences provide a concrete image of who a younger person can become. By contrast, a mentor is someone who lends
guidance and support to enable the young person to become whoever they choose to be” (Flakus-Mosqueda & Palaich, 1990, p. 4).

Stages of mentoring/temporal dimensions

Levinson et al. (1978) suggests that the involvement of a mentor is based around a life event. That is, the mentor is engaged as the protégé is entering a period of change and the mentor guides and protects the protégé through the transition, then departs. Kram (1983) offers four phases of mentoring. During initiation, the pair begins to work together and can see each other’s approach to the tasks and work ethic. If their styles are compatible, their rapport may then lead to the cultivation (also called establishment) stage, where the relationship develops (protégé learns from the mentor as his or her career develops, mentor acts as promoter and supporter, heightening the protégé’s visibility and opportunities within the organization; also discussed in Chao, 1997). This is consistent with a study by Olian, Carroll, and Giannantonio (1993) where banking industry managers were more willing to develop mentoring relationship with protégés with good performance reviews. The separation phase marks a disjointing of the relationship as the protégé becomes more independent and lessens his or her reliance on the mentor for guidance. While this may be due to the protégé leaving the firm or transferring to another department or location (Kram, 1985; Ragins & Scandura, 1997; Ragins & Scandura, 1999), the protégé may also feel that the mentor may not have more to offer. In the final stage, redefinition, the relationship either evolves or dissolves: a supportive friendship may develop where the once-protégé acts to serve the mentor and vice versa as peers (Chao, 1997) or the relationship dies.
Many interesting studies have been done on the cultivation and initiating phases of the mentoring relationship. Especially noteworthy are Scandura and Williams (2001), who postulate that mentoring success may be directly related to the mentor’s initiation of the relationship, and Davidson and Foster-Johnson (2001), who suggest that mentors develop a multicultural aptitude and sensitivity to ease the cultivation phase and increase the benefits of mentoring to graduate students of color.

**Benefits to the Protégé**

Anyone who has been a protégé can recount many benefits gained from a mentoring relationship. Having a confidant, advocate, supporter, and friend allows those individuals to share experiences, without organizational hindrances and bureaucracy to stifle the exchange (Flakus-Mosqueda & Palaich, 1990). Career mobility, promotion rates and compensation have each been found to be positively affected through involvement in a mentoring relationship. Protégé’s also report higher levels of satisfaction with their jobs, careers, pay, and are more optimistic about career expectations than their un-mentored colleagues. (Baugh & Scandura, 1999). Work stress has been found to be lower for those in a mentoring relationship (Baugh, Lankau, & Scandura, 1996). Benefits also include higher salaries, more promotions, and increased job satisfaction among those with mentors compared to employees with no mentor (Dreher & Ash, 1990).

**Benefits to Mentors**

There are many intrinsic and extrinsic benefits associated with being a mentor. The motivation to mentor may be predicted by individual characteristics (altruism, positive
affectivity), situational characteristics (employee development-linked reward system and opportunities for interaction on the job), and their interaction terms (opportunities for interaction on the job and altruism) (Aryee, Chay & Chew, 1996).

Levinson et al. (1978) contends that many mentors feel that it is a rejuvenating life experience to work with younger people. They enjoy “loyalty and support from the protégé (and a) sense of well-being in passing on knowledge to the next generation,” (p. 100). Mentors have also noted additional benefits including a sense of immortality (Erikson, 1963) and the sharing of valuable information from protégés (Mullen, 1994). Mullen and Noe (1999) contend that developmental relationships often serve as rich sources of information and feedback for those who participate in them. Mentors reported relying heavily on protégés for insights on technical issues, social gossip, and performance feedback. Other benefits may include higher levels of mentor performance and increased career success.

Kram (1985) explains that mentors may have higher levels of performance because they are surrounded by supportive protégés, ideally working in many areas throughout the organization. Bozionelos (2004) found a strong positive correlation between the amount of mentoring a manager provided and his or her career success. Having protégés throughout an organization affords a manager a much-needed support system (Levinson et al., 1978), which may increase opportunities or visibility for that manager’s initiatives.
**Benefits to Organization**

Companies want productive and happy employees. Employees want to understand what mechanisms are in place to help or hinder their performance and growth within that firm. Mentoring is often cited as an ideal way to support the development of junior level employees (Burke & McKeen, 1989). While little research has been done to clarify benefits that the organization receives from mentoring, a few studies have shown positive firm level results, including increased organizational commitment (Donaldson, Ensher & Grant-Vallone, 2000; McManus & Russell, 1997) and job satisfaction (Seibert, 1999; Allen et al., 2004), which may also lead to higher levels of employee involvement and more mentoring relationships. If people feel comfortable and can forsee opportunities for their own growth within the firm, turnover is reduced. Clutterback (2004) found that organizations do benefit from the skill sets that protégés develop and sharpen through mentoring relationships. The “similar to me” effect, also known as the similarity-attraction paradigm, may also play a role in that shared background, ethnicity, gender, experiences, etc. allow for early bonding through shared attitudes and beliefs, which makes modeling the mentor’s success or career path more realistic. As evident in later chapters, many companies have set up formal mentoring programs focused on diversity initiatives: specifically for females or African-Americans, Hispanics, and other minority groups. Through these initiatives, firms are able to attract, develop, and retain top minority applicants who offer not only their individual skills but also potentially another perspective on the needs of the marketplace. In some cases research has shown that same-ethnicity or gender pairings increases mentoring effectiveness (Cohen, Steele & Ross,
1999; Ibarra, 1992), although Blake-Beard (1999) found that similarities in gender, specialization, ethnicity, and socio-economic status did not appear to increase mentoring effectiveness.

**Formal versus Informal Mentoring**

Formal programs are started and managed by the organization, with policies and rules in place (Burke & McKeen, 1989). Typically formal programs involve pairing volunteer mentors with protégés for the purposes of firm orientation or diversity initiatives. Formal “mentor(ing) programs ensure the extension of mentoring to groups that have had the most difficult time finding seniors to serve as sponsors, namely women and minorities” (Zey, 1985: 53). Researchers have described that the glass ceiling is a problem for women and minorities seeking advancement (Morrison, White & Van Velsor, 1987) and mentoring may help in overcoming barriers (Ragins, Townsend, & Mattis, 1998). Ohlott, Ruderman and McCauley (1994) found that cross-gender and cross-ethnicity formal mentoring pairings were not as beneficial as same gender or ethnicity pairings. Minorities (both in gender and ethnicity) report feeling higher levels of understanding and that they can “relate better” to mentors of the same gender or ethnicity (Ibarra (1992).

Kram (1985) offered a definition of informal mentoring as a relationship initiated by shared interest in work or goals and the development of mutual respect. Style effectiveness has been in question since Kram (1985) posited that informal mentoring might be more valuable than formal mentoring. Several studies have found strong evidence that informal mentoring is more effective than formal mentoring. Keele,
Buckner and Bushnell (1987) and Noe (1988) were clear in their dismissal of the contention that formal programs offer the same support to protégés that informal mentoring has been found to provide. Scandura and Williams (2001) found that protégés in informal mentoring relationships reported higher quality mentoring than those in formal relationships. In regard to career guidance, both Chao, Walz, and Gardner (1992) and Scandura and Williams (2001) found that protégés in formal mentoring relationships felt they had less career support from their mentors than those in informal mentoring relationships. Informal relationships also had higher reported levels of encouragement and support (Fagenson-Eland, Marks, & Amendola, 1997). Reported quality of mentoring also differed between informal and formal mentoring relationships in regard to functions including friendship, psychosocial support, feelings of acceptance, and role modeling, with informal rated more positively (Ragins & Cotton, 1999). Ragins and Cotton (1999) suggest that formal mentoring programs should attempt to base their pairings on the natural, organic relationship development that occurs in informal relationships through promoting and supporting networking events and opportunities.

**Peer Mentoring**

First defined by Kram in 1985, peer mentoring occurs when individuals within a cohort offer feedback on performance, provide constructive criticism, make suggestions for improvement, and provide psychosocial support to their co-workers. McDaugall and Beattie (1997) offer a definition of peer mentoring: “mutual involvement for learning and development between two peers” (p. 425). They feel that peer mentoring is an important resource to increase professional learning and is especially useful in times of
organizational and social transformation. Lorenzet (2005) found a positive relationship between peer mentoring and an environment which supports continuous learning, suggesting that a culture of learning encourages peers to help each other rather than compete.

Ensher, Thomas and Murphy (2001) found that while peer mentoring offers excellent psychosocial support, supervisory mentoring is best for career support. Benefits of peer mentoring include enhanced individual competency and organizational learning (Lorenzet, 2005; McManus & Russell, 1997). Managerial workload may also be reduced as peers can help guide and critique normal routine tasks, allowing managers to deal with organizational challenges (Lorenzet, 2005). Bryant (1997) reported that high levels of perceived peer mentoring were correlated with high perceived knowledge creation and sharing within the organization. Bryant’s empirical study also introduced a training course, which was found to increase peer mentoring knowledge and skills.

**Upward Mentoring**

One area that has little research but many benefits is called upward mentoring, which typically involves an informal pairing of a subordinate mentor with an executive protégé to expose him or her to new technologies, trends, and perspectives. Research in upward mentoring has been conducted in the context of benefits to the mentor (Mullen, 1994).

**Multiple, Team, and Composite Mentoring**

Kram (1983) first suggested that protégés may have many mentors over the course of their careers, but not necessarily with any overlap in skill or in time. The literature
explained that any mentor may provide some mentoring functions, but not all of them. Multiple mentors were needed to fill in the gaps (Ragins & Cotton, 1999). The concept of network mentoring (Higgings & Kram, 2001) was developed to define the multiple concurrent mentoring relationships that may occur, finally moving the literature beyond the notion of the single, two-person monogamous mentoring relationship.

This concept found further support from Henderson (1985) as the protégés he studied reported having two to three mentors while in the workforce. Assuming that all mentors are from the same firm, research has also suggested that the mentoring outcomes of increased job satisfaction, organizational commitment, and career expectations are enhanced by having multiple sequential mentoring relations (Baugh & Scandura, 1999). As early as 1991, Burlew proposed the Multiple Mentor Model, in which he described three different kinds of mentors that protégés may need at different points in their careers. First, the **training mentor** helps the protégé in his or her fledgling career by sharing his or her experiences and knowledge of the job or career opportunities. Burlew is clear in noting that the training mentor does not have to work for the same firm, or have experience in the protégé’s position, but does help in the adjustment period to starting a career and offers instruction as to increasing his or her value within the organization. Next, the **education mentor** is involved in long-term strategic planning to assist the protégé in meeting his or her career goals. The mentor gives advice on how to get ahead, creating a network of support, and educational options. Finally, the **development mentor** helps the protégé develop fully, both professionally and personally. He or she may see imbalance in the protégé’s life and help find ways to develop interests outside of the
workplace and offer support to try new things. Burlew concludes that each role requires a special type of person with distinct skills, furthering the argument for the need of more than one mentor.

The idea of team mentoring, where mentoring within the team occurs, both between and within peers and team management (Kaye & Jacobson, 1996) is also receiving attention. As is evident in the case study results, team mentoring is very important for the innovation process.

Finally, the concept of composite mentoring is gaining popularity in the education literature. Advanced by Packard (1999, 2003), the composite mentoring model involves the protégé creating the ideal role model by strategically choosing mentors and following some or parts of the guidance and behaviors from each instead of trying to find one person as a mentor who has all of the qualities the protégé may desire to meet his or her goals and aspirations (Ibarra, 1999). Composite mentoring allows for diverse gender and ethnicity pairings (Sosik & Godshalk, 2000), which is not common in diversity initiatives in large firms. This model also supports the multiple mentoring literature that may be summarized as a “two heads are better than one” approach (Bird & Didion, 1992; Burlew, 1991; Nolinske, 1995). Multiple mentors may be needed for different periods of life, challenges, or tasks (Nolinske, 1995).

**Electronic Mentoring**

Electronic mentoring (e-mentoring) involves carrying out the mentoring relationship primarily through electronic means (not face-to-face). This can occur through the use of
email, chat, or webcam (Hamilton & Scandura, 2003). Support functions, like role modeling, guidance, and encouragement, have been found to be present in e-mentoring relationships (Hamilton & Scandura, 2003). E-mentoring may provide the same levels of career guidance and support functions as traditional mentoring (Ensher, Huen, & Blanchard, 2003). E-mentoring can also occur at the team level where virtual team mentoring has been found to offer both constructive criticism and support to partners in the relationship (Knouse, 2001).
The literature on innovation is vast, as organizations strive to meet or predict market needs with innovation as the key ingredient. I will examine multiple definitions of innovation and the metrics and methods associated with its measurement will be described. Finally, I will explore roles and functions of management in the innovation process.

**Definition of Innovation**

Two distinct constructs of innovation have developed in the literature; the first as a learning or knowledge concept and second as a market-driven activity. Arising from economic theory, Schumpeter (1926) advanced the notion of innovation as a broad set of activities that the manager overseeing the innovating team considered new. This could include changes or development of novel organizational policies, methods, processes, products, or other opportunities in the market. His concept became more refined as his research on business cycles and creative destruction evolved. His widely cited definition of innovation is “... introducing new commodities or qualitatively better versions of existing ones; finding new markets; new methods of production and distribution; or new sources of production for existing commodities; or introducing new forms of economic organization” (Schumpeter, 1942).

Organizational learning and education have also made efforts to define innovation. Amabile et al. (1996) offered the viewpoint as the “successful implementation of creative
ideas within an organization” (p. 25). Others have argued that one must consider the user’s perceptions in deciding what is innovative: Innovation is “an idea, practice, or material artifact perceived as new by the relevant unit of adoption” (Zaltman, Duncan, & Holbek, 1973, p. 2).

Over time, the definitions for innovation began to focus increasingly on the concept of creating value. In 2004, the U.S. National Innovation Initiative offered this view: “The intersection of invention and insight, leading to the creation of social and economic value.” The next year, the innovative part of their definition (the inclusion of social value as a goal of innovation) was removed. Similarly, the U.K. Department of Trade and Industry defined innovation in 2003 as “The successful exploitation of new ideas.” Their current (2007) definition has expanded to “The development of new ideas and their economic application as new products or processes.” Scope is also included as a construct: “An innovation is anything new that is actually used (enters the market place)—whether major or minor” (Von Hippel, 2005).

With the definition itself in flux, careful consideration must be made to the key aspects that should be present in a definition of innovation that allows for understanding and a clear-cut rationale for what is innovative and what is not.

For the purposes of this study, I will use Michael Porter’s definition of innovation: “A new way of doing things . . . that is commercialized” (Porter, 1990) because of its simple approach that includes both aspects of importance, the delivery of something novel to the
market. This also allows for benefits to social value to be included in innovative measures and output.

**Measuring Innovation**

Innovation has to be measured in unique ways to capture time, financial, and human costs incurred in researching and developing a potential invention. The technology may take many forms in the market after a decade of testing; the final discovery may not be of interest to the firm, but licensing may generate revenue and other opportunities. Forecasting seems close to impossible. We will first explore measurements commonly used concerning innovative output, then a few ways in which the management of innovation is evaluated.

The most common gage of organizational innovativeness is using product-development metrics, including number of patents filed or granted, number of ideas submitted by employees, annual R&D budget as a percentage of annual sales, and percentage of sales from products introduced in the last year (Albert, Avery, Narin, & McAllister, 1991; Chiesa, Coughlan, & Voss, 1996; Turrell, 2004). Number of patents filed is a function of the amount of money a company is willing to spend filing patents, which offers no indication of said potential patent’s worth, nor the likelihood of a patent being granted. The measure of number of patents granted shows that some novel invention occurred, but again infers no value that holding the patent imparts. Patent citation analysis may prove a better technique, as it assumes that the better quality or level of influence a patent has, the more it will be cited within the prior art section of subsequent patent filings (Albert,
Avery, Narin, & McAllister, 1991). Number of ideas submitted has wide variations depending on type of industry and employee population make up and doesn’t take into account idea quality. This measure may be best utilized as a growth rate metric for inspiring employees to participate in organizational initiatives. Adams, Bessant, & Phelps (2006) argue that a balanced scorecard approach should be utilized to measure firm-level management of the innovation process to realize the full view of activities. This sentiment has been echoed throughout the literature (Cordero, 1990; Frenkel, Maital, & Grupp, 2000; Wolfe, 1994). It is clear that many aspects of the firm must be kept in mind to find the appropriate balance between the different and competing perspectives of firm strategy. Resources like capital, time, and labor must be balanced between existing business and new opportunities (Barney, 1991; Collins & Montgomery, 1995; Day, 2003). The firm’s capabilities in terms of organizational culture, competitive advantages, and processes in place to measure competencies also offer insights into innovative potential (Cooper & Kleinschmidt, 1995; Dyer, 1996; Porter, 1985). Finally, leadership’s commitment to innovation can be evaluated through the establishment of challenging
innovation goals and the involvement of senior executives in supporting innovation initiatives (Chiesa, Coughlan, & Voss, 1996; Rivette & Klein, 2000).

**Management’s Roles in the Innovation Process**

The literature has been consistent in describing innovation with organizational behavior constructs, focusing on the important roles that managers play (Allen, 1977; Barczak & Wilemon, 1989; Mumford, Scott, Gaddis & Strange, 2002; Roberts & Fusfield, 1981). Innovation has been found to be more likely to develop in organizations where top management encourages and supports new ideas and risk-taking from employees at all levels (Kanter, 1983, Kouzes & Posner, 1988). Product success, as measured by domestic market share, profit objectives, payback period and relative profits, were found to be related to top management support for the new product (Cooper & Kleinschmidt, 1987). Even the perception of having top management support has been found to increase innovativeness, expected contribution, and investment size, as well as a strong negative relationship with project termination rates (Green, 1995).

Barczak & Wilemon (1989) reported that leaders in innovative environments play multiple roles: communicator, climate-setter, planner, and interface. A research and development (R&D) team or product development group each depend on a leader that serves many functions to ensure team success including contributing to brainstorming, championing the project throughout the organization, gatekeeping, and coaching, in addition to leading the team (Roberts & Fusfield, 1981). Kim, Min, & Cha (1999) added that leaders should be technical experts and possess strategic planning know-how, both of
which were related to team performance. Interestingly, the relationship between technical expertise, strategic planning, and team performance became stronger as the leader’s tenure within the firm increased.

After, sometimes even before, the idea is developed to the stage where prototypes have been tested and approved, the manager’s job may become even more complicated. Managers involved in innovation need a wide set of skills beyond technical prowess to lead inventions to market (Mumford, Scott, Gaddis, & Strange, 2002). Incredible proficiency in understanding personality types and departmental goals is needed to work with marketing, finance and other departments to convince relative outsiders to continue or increase funding when the project horizon may still be years away from introduction to market. The notion of an idea champion is similar to that of the sponsoring concept in the mentoring literature. Having a respected or powerful person fighting for a cause, be it an individual or a project, has been shown to provide many benefits. Researchers have found that more resources are allocated to championed projects and the termination rate of those projects is significantly lower than projects without a champion (Markham, Green & Basu, 1991). A transformational leader who exhibits championing behavior has also been found to increase project effectiveness (Waldman & Atwater, 1992). Behaviors commonly exhibited by transformational leaders were more commonly used by champions than by nonchampions (Howell & Higgens, 1990), which may impart some of the benefits previously noted by motivating employees to push themselves harder (Bass & Avolio, 1994), thereby increasing the innovative output.
A common practice in business is promoting the best (i.e. most productive) employees to managers others. While logically that may make sense in sales or many other careers, the expertise needed to be a great computer programmer also may negatively affect that employee’s social skills, which is an important attribute of a manager. Likewise, the skills involved in innovation are very different than capabilities required to manage others. Multiple studies have explored the implications of a manager who is not perceived to be as technically skilled as the group members he or she is leading. In an early study by Andrews and Farris (1967), scientists reported having more latitude to experiment and challenge paradigms under managers perceived to be less technically skilled. That additional freedom may result in higher levels of quality output. Following those findings, Farris (1972) studied roles across different stages of the innovation process. While supervisors were not seen as contributing novel solutions in the suggestion stage, their skills were utilized during the proposal and solution stages in offering technical guidance, feedback, and playing an important administrative role. Creating the learning environment again must be stressed. Information sharing of research developments in science and technology between managers and researchers leads to higher levels of innovative performance (Allen, Katz, Grady, and Slavin, 1988).

Managers can also develop a climate conducive to innovation. Consistent with our discussion of organizational climate in Chapter I, managers report that innovation thrives where employees feel like part of a family—sharing information, socializing, caring about each other, working as a team (Judge, Fryxell, & Dooley, 1997). In effect, a workplace community is created where individualism is respected but a collectivist
mindset is also present (Fryxell & Judge, 1995)—truly all for one and one for all. Individual recognition and awards are commonplace but teamwork and organizational commitment are the norm. Judge, Fruxell & Dooley (1997) contend that the groups with the highest levels of innovative output had clear strategic goals but had autonomy in deciding how they could be reached, what they label a goal-directed communities. They go on to offer four practices that managers can adopt to develop a goal-directed community. First, managers granting autonomy (having control over one’s own work) to employees was found to have a strong benefits to their innovative output (Bailyn, 1985; Judge, Fruxell & Dooley, 1997). Recall that managers set clear strategic goals and gave some directives, but employees were able to be intrepreneurial and take ownership of their projects. Second, personalized recognition measures and events were found in the more innovative units while less innovative units mostly focused on monetary rewards. The organization’s expressing gratitude may be just as fulfilling as being recognized by one’s peer group. Even through autonomy on projects, the sense of self-confidence and pride can be expressed as its own reward. Employees enjoy a feeling of accomplishment which is often reenergizing and motivational to others in the environment. Research has found that focusing on monetary rewards or promotions breeds competition in the workplace, decreases learning, and discourages risk taking (Kohn, 1993). Third, Judge, Fruxell & Dooley (1997) argue the importance of an integrated sociotechnical system (Pava, 1986), which manifests itself in a workplace where technical skills are balanced with people skills (such as group cohesiveness). These managers considered how new hires would fit into the team as a condition of employment. This allowed for socialization
to occur more easily and high performing teams were the norm in these units (Thamhain & Wilemon, 1987). Fourth, continuity of slack is offered as a final managerial approach to supporting innovation. Organizational slack is the notion of utilizing some percentage less than 100% of available resources to be able to adjust for any changes in internal or external conditions or assumptions (Bourgeois, 1981). Judge, Fruxell & Dooley’s (1997) contention is that maintaining a cushion so that there are always some reserves available in case of crisis avoids the trauma of running out of money, time, or manpower, which can affect the firm’s reputation as well as cause stress and a lack of confidence in the team.
PART III

INNOVATION AND MENTORING LITERATURE

As we have seen in the first section of this chapter, the current mentoring literature focuses mainly in soft science roles for the purposes of career development and diversity retention initiatives. Through an extensive search a handful of studies have surfaced that address mentoring playing a role in the innovation process, or at least allude to mentoring functions like coaching or sponsoring. Early research in this area has generally been published in technical journals or in conference proceedings. A conference paper for the American Chemical Society was the first mention of mentoring playing a role in innovation. Pierce (1983) discussed the importance of the first mentor relationship for a new technical employee in the research lab as the most important of his or her career. Pierce offers many ways in which lab room mentors can stimulate innovation:

1. Helping the new hire gain confidence by assigning projects which are challenging but within the protégé’s capabilities.

2. Developing networking and collaboration opportunities between the protégé and accomplished innovators.

3. Acting as a role model by developing an idea through to application.

4. Explaining and facilitating accesses to organizational resources.

5. Supporting the protégé in working on independent projects.
Fourteen years later, Tarao (1997) clearly articulated the importance of mentoring in the innovation process. He noted that mentors are often overlooked in the pivotal roles they play in developing innovative technologies and bringing them to market. Tarao states that “One of the mentors’ probably most important requirements is to encourage protégés to publicize their ongoing research” (p. 24). Citing the tendency for technically proficient protégés to not see the full value of their ideas or results, he suggests that mentors find and propose opportunities to share materials or publish. As with Pierce (1983), a connection to chemicals research exists as Tarao’s article was published in Chemtech.

A third and final finding of mentoring being tied to innovation exists in the form of a working paper by Roger Smith, the Chief Technology Officer (CTO) of Titan Systems. The title seemed promising, naming both innovation and mentoring as constructs of interest. One mention is made of mentoring in the 24-page piece: “That is one reason that it is important for the CTO to mentor the Chief Scientists and to direct their focus such that it contributes to the success of the company” (p. 18).

Two other pieces should be mentioned as coming very close to making the innovation and mentoring connection. Tang & Tang (2004) offer a strategy for developing “enterprising students,” who they require to “be willing to try new, untested routes, without undue fear of failure. [They should have] the ability to create and seize new opportunities, rather than increasing efficiency of conventional methods” (p. 733). They propose what may be considered both peer and team mentoring in creating an environment for cooperative learning.
Finally, while Mulejz, Likar, & Potocan (2007) are interested in developing capabilities for knowledge transfer between organizations and academia, they also offer ways in which those firms can internally encourage employees to innovate. They suggest that the European Union is not competitive because of a lack of innovative thinking and strategy. They prescribe that academia must first be properly trained to teach students to be innovative. Part of that may entail close collaborations out of the classroom in projects utilizing creativity, knowledge, and product development techniques.
CONCLUSION

Researchers have been studying the concept of innovation for decades from many perspectives: behaviors of innovators, their motivators, as well as the environment in which they work. As organizations continue to seek ways to increase innovation to create or maintain competitive advantages, many companies are trying novel approaches to put systems in place to support knowledge management as well as increase innovative output. Resources (time, financial, and executive support) have been found to be necessities, yet little has been done in the literature to understand the importance of mentoring relationships in the innovation process.

The business literature has not explored this topic, leading to an exploratory case study methodology to be employed in this research. In interviewing the top innovation experts in industry, invaluable insights will be shared from resource and efficiency-based perspectives (Hertz & Imber, 1995). The cases will offer new perspectives on this little-examined area and may garner new lines of research for future studies.

This study focuses on the role of mentoring in the innovation process. The specific aim is to examine how innovators (from design and technical fields) view and describe the role of mentoring in their careers in product development or research, as opposed to the more traditional views offered by management and executives. As an exploratory study in this area, we will seek multiple perspectives on how institutions introduce, facilitate, and support mentoring within their organizations for the purposes of increasing innovative output.
CHAPTER III

METHODOLOGY

Introduction to Methodology

The purpose of this study is to assess the role of mentoring in the innovation process. This chapter will explain the criteria for selection of participants, the rationale for choosing a qualitative methodology using case studies, and how data quality will be ensured. The initial contact with potential participants and the interview process with those who agree to be part of the study are described. Finally, I will reiterate the research questions, clarify the analysis procedures used to understand the data, and explore my role as a researcher serving as an instrument of data collection.

Selection of Participants

Since the goal of this study is to assess the role of mentoring in the innovation process, I focused on the most innovative companies for best practices. Fortunately, many respected business magazines publish annual lists of whom they deem the most innovative, based on a wide-variety of methods (see Appendix A for “Most Innovative” list methodologies). Initial participant selection for this study was conducted based on the “Champions of Innovation” (CoI) list published by Business Week on June 19, 2006. CoI named 25 individuals who are considered innovation leaders in Fortune 500 companies. The CoI list was then compared with the “Most Innovative Companies” lists from Business Week (published April 24, 2006 and May 4, 2007); the “Most Admired Companies for Innovation” list published by Fortune (in the March 19, 2007 issue); and “The Wired 40: Most Innovative Companies in the World” by Wired magazine (March,
2007 issue). Each of these magazines is a well-respected and widely-read mass market business publication.

I used three phases of participant selection. In the first phase, a combination of theory-based and outlier sampling (Patton, 2002) was used. However, this was dependent on who would give me the access to information and their time. Individuals from the CoI list who work for companies on one or more of the other lists were targeted as the first round of potential participants (PP). I contacted fourteen individuals on the COI (by email, in person, by phone, or through personal connections), and eight responded. In the second phase of participant selection, other high-ranking members of companies listed on one or more of the “Most Innovative” lists were identified for potential inclusion. Only CIOs or executive level (VP or director level) individuals were targeted, including the upper-level-management of the R&D or product development departments. Six individuals were contacted and four agreed to be interviewed. The third phase of participant selection utilized a snowball sampling approach. That is, following the completed interview, each participant from phases one and two was asked if he or she could recommend one or more of their employees, protégés, or inventors within the firm who might be helpful for me to interview to better understand my research questions. As the theory evolved, emergent sampling, where I can take advantage of opportunities presented as the participants offer introductions to researchers who would not have otherwise been on my radar (Patton, 2002), offered the most depth to obtain more detail about specific areas and roles within the company, especially for anecdotal information. This multiple perspective reporting assisted in triangulation to ensure validity.
Based on these three phases of selection, a total of 23 interviews were conducted. It is important to acknowledge that many of those who accepted my request to be interviewed had strong opinions about the role of mentoring in his or her career as an innovator, with mostly positive views about the issue. By agreeing to the interview, the self-selection bias was evident as many participants spoke with great emotion concerning how he or she feels about mentoring.

**Methodology Rationale**

"Research in mentoring is in need of more qualitative field studies to have a more holistic and an in-depth understanding of mentoring relations."

- Scandura & Pellegrini, 2007

Why Qualitative?

An extensive research literature documents that mentoring changes lives, creates opportunities, and benefits everyone involved. In addition, scores of articles address the importance of innovation as a competitive advantage that very few firms have been able to achieve purposefully. Yet there is little overlap between the mentoring literature and innovation research. Thus a qualitative-research approach is called for because this area has no theory from which to draw. By using in-depth interviews and focusing on individual firms, the dialogue has started about what has worked for the handful of organizations that have adopted the mindset of using mentoring to further innovation and made it part of their culture, at least at the department level. Qualitative research methodology provides a design for research that attempts to understand and describe the
dynamics of organizational behavior. To better understand and describe the how mentoring may be used to support innovation, I observed, documented, and investigated the environment in which the innovation occurs (Creswell, 1994; Guba & Lincoln, 1989; Lincoln & Guba, 1985). Goetz and LeCompte (1984) propose that utilizing qualitative methods provides rich, descriptive data regarding experiences of the participants. Several assumptions support the use of qualitative methodology for this study, including the interest in meaning, descriptive data analysis, the researcher as an instrument, and an emphasis on process (Creswell, 1994). Theory was not developed a priori but evolved through research and interviews. I focused on both the individual differences between companies as well as areas where similarities occurred. Theoretical sampling was employed to maintain the research agenda as theory development opportunities became more clearly defined. Focus was on each participant’s experiences and on assessing their experiences relative to emergent theory. Data are descriptive, offered in words rather than numbers. The richness and depth of the interviews allowed for the development of a greater level of understanding of the processes and issues involved rather than just the outcomes. As the instrument of data collection, I had a great responsibility in maintaining consistency during the interview and analysis procedures that were repeated throughout the study. I also had to be aware of any biases I may have and be transparent in my role as a researcher.

Data Quality

The issue of maintaining quality of the data was continually monitored during this study. The four criteria used to ensure validity and reliability (trustworthiness, in naturalistic
terms) are credibility, dependability, transferability, and confirmability (Lincoln & Guba, 1985). In the naturalist paradigm, the issue of trustworthiness is based on the question, “How can an inquirer persuade his or her audiences that the findings of an inquiry are worth paying attention to?” (Lincoln & Guba, 1985, pp. 301). A discussion of the four criteria follows.

Credibility involves having “adequate representation of the constructions of the social world under study” (Bradley, 1993: pp. 436), similar to the goal of internal validity. In quantitative research, there are a variety of means to improve the credibility of results, including checking interpretations against raw data, prolonged engagement in the field, persistent observation, triangulation, member check, and negative case analysis (Lincoln & Guba, 1985). This study employed triangulation (through multiple interviews with individuals in the same company and comparing those data to materials in the news or found in research) and member checking (with each participant receiving a transcript via email of his or her interview for review, clarification, suggestions and for additional comments).

Transferability involves the ability of the research findings to be applied to another context, much like the external validity paradigm in quantitative research. In using a naturalist method, my focus is on providing enough depth in description and a richness in the data so that researchers may make a decision regarding the context for the findings allowing for simple application to other studies. I do not make a claim of generalizability of my results outside of the firms studied.
Dependability involves the study’s consistency as it relates to process, such as the researcher’s approach to interviewing and analysis (Lincoln & Guba, 1985), similar to the reliability factor. Confirmability involves the likelihood that others would agree with the researcher’s conclusions by reading or reviewing the results. Lincoln and Guba (1985) suggest an audit to check for dependability and confirmability to ensure that both the process consistency and soundness of reporting was maintained throughout the research. A self-audit was conducted repeatedly throughout the process to address dependability and confirmability (Foster, 2004). The self-audit included the use of notes detailing all thoughts I had regarding who I wanted to interview and why, research on the participants and their organizations, reactions to the interviews and articles, the use of topics and concepts for development and refinement through additional data collection and the development of the theories and comparisons that led to the case studies presented in the results chapters.

Why Case Studies?

“A major reason for the popularity and relevance of theory building from case studies is that it is one of the best (if not the best) of the bridges from rich qualitative evidence to mainstream deductive research.”

Eisenhardt & Graebner, 2007, p. 25.

The case study methodology focuses on the in-depth, contextual understanding of a “bounded system” (Miller & Salkind, 2002; Stake, 1995) through multiple-source data collection. Each of the organizations studied (3M, IBM, Proctor & Gamble, and Whirlpool) has unique methods and offers a different perspective in best practices in the
use of mentoring for department- and firm-level innovation. Case studies require the collection of data from many sources to comprehend the process on every level of analysis.

I followed the guidelines of case study development offered by Stake (1995). I offered an “in-depth” analysis of a “bounded system.” I accomplish this through many interviews with decision-makers and stake-holders as well as by incorporating multiple published articles and documents into my analysis of each company. Detailed questions were asked of each participant as to the nature of the innovation process and mentoring at their workplace. My descriptions in each case provide analysis of important themes and issues within the context of the organization that offer a foundation for theory development. Finally, I offer lessons-learned (Lincoln & Guba, 1985) to give meaning to the analysis offered throughout the case.

The case study methodology was chosen since this area lends itself well to inductive theory development, as the techniques utilized allow for the data to guide the theory. Hallmarks of this method were incorporated into the study design (Creswell, 2002; Glaser, 1992; Glaser & Strauss, 1967; Miller & Salkind, 2002; Patton, 2002; Strauss & Corbin, 1990). I created a “broad explanation” of a process (Miller & Salkind, 2002; Strauss & Corbin, 1990) which allowed me to examine how mentoring is involved in process of innovation at several organizations known for being innovative. I used the four central criteria to be considered “good” grounded theory (Glaser, 1992):
• fit—The theory has to make sense to those in the field and those researching the phenomena. Through the participant’s reviewing the research as it develops a dialogue has been created for theory development.

• work—Explains differences between the participants’ actions. The interview data offer new dimensions of study that serve as comparison points between the participants.

• relevance—Assumes fit and work. And

• modifiability. It can evolve as new data become available. As research continues in this area, the theory can be extended as new situations reveal themselves.

Data were collected from experts in the field who are active in setting the innovation strategy or engaged in the process of innovation. Data were constantly compared as each interview was completed and questions refined. Each interview was analyzed before the next interview was conducted (Miller & Salkind, 2002). As research progressed, trends became clear and additional questions were added based on area of expertise (Patton, 2002) and as the need for conceptual refinement became clear. I focused on a central question: What is the role of mentoring in the innovation process? (Use of “What” is not typical to qualitative research although Miller & Salkind [2002] maintain that it is appropriate when stating the research agenda).

Initial Contact

Each PP was contacted directly by email, phone or in person. The PP was then briefed on the research focus and asked to share his or her insights in an approximately 30-60 minute interview, either by phone or in person. The same email was delivered to each PP
(see Appendix B) to schedule the interview with the PP’s assistant. The informed content was waived by the University of Miami Internal Review Board (IRB) as a standard contact email or script detailed the request (see Appendix C) and the IRB understood that the nature of the interview requests posed no risk to successful businesspeople who could hang up the phone on me at any time. The participants were not given any offer of confidentiality as each was chosen for this study because of his or her job title and functions, thus offering both credibility and comparisons opportunities.

**The Interviews**

**Telephone Versus Face-to-Face**

Telephone interviewing is a very commonly-used tool in quantitative research (Aday, 1996; Bernard, 2002), yet, surprisingly, research examining this medium of data collection has yielded unsatisfactory results—conclusions so obvious that one wonders why the study was undertaken in the first place and, failing to address the central issue of whether random-digit dialing telephone surveys can produce a representative sample and how the researcher might adjust raw findings to take into account the absence of true representation.

In the first category of “obvious conclusions” research, one learns that telephone use is usually cheaper and less time-consuming than face-to-face interviews (Aday, 1996) and that it increases interviewer safety (Bernard, 2002). Certain drawbacks have been noted in the nature of telephone interviewing, such as the lack of visual cues (Aquilina, 1994; Groves, 1990) and the need to shorten interview duration (Aday, 1996; Bernard, 2002).
Within quantitative studies, research on the implications of the mode of communication for data collection have yielded mixed results. The quality of the data collected has not been verified through research that could demonstrate its reliability by cross-checking against other modes of data collection. Much of the literature has focused on response rates and on the quality of responses to written or oral surveys involving mainly fixed answer choices from anonymous respondents (random digit dialing) about health issues (Colomboto, 1969; Siemiatycki, 1979, Van Campen, et al., 1995). For example, Acquilina (1994) reported that telephone interviews elicited higher levels of admission of substance abuse versus face-to-face interviews, but others have found conflicting results (Pridemore, Damphousse, & Moore, 2005; Moum, 1998).

Concerns have been acknowledged that area variances in telephone usage rates may not be yielding a truly representative sample (Bernard, 2002; Groves, 1990), but further research has not been published attempting to quantify these variances or suggest how adjustments could be made to the raw data to achieve greater accuracy in findings.

Little research exists on the methodology of using this medium in qualitative studies. Telephone interviewing is a common and accepted mode in qualitative research for a variety of reasons. Respondents seem to be relaxed and willing to disclose information readily; the data gathered is considered to be high quality: rich, vivid, and detailed (Chapple, 1999; Kavanaugh & Ayers, 1998; Sturges & Hanrahan, 2004; Sweet, 2002).

The advantages of telephone data collection compared to in-person interviewing are many: decreased cost (Chapple, 1999), increased access to geographically distant
participants (Sturges & Hanrahan, 2004; Sweet, 2002; Tausig & Freeman, 1988),
decreased space requirements (Sweet, 2002), increased interviewer safety (Carr & Worth,
2001; Sturges & Hanrahan, 2004), and the ability to take notes unobtrusively (Carr &
Worth, 2001; Smith, 2005; Sturges & Hanrahan, 2004; Tausig & Freeman, 1988).

The peripheral benefits just recited would not, of course, outweigh a lesser assurance of
valid results. But in that respect, findings are positive that telephone data collection has
inherent advantages. Participants are able to stay on “their own turf” (McCoyd & Kerson,
2006, p. 399), permitting more anonymity (Greenfield et al., 2000; Sweet, 2002; Tausig
& Freeman, 1988) and privacy (Sturges & Hanrahan, 2004). This both decreased social
pressure and increased rapport (McCoyd & Kerson, 2006), which increased respondent
comfort. An additional benefit: telephone interviews are especially effective for reaching
hard-to-access participant groups (Creswell, 2003, Miller, 1995; Tausig & Freeman,
1988, p. 420).

Some of the disadvantages of using the telephone to collect data are also present in face-
to-face interview situations. The potential for distraction of participants by activities in
their environments (McCoyd & Kerson, 2006; Opdenakker, 2006) occurred when the
interview was conducted in person (Sturges & Hanrahan, 2004). Lack of nonverbal
communication (Garbett & McCormack, 2001) and lack of telephone coverage for certain
populations (Carr & Worth, 2001) were additional concerns. The major disadvantage of
telephone interviews is that they usually are shorter than those conducted in-person
(Chapple, 1999; Creswell, 2003; Garbett & McCormack, 2001; Harvey, 1988; Sturges &
Hanrahan, 2004; Sweet, 2002), which reduces the opportunity for in-depth discussion.
Some researchers have suggested that telephone interviews are appropriate only for structured interviews (Fontana & Frey, 1994) or in very specific situations (Rubin & Rubin, 1995).

Because the people I interviewed are all busy executives and researchers, I think this actually worked in my favor as they have very little time and the telephone meeting allows for a lesser investment of time and energy. Several of the interviews were conducted as people were traveling (one in a car, one at an airport), while another occurred as a participant walked her dog. Had I required face to face interviews, I am confident my response rate would have been negatively affected. Many researchers (Burke & Miller, 2001; Carr & Worth, 2001) suggest establishing contact or building rapport in person before conducting telephone interviews and using a prepared script to introduce the study at the beginning of the call. When possible I did meet the participants in person before conducting the interview, and I found no difference in the data quality between those interviews and the others where no face to face contact occurred. I started each call with a summary of my research agenda, which I found helped focus the discussion greatly. As the data were collected in both face-to-face and telephone interviews, an emphasis was made on establishing rapport as early as possible in the exchange.

Interview Day

On the scheduled date and time, I called the participant at the specified phone number, usually at the participant’s offices, but twice at the participant’s homes and twice on the participant’s cellular phones. If the participant consented, the conversation was recorded.
If not, I took notes. The recording and any notes were transcribed after the interview and checked for accuracy.

The general topical issues were discussed with each participant (see Appendix D). However, some modifications to the open-ended questions occurred based on the participant’s role, special initiatives or events at the company, his or her background and emergent topics. All were asked questions concerning the following: the origin of their role and length of tenure, the use of metrics to evaluate innovative output, formal or informal mentoring practices within their companies and departments, how they view the role of mentoring in the innovative process, and their anecdotes of mentoring successes.

One 30 – 60 minute interview was conducted with each participant, and follow-up emails or calls were made for the purposes of clarifying or expanding upon previously made statements. The interview format was semi-structured, focused on the participant’s specific company or department and position due to extreme time-constraints.

After the interview, a thank you note was sent to each participant. Each participant was emailed the transcript of the interview for review and clarification. In some cases a follow-up email was sent as well to expand on responses.

The questions used in the semi-structured questionnaire (see Appendix D) were developed through several informal discussions with inventors and researchers. I also hosted an informal focus group with several innovators who are currently working in technology-intensive industries. This gave me the opportunity to investigate the perceptions and attitudes of technology professionals concerning the themes and definitions used in my study. The goal was to obtain the views and feelings that the
participant cohort experienced rather than gaining consensus of the focus group members (Patton, 2002; Vaughn, Schumm, and Sinagub, 1996). This exercise allows for insights that may not be accessible had the focus group not been conducted (Krueger, 1988; Morgan, 1988). I wanted the questions to give direction but to be broad enough to allow the participants latitude to discuss any practices unique to his or her company.

**Research Questions**

The overarching premise of this study is that innovation has become a core competency and competitive advantage for many companies. Typically the innovation process is supported by many practices in the organization so that this permeates the culture. The research questions asked here attempt to assess the fundamental role that mentoring plays to create the climate for innovation as well as supporting its existence. Thus, the research questions will address the following such issues: How do mentors and protégés find each other to work on innovative projects? How do firm factors such as size of organization, product offerings, and type of industry affect how, when, and why mentoring relationships are developed or nurtured? How is formal mentoring or mentoring training utilized at the most innovative companies? How and why is mentoring useful for innovation? How do the people championing innovation view the role of mentoring?

Limitations and areas for improvement will also be discussed.

Data to address these questions came from interviews with Chief Innovation Officers or executives overseeing innovation initiatives at the top companies for innovation, R&D team members, and inventors themselves. Data were also obtained through content
analysis of numerous magazine and journal articles, company materials and books on best practices in innovation citing these firms.

**Analysis Procedures**

Data were arranged for analysis (Patton, 2002; Schilling, 2006) by first transcribing the interview (typically six to ten pages of single-spaced type) or finding articles about innovation or mentoring within the companies. All of the questions and answers were transcribed literally but non-interview related sounds and pauses were not transferred. I chose to focus on themes as the unit of analysis since I was searching for consistency in concepts shared through the interviews within and among the companies (Minichiello, 1990). This allowed me to use anything from a single word to a paragraph as evidence in support of each theme. The categories and the coding scheme were developed inductively from the data as no theories were available as a guide (Miles & Huberman, 1994). This approach required constant comparison to ensure that the categories were distinct (Glaser & Strauss, 1967) and internally homogeneous (Lincoln & Gupta, 1985). Test coding was done and consistency was checked by recoding the same data after several weeks and the exact results were achieved. Coding was done within two to four days of the completion of each interview transcription. Coding consistency was rechecked regularly by randomly choosing earlier transcripts to recode so the stability of the category distinctions and coding rules (Miles & Huberman, 1994).
Conclusions were drawn from the coded data throughout the process. I was able to identify relationships between the categories and observed patterns. The findings are reported largely through the use of quotations “to allow the reader to understand the basis for an interpretation, and sufficient interpretation to allow the reader to understand the description” (Patton, 1990: p. 503-504).

A cross-case analysis was done on the case studies. The use of case studies and the conduct of a cross-case analysis created a synergy in the research that adds value and importance to the findings. Patton (1990) stated, “Cross-case analysis means grouping together answers from different people to common questions or analyzing different perspectives on central issues…Synthesis of different qualitative studies [case study] on the same subject is a form of cross-case analysis” (p. 425). Patton (1990) went on to say, “For scholarly inquiry, the qualitative synthesis is a way to build theory through induction and interpretation. For evaluators, the purpose of the qualitative synthesis is to identify and extrapolate lessons learned” (p. 425). Miles and Huberman (1994) explained the principles, purposes, and strategies for cross-case analysis. “We need a theory that explains what is happening—but a theory that does not forcibly smooth the diversity in front of us, but rather uses it fully to develop and test well-grounded set of explanations” (p. 207). Miles and Huberman (1994) offered working principles for cross-case analysis. There is a need to understand what is crucial to the dynamics of the individual case and to avoid idly joining cases together for study. The case configuration contributed to an understanding of the whole picture that the case presented. Explanations came from cycling back and forth or synthesizing between efforts to understand the dynamics of the individual case and the effects of key variables. Unusual cases that did not fit emerging
explanations added to the understanding of the case dynamics. Miles and Huberman (1994) stated that one purpose for doing cross-analysis is to enhance generalizability. They cited Denzin’s (1983) and Guba and Lincoln’s (1981) argument that generalizability is an inappropriate goal for qualitative studies. Instead, Miles and Huberman suggested that cases, adequately sampled and carefully analyzed, could help answer reasonable questions that made sense beyond the specific case. They also felt that cross-case analysis deepened understanding and explanation. They cited Glaser and Strauss’s (1970) conclusion that the researcher could “calculate where a given order of events is most likely to occur or not occur” (p. 173) in other situations.

Miles and Huberman (1994) listed two basic strategies and identify a third, which is the combination or integration of the first two. In the case-oriented strategy, one case is studied in depth. Subsequent cases are studied to try and match patterns found in the first case. In the variable-oriented strategy, themes that “cut across the cases” are sought. The mixed strategy uses a standard set of variables across the several cases from which matrices are constructed for analysis. As they indicate, “It’s possible, and usually desirable, to combine or integrate case-oriented and variable oriented approaches” (Miles & Huberman, 1994: p. 176).

The Researcher’s Role

As the instrument of data collection and analysis (Lincoln & Guba, 1985), my biases, assumptions and values need to be discussed. Hopefully my background and experiences offer an additional benefit to the research since I am an inventor and have been mentored extensively throughout my career. I have had positive experiences with mentoring and
know the powers that a strong mentoring relationship can offer, both in terms of the traditional career development model and in the innovation process. While this experience may predispose me to search for benefits and give them more weight than deserved, I am aware of my feelings and made efforts to temper my opinions in my questioning and my follow-up correspondence. I have worked for several small start-ups (under 20 employees) and have not worked in a corporate setting with levels of bureaucracy and departmental silos which often occur in large corporations.

SUMMARY

At every state of data collection, this study focused on the role of mentoring in developing innovations. I consistently questioned which components of mentoring were being utilized, either formally or informally within the workplace. I gathered news articles, various internal memos, and published materials to verify information and understand aspects of the organizational culture. Thus the data collection utilized multiple sources of information and through self-audits and post-interview contacts with the interviewees, I was able to check data quality and the theory being developed.
3M Company (formerly Minnesota Mining and Manufacturing Company) is a diversified technology innovator, manufacturer and marketer, today offering more than 5,000 products.

3M’s early history gave little hint of its future success. The company was founded in 1902 to mine and sell corundum, a mineral almost as hard as diamonds that could be used as a cheap substitute for garnet in grinding wheels used by furniture makers. Unfortunately, the 3M mine contained a much softer mineral, which turned out to be useless as an abrasive. By 1904, 3M abandoned the business of raw material supply, deciding instead to manufacture grinding wheels. A superior invention by an East Coast competitor soon ended that plan, however.

The third attempt to operate a business involved sandpaper manufacturing. With competitors dominating the two U.S. sources for garnet, 3M found a source in Spain and received its first shipment in 1907. A sandpaper manufacturing plant was built in St. Paul, Minnesota. In 1910 all the materials to begin producing sandpaper were stacked on the first floor of the new plant, causing the first floor to collapse under the weight. The plant was rebuilt and production began. Sales in 1911 exceeded $200,000, but customers were extremely dissatisfied with the product because the crushed garnet simply fell off the paper when used. A keen-eyed employee discovered that the garnet left an oily residue in water. Investigation revealed that some casks of olive oil had broken and leaked onto the garnet during the rough Atlantic passage. Roasting the oil off the garnet
solved that problem and, after 12 years in business, 3M was finally able to boast of a profitable product (Three-M-ite cloth) in 1914.

In the 1920s, 3M hired a man who invented sandpaper that apparently could be used wet or dry. Wet sandpaper would be a huge innovation—by significantly reducing particles of wood or metal being inhaled by workmen, wet sandpaper could reduce work-related respiratory problems and deaths. 3M purchased his patent and for the next two years an engineering school dropout and banjo player named Dick Drew worked in quality control while others tried to perfect the sandpaper. Eventually he took samples to an autobody shop for testing. While there, he witnessed firsthand the frustration of autobody painters. Plaster tape was then being used to separate the two-toned paints, but its removal proved difficult without also removing the fresh paint. He became intrigued with finding a solution to that problem and immediately began working on it. Drew promised he could find a better adhesive tape, but after weeks of experimenting, McKnight ordered him to stop that work and concentrate on improving the Wetordry sandpaper. Drew did both and within two years, Scotchbrand masking tape revolutionized the market. From that point, 3M’s dominance in abrasives and adhesives took off.

Lessons learned from the early days:

- “Persistence—combined with creativity and faith—is still the best formula for long-term success.”

- “Don’t let one approach or solution blind you to better options.”

- “Give good people opportunities, support them and watch them thrive.”
• “Ask your customers what quality is—they never let the standard slip.”

(A Century of Innovation, 11)

Another early ingredient of the 3M culture of innovation that blossomed by the 1920s was its solid commitment to research and development (investment in R&D was initially pegged at 5% of sales and later raised to 6-7% of sales). R&D focused on “product development” first, but by the mid-1930s, it also included pure research. It was estimated that from 1926 to the early 1950s, $28 in gross sales were generated by each dollar invested in R&D. (3M Company, 2003)

As is evident in the brief sketch of 3M’s early years, leadership learned the value in having a “broad tolerance for failures [, which] powerfully reinforces individual thinking and initiative in personal creativity” (Mauzy and Harriman, 2003, p. 126). The contribution of that attitude to innovation will be discussed later in greater detail.

Over the course of the last century, 3M has created and sustained a corporate culture and hallmark practices that have fostered unparalleled innovation. Whether measured by the number of 3M patents awarded annually (typically 500-600), or by the revenues generated from new products as a percentage of total sales revenues, or by its customary ranking by industry analysts among the corporate elite in innovation (both U.S. and worldwide), 3M has earned its reputation for “lifetime achievement” in innovation.

Today, still headquartered in St. Paul, Minnesota, 3M operates in over 60 countries. Thirty-two of 3M’s international companies are involved in manufacturing operations and 35 are laboratories. Operations in the United States are located in 27 states.
In its 2007 *Annual Report*, 3M boasted a record $24.262 billion in worldwide sales. By aggressively pursuing sales opportunities in emerging overseas markets, 63% of that figure came from international sales, a percentage that is expected to continue to climb.

3M’s net income in 2007 was $4.096 billion, or 16.7% of sales revenues. In 2003, 3M estimated that each year between 1999 and 2002, the company generated over $4 billion from new product introductions. 3M spent $1.368 billion on R&D in 2007 and a total of $6.6 billion on R&D in the past five years. 3M owns over 20,000 patents, of which 571 were awarded in 2007.

*Business Week* reports that 3M “claims to have leading know-how in 42 diverse technologies” (Arndt, 2006). As of December 31, 2007, 3M employed over 76,000 people—34,000 in the United States and 42,000 internationally.

3M operates more than 35 business units, which are managed in six operating business segments, each responsible for global operations:

*The Industrial and Transportation Business segment* serves a broad variety of markets, including the appliance, paper and packaging, food and beverage, and automotive markets. Their products include hundreds of specialty tapes and adhesives, a wide variety of coated and nonwoven abrasives, closures for disposable diapers, and components and products used in the manufacture, repair, and maintenance of automotive, marine, aircraft and specialty vehicles, as well as cleaners, polishes, waxes and other products.

*The Health Care Business segment* serves markets that include medical, clinic and hospital, dental and orthodontic practitioners, and health information systems. Products
and services supplied to these markets include these: medical and surgical supplies, such as medical tapes, dressing, wound closure products, orthopedic casting materials, electrodes and stethoscopes; skin health and infection prevention products, such as surgical drapes, masks and sterilization assurance equipment; drug delivery systems products, such as metered dose inhalers and transdermal patches; dental and orthodontic products, including adhesives, finishing and polishing products, crowns, impression materials, preventive sealants, professional tooth whiteners, and orthodontic appliances. 3M also develops and markets software for hospital coding and data classification.

3M’s Consumer and Office Business segment serves the consumer retail market, office retail, home improvement, building maintenance and other markets. Products in this business segment have made the 3M brand a household name worldwide: Scotch® brand products, such as Scotch® Magic™ Tape, Scotch® Glue Stick and Scotch® Cushioned Mailer; Post-it® Products, of which there are now 1,000 different products, such as Post-it® Flags and Post-it® Note Pads; home care products, including Scotch-Brite® Scour Pads, Scotch-Brite® Scrub Sponges, and Scotchgard™ Fabric Protectors; and Nexcare™ Adhesive Bandages. The segment also manufactures construction and home improvement products, including surface-preparation and wood-finishing materials, adhesive products and filters for furnaces and air conditioners.

The Display and Graphics Business segment serves the electronic display, touch screen, traffic safety and commercial graphics requirements of many markets. Among this segment’s products are optical films and lenses for electronic displays (LCD computer monitors and televisions, cell phones, notebook PCs); touch screens and touch monitors;
computer screen filters; reflective sheeting (for highway signs, pavement marking, license plates) for transportation safety; and commercial graphics systems.

**3M’s Safety, Security and Protection Services Business segment** focuses on markets that increase the safety, security and productivity of workers, facilities and systems. Products include personal protection, safety and security products (such as reusable respirators, protective clothing, and reflective materials used on apparel, footwear and accessories to increase visibility in low-light situations), electronic surveillance products, energy control products (Thinsulate™ Insulation and, 3M™ Scotchtint™ Window Film for buildings), cleaning and protection products for commercial establishments, roofing granules for asphalt shingles, and supply chain execution software solutions.

**The Electro and Communications Business segment** provides innovative products for the electrical, electronics and communications industries—electrical utilities, electrical construction, maintenance and repair, equipment manufacturers of computers and peripherals, consumer electronics, telecommunications industry, as well as aerospace, military, automotive and medical markets.

When examining 3M’s historic and continuing record of success, business analysts generally recite specific innovation-enhancing practices with nicknames—the “15% rule,” the Tech Forum, the Golden Step awards, and the GRIT (Grass Roots Innovation Team), for example. The contribution of mentoring to innovation at 3M typically has been noted in passing, as a minor component among many, and mainly with respect to its easily-identifiable, discrete components.
If mentoring at 3M seems as invisible to outsiders as Scotch Magic Transparent Tape, the reason may be that mentoring is, in fact, the whole matrix in which 3M operates. The corporate philosophy articulated by William L. McKnight, 3M’s visionary president and later chairman (serving in these capacities from 1929 to 1966), recognized that entrepreneurship requires freedom for individuals to pursue innovative ideas and make mistakes in an environment of mutual respect among colleagues who freely mentor each other through constant exchanges of knowledge, ideas and suggestions. Myriad formal and informal mentoring policies and practices at 3M exist to facilitate innovation by greatly enhancing the knowledge base and competencies of technical and business employees. This has allowed scientists, with the help of their senior, peer and cross-divisional and cross-functional mentors, to identify, develop and introduce a steady stream of commercially marketable technologies.

Before examining the specific mentoring practices at 3M that foster innovation, it’s instructive to see how thoroughly and enthusiastically this connection is understood by 3M personnel. To a person, they attribute their career success and their job satisfaction to the mentoring culture of 3M.

**How 3Mers See the Role of Mentoring**

In the course of interviewing several high level current and retired scientists at 3M, this open-ended question was asked: What do you think is so special about 3M’s culture that it allows for it to be so innovative?
Dr. Matt Scholz, a corporate scientist in 3M’s Health Care Group where he has worked for 25 years, spoke enthusiastically about 3M’s “unique environment” of “phenomenal” networking and collaboration. Scholz credits his first two bosses for being coaches, mentors and models to him in ways he wanted to emulate. He estimates that he’s worked with hundreds of people at 3M and, as a result of collaborative mentoring, has many co-inventors from across the company named on patents with him. The personal networking, making human connections in an atmosphere of mutual respect, mutual learning and common purpose—commercialization—makes the job “fun” and “empowering.” He loves to mentor both formally and informally because of the opportunities it presents for teaching others, for learning new things himself and for deriving the satisfaction that comes from helping a colleague find the solution to a technical issue (or find the person in 3M with the solution) which produces the tangible result of an innovative product.

Scholz explained how his viewpoint on technology mentoring evolved under the tutelage of one of his early mentors:

“I think the first ten years or so that I was here, I would go to these poster sessions [where people explain what they’re working on] which we held several times a year. I was trying to figure out how each one of those technologies could help my project. One of the retired corporate scientists, named George Tiers, a very brilliant guy, changed the way I looked at things. He said he goes to every single booth at these poster sessions, not trying to figure out how they can help him, but how he can help them. And that describes the 3M culture more than anything. It’s these people who want to help you, and what a wonderful environment when you’ve got several thousand scientists working together to
try to help you grow. And when there’s so much diverse technology, you get a cross-
fertilization that’s very hard to explain. I mean people with optics backgrounds come up
and help you with anti-microbial stuff. In other words, it’s just phenomenal!”

Sharon Grosh, employed by 3M for thirty years, has served since 2003 as the Director of
Strategic Intellectual Asset Management. Ms. Grosh also describes 3M as a remarkably
“collaborative company.” Because of her work with outside companies that license 3M
technologies, Ms. Grosh was able to compare the environment and structure of 3M in
terms of mentoring to the environment and structure of some of 3M’s partnering
companies:

“I have worked with outside companies a lot and I do realize … a lot of them are silo
companies. So there’s individual business units running their business individually
without ever communicating with anyone outside. On the other hand, we almost have to
collaborate with other parts of the company, and we have an environment, we have
different infrastructures that allow us to talk with others. … We are a technology
company that develops diversified products, so we have the benefit of having core
competency in these basic technology areas.”

Ms. Grosh offers a concrete example of the benefits of a collaborating network of
scientists with different competencies:

“If I was in a plant, running adhesive, and I got bubbles in my adhesive and I couldn’t fix
it, I could call somebody that’s an expert in static electricity. Then they’ll say: “Well, this
is what you do. You’ve got bubbles, do this, do that, put this here and you know, you can
eliminate bubbles that way.” And that’s just a simple example, but people are very willing to help each other. And I just notice that some other companies are set up quite the opposite. There is almost a competition between groups.”

Dr. Andrew Ouderkirk is also among the elite group of about twenty-five “corporate scientists.” He works in 3M’s Film & Light Management Technology Center. Employed with 3M for 21 years and the co-inventor of a core technology responsible for a broad variety of products and billions in 3M revenues, Dr. Ouderkirk explains, inter alia, the central role of informal mentoring: “Anybody in the company can call anybody else and say I need your advice or help.”

Dr. Jayshree Seth, who joined 3M fifteen years ago and is a division scientist in the Industrial Adhesives and Tapes Division, has seen the value of mentoring in the innovation process and shared these observations with the author:

“Mentoring gives you a sounding board. And if you have the right mentor you can … be more innovative. Sometimes [mentees] just want people to say: ‘That’s okay.’ ‘That’s a great idea.’ ‘I think you should go pursue it.’ ‘I think you should go talk to this person’ … those kinds of things. Because a lot of people have ideas but don’t have the confidence to push it through, and I think that’s where mentoring could be very useful. Sometimes all you want is a sounding board, because you don’t want to unveil it too publicly and find out twenty people think you’re stupid.”
The person whose advice is sought does not have to be a formal mentor. She explains that 3M is set up in such a way that senior scientists are very approachable and pleased to share their advice and contacts.

**Overview of 3M Policies and Practices that Foster Innovation Through Mentoring**

From interviews and research, a list of twenty (often interdependent and sometimes overlapping) mentoring practices at 3M which foster innovation have been identified. Each will be mentioned in the discussion, organized into the following seven broad categories:

- New employee enculturation
- The “15% rule”
- Open door mentoring policy throughout every division and level of the company
- Collaborative concurrency teams of cross-functional and cross-divisional employees
- Technical networking and expertise sharing through formal structures
- Miscellaneous policies that support innovation (e.g., sponsors and champions)
- Celebrating and rewarding innovation

**New Employee Enculturation**

The enculturation of new employees principally entails introducing them to “the network” of experts available to help them with technical problems, career advancement,
and any job adjustment concerns that arise. It means folding them into the collaborative culture, helping them to identify as a 3Mer—a member of the team who is welcomed and expected to make significant contributions to the company. That expectation is not meant to intimidate newcomers; it is a mark of respect and solidarity, carrying the promise of the 3M community to help the new employees actualize their potential. Some aspects of the culture that are hallmarks of 3M (even if they are no longer unique to the company) are 3M’s heroes and legends, the freedom to pursue one’s own areas of interest while benefitting from collaboration with others, an open-door policy at every level of the company, its free technology “candy store,” 3M’s investment in their employee’s lifetime on-the-job education/cross-training to maximize his/her personal value and achievement, and an esprit de corps of “all for one and one for all,” the antithesis of the silos and secrets approach where corporate divisions compete for dominance over each other.

Acquainting new employees with the stories of 3M’s heroes and legends inspires their creativity, risk-taking and perseverance. Heroes and legends are the scientists whose dogged perseverance and faith in themselves and the value of their work paid off in their developing a revolutionary technology that has served as a platform for hundreds, even thousands of new products. The stories foster corporate pride and loyalty, and they also demonstrate qualities 3M encourages, or at least tolerates benignly, in its employees. The Dick Drew story, recognizing a market need through observing consumer problems unrelated to his sandpaper assignment, followed by a can-do attitude and even defiance of orders coupled with perseverance, shows that one can achieve success (indeed, hero status) with these attitudes and behaviors.
William L. McKnight, 3M’s leader for over four decades, learned that to unleash “systemic creativity,” management had to show patience and tolerance of failure:

“As our business grows, it becomes increasingly necessary to delegate responsibility and to encourage men and women to exercise their initiative. This requires considerable tolerance.

“Those men and women to whom we delegate authority and responsibility, if they are good people, are going to want to do their jobs in their own way. These are characteristics we want, and people should be encouraged as long as their way conforms to our general pattern of observations.

“Mistakes will be made, but if a person is essentially right, the mistakes he or she makes are not as serious in the long run as the mistakes management will make if it’s dictatorial and undertakes to tell those under its authority exactly how they must do their job.

“Management that is destructively critical when mistakes are made kills initiative, and it is essential that we have many people with initiative if we are going to grow” (Appledorn, 1997, p. 58).

Many of 3M’s oft-told tales of heroes and legends involve apparent failures that became blockbuster products through serendipity and perseverance (often against odds and against orders). Spencer Silver, for example, invented an adhesive that didn’t do its job very well: with pressure it would hold two pieces of paper, but not permanently. The papers could easily be separated without, however, the adhesive damaging the paper. Silver spent several years talking to 3M’s many businesses to see if there were any
product potential. There were no takers. By then, practically everyone at 3M knew about Spence’s useless glue, including Art Fry. And it came to his mind in the choir loft one day before a church service when a scrap paper bookmark fell out of his hymnal for the umpteenth time. The next day, Fry ordered a sample of the adhesive and saw he had the perfect bookmark. Then he wrote a note to his boss on paper he treated with the adhesive and realized he had the perfect Post-it® note. It would be years before the adhesive and manufacturing process was perfected and test-marketed, but it paid off in over 400 Post-it® products, sold in over 100 countries.

Hard work plus serendipity is also a recurring theme in stories of heroes and legends.
Patsy Sherman began working for 3M as a research chemist after graduating from college in 1952. She and her colleague Sam Smith were trying to develop a new type of rubber for aircraft fuel lines when a lab assistant accidentally dropped a glass bottle containing synthetic latex Patsy had made. The synthetic latex splashed on the lab assistant’s canvas tennis shoes. Patsy and Sam discovered the latex wouldn’t wash off with water and couldn’t be removed with solvent. It also resisted soiling. Although many experts had thought such a product to be “thermodynamically impossible,” Patsy and Sam immediately saw its value in manufacturing textiles used in furniture and clothing. Thus was Scotchgard® born.

As Jayshree Seth explained in an interview with the author:

“I think the myths and legends are definitely part of the culture, and that’s kind of our history. You know a few products that were really ground breaking in terms of satisfying an unmet need, and people coming up with those ideas and doggedly pursuing it in some
cases despite management decisions to kill and all of that. So these myths and legends I guess are rooted.

Dr. Lockwood Carlson, who retired after thirty-nine years at 3M, headed a small group focused on business acceleration or development. He is now a business consultant, and in an interview with the author, he describes the very natural and unstructured mentoring approach that has served 3M so well:

“[In the] technical community and technical management culture, most—ninety percent or ninety-five percent—of the mentoring was informal. … There were very few if any formal programs that actually got off the ground. On the other hand, mentoring with a small “m,” was absolutely crucial to innovation. …What we call technology networking accounts for the largest variance in innovation, plus or minus, in a 3M-type of organization. In other words, it was the main critical factor, and the fact that it was informal meant that it took many forms and was really totally woven into the culture and celebrated in various ways in terms of rewards and recognition.

“Rather than the textbook mentoring … many of the laboratories that I led or participated in, would have an informal program where a new hire would come in and that person would first of all be assigned … to show them where the basics are … to a more senior person for a period of months. But then, what we would do is watch closely to look for natural relationships of mentoring that start to sprout, and to me that’s the most important aspect. Not a formal imposed one, but a natural one that forms between two people, a senior person and a more junior person. And then, [you would] strengthen those, reward those, and reinforce them in ways that a technical manager can do.”
Dr. Carlson firmly believed that technology people need to form mentoring relationships, and their foundation has to be “mutual technical respect, professional respect”:

“The classic mentoring relationship that maybe textbooks and academics would look for is a little too formal for most technical people. And that’s why I believe in the technical community it’s been very difficult to have mentoring programs, they see it as artificial and a little Mickey Mouse. … It won’t take as well in a high performing technical community, compared to let’s say sales and marketing or even manufacturing. … Having said that, there are cases where some people at the very senior level—at my level, one guy I know, a well known chemist, every week he takes two or three young people out to lunch, and it’s mentoring, high powered mentoring because he happens to be a gregarious, outgoing person. He leverages his social skills in mentoring, whereas, other people, a mentor by being in a meeting and pointing out ways that certain people can advance their ideas or solve technical problems and no one’s really aware that it’s been happening.”

As asked how the culture of mentoring was set up in the first place, Dr. Carlson responded that one key was that the people on the management ladder have to support it—but it’s more about getting out of the way and providing a positive environment than any overt act of management.”

He hastened to add that there are exceptions that exceptions exist, where management can facilitate mentoring through over acts. A second key “is the technical senior people themselves. They have to see this as a high pay off, critical activity, as part of their job, part of earning that promotion they got to the senior level, not just how many patents they
had and so forth. On the other hand, management itself has expectations of the senior technical people and also has a delicate hand in trying to identify these budding natural mentoring relationships and then reinforcing them, rather than trying to push it on to people.”

The “15% rule”: 3M’s White Space

Retired 3M corporate scientist Roger H. Appledorn describes the fabled 3M “15% rule” as “an integral part of 3M lore, which is to say, our culture.”

The practice does not actually restrict employees to use no more 15% their time on a pet project; nor does it exist as a written rule. What it means is that any 3M technical employee can work on any project of his choosing—provided it could potentially benefit the company—and put in as much time as he or she wants, as long as the employee is getting his or her own work done on time.

There is no mechanism for recording the time spent on pet projects. Some scientists may spend 85% of their time on research that interests them and, clearly, that means a lot of evening and weekend work. But the creative thinking essential to innovation is more likely to occur when the scientist is passionate about the subject.

Interestingly, the 15% rule came about as the response of William McKnight to Dick Drew’s success in inventing masking tape (originally created for use in autobody paint shops), a product that forever changed the direction of 3M. Drew experimented with different adhesives and different backings for several weeks, but McKnight eventually ordered him to stop trying to develop a tape that could be removed without damaging the
surface to which it had adhered and return to work on sandpaper. Drew persevered stubbornly (but quietly), and eventually discovered that crinkly backing material would allow the adhesive to pull away from the painted surface a little bit at a time, reducing the risk of stripping paint off the surface. McKnight recognized that he had been wrong in trying to stifle Drew’s impulse to create a valuable new product. To make sure 3M scientists would have the time and freedom to pursue research that potentially had commercial value, McKnight conceived of this very flexible tool.

The benefits of the 15% rule go far beyond having free time to pursue unofficial research, however. Under this rule, employees in one business or division may spend their “free time” collaborating on projects in other businesses and divisions. The end result is more networking, more mentoring, more technology and expertise sharing, more cross-fertilization, and employees who are happier, more energized and challenged, and more valuable to the company.

Bill Coyne, a retired senior vice president of Research and Development, quoted in 3M’s *A Century of Innovation*, explains the central role of 15% time:

“The 15% rule is unique to 3M. Most of the inventions that 3M depends upon today came out of that kind of individual initiative. … You don’t make a difference by just following orders.”
Dr. Andrew Ouderkirk stresses the central importance of the 15% rule to innovation mentoring at 3M:

“Fifteen percent … is the currency of the [innovation] network. Without fifteen percent time you can’t really have a network. [You can’t have] access to multiple markets with[in the] tech forum community and [the 15% rule means] there is a large number of places that you can take your idea. And you won’t be punished for doing it. It’s essential for, again, molding the network and molding people to be entrepreneurial.”

The 15% rule often results in employees transferring to the business unit with which they worked informally during their 15% time. Dr. Ouderkirk explains that, although he has lost some talented young scientists to other business units due to their 15% collaborations, he supports this flexibility because it is clearly good for 3M and its employees:

“The best relationships are the ones that are action learning, action research. … So, fifteen percent time is often described as: you have fifteen percent of your time is to work on the project of your choosing, in any part of the company and with any group, any product. … What that does, is it allows people to get experience working with other teams on other projects that are outside their current field of interest. And of course, often times what will happen is that those programs start looking pretty exciting. … So I fully expect I’ll lose some people in my group due to exciting projects based on fifteen percent projects. … What’s interesting is that even though it hurts me personally [to lose a great employee to another group], since it’s such a strong part of the corporate culture, the expectation is that managers will support that process.”
Open Door Policy Throughout Every Division and Level of the Company

The open door policy 3M fosters among all its employees helps mentees to find specific solutions to technical problems and, more broadly, expands the corporate knowledge base. Asking questions and seeking help in other corporate environments might be seen as an admission of failure or inadequacy. The fact that informal networking is actively encouraged at 3M, and that the exchange of information is done in an atmosphere of “one for all and all for one,” help eliminate young employees’ fear of appearing foolish, and speeds up the discovery of technical solutions, product innovation and market placement.

Dr. Yarusso explained that “part of the 3M culture is that you’re just sort of expected to be open to providing information and talking to people from all different divisions and all different levels of the company as they call you up, because they’ve heard that you’re an expert on something. And so I did that in my early days. I got a list of names and I called these people up, and they were happy to let me come in and sit down and chat with them for an hour and ask all kind of dumb questions and get ideas from them and go back to my lab and come back and show them results later. And they might be in a totally unrelated function, and they would just do this and nobody ever batted an eye about it.

“And now that I’m one of the more senior scientists around, I find myself doing the same thing. I’ve got my name listed in one of the corporate websites, and we’ve got a skills roster, and so I’ve listed some of the things that I consider myself an expert in. And people look through that and find my name out of the blue and call me up and say, ‘Hey, can I chat with you about rubber adhesives, because I’m working on this product,’ and I say ‘sure.’ And so they talk to me on the phone or they come over and visit. There’s a lot
of that kind of interaction that goes on and that’s one of the great things about this company. Even though we might be under a lot of time pressure with our own projects, we still are willing to give that time to anybody who wants to ask questions and start chatting with them. And in addition to that you do find a lot of opportunities where multiple divisions might be working on a new process technology at the same time, because they all see some benefit for it. So, you get into these informal teams and start learning from them what they’re trying to do with it. ‘Well, we tried this and it didn’t work for this, but we learned this in the process.’ And just from those kind of informal communications, sharing what your experiment results were and where you’re going next, helps a lot.”

Dr. Ouderkirk compared his employment experience prior to working for 3M. In a year or two with his former employers, he got to know about twenty-five people well. At 3M, he noted, he knows six- to seven-hundred people on a first name basis: “I might not see them for ten years and I could come back and it’s just like we talked yesterday. It’s also a very open culture, in terms of helping. If you ask for help, it’s just a culture you feel obligated to almost to do everything to help that person out.”

Asked how he chooses the mentees with whom he will invest a lot of time, Dr. Ouderkirk explained:

“In terms of folks that I’m really going to spend a lot of time and energy and thought on, it’s usually people that are going to make an investment in themselves. It used to be that I just talked to lots of people and a group of people. I never really got into great depth with any one of them. Then I went to almost the equivalent of needing an MBA to do this
well. So I gave some of them seven books that covered everything from finance for
financial managers to logistics and product development. The point wasn’t that they
become good at this. The point was to be an innovator you have to be aware of all these
different things and the role they play. And if you know more about this area than the
person that’s running that area, then that’s a red flag. So, you need to be conversant in all
these different skills. What I found was that weeded out about ninety percent of the
people. But, the ten percent who do follow through, I invest a lot of time in, because they
invest a lot of time in themselves.”

Collaborative Concurrency Teams of Cross-functional and Cross-divisional
Employees

Sometimes innovation is inspired by a customer need (masking tape in autobody
painting). At other times, a technology innovation plus the customer need may inspire a
product (Post-it® notes). For any product to be a success, however, it ought to respond to
and exceed the customer’s needs, ideally “needs” of which the customer is still unaware
so that the product innovation will be first to market. Innovation also requires the
combined expertise of scientists, engineers who can devise a manufacturing process, and
advertising, marketing and sales people who can effectively convey how the product will
contribute to the consumer’s well-being.

Innovator, Know Thy Customer!

“I recall coming across historical records from abrasives that described McKnight’s first
sales meeting in the early 1920s. He said, ‘Go and find out what the customers want . . .
and come back and tell us what it is.’ That was the founding philosophy of 3M. From that came huge advances . . . from our understanding of the marketplace we served,” said Richard McGrath retired vice president, Industrial Markets (3M Company, 2003, p. 111).

When first appointed to the position of salesman, bookkeeper William McKnight knew little about how 3M’s sole product, sandpaper, was being used. He sought permission of customers’ “gatekeepers”—the purchasing offices—to speak to the men on the factory floor and observe what they needed.

This is, essentially, what Dick Drew was doing when he perceived the need for autobody painters to have a removable tape to separate the paint tones without destroying previously painted surfaces. Customers become mentors to the innovators by showing exactly what they need and how they will use it.

For more than a decade, 3M has been talking to “lead users”—innovative “companies, organizations, or individuals that are well ahead of market trends and have needs that go far beyond those of the average user” (von Hippel, Thomke, and Sonnack, 1999, p. 3). Lead users create innovative solutions for their specific business purposes, building on the best product currently available. They are consumers, not manufacturers, and therefore are happy to share their improvements on existing technology with 3M, which is then able to refine and develop new products that will appeal to early adopters and eventually to a broad market of routine users.
3M raised its historic “learn the customer’s needs” approach to product development to new heights through concurrent engineering and integrated product development focused on customer-needs.

3M’s Peter Fritz, the worldwide president of the Society of Concurrent Product Development, describes “Concurrency in a Nutshell,” quoting the Institute for Defense Analyses report “R-338, [December] 1988.” Concurrency“ is a systematic approach to the integrated concurrent design of products and their related processes including manufacture and support.” Fritz has overseen the 3M concurrency initiatives for many years at 3M. “This approach is intended to cause the developers from the outset to consider all aspects of the product lifecycle from concept through disposal including quality, cost, schedule, and user requirements” (Fisk, 2008).

Concurrency allows a company to “achieve multiple competitive advantages simultaneously: cost, time, quality [and] innovation” (Ibid.). Product development cycle time is reduced on average 50% across industries as diverse as agriculture to telecommunications.

Concurrency is a natural fit in 3M, given the level of networking and cross-functionality that has always been the hallmark of the organization. It systematizes the whole process and brings in the customer as a co-innovator, mentor and stakeholder. Key people who will be involved at every stage of development—R&D/Engineering, Marketing, Production Planning, Manufacturing, Sales and End Use—work as a team to plan the entire product cycle.
Peter Fritz explains that the byline for the Society of Concurrent Product Development (SCPD) is: “Integrating Strategy, People, Process, Tools and Technology. Those are the five pillars. How I see that happening here at 3M, you as an individual have got to come in with this mindset that, at best, you are bringing in information that a lot of people don’t understand. And recognizing that everybody else in that room is also bringing in information that a lot of other people don’t understand, and the best thing that you can do is start drawing out all of that information so that it’s in front of everyone, so that you’re really having a robust conversation. And understanding that, if we are to go down this path, it is going to have this impact on manufacturing, and quality and our customer, so how do we integrate those three stakeholders in a way that we can, I guess, do the best in trade offs and maintain our high quality, meet our manufacturing needs, and exceed the expectations of the customer. And so you’re having these conversations very, very early on in the product development cycle and then what that requires is again, the mindset of recognizing, ‘I need to bring someone in from manufacturing,’ very early on, because we’re going down an entirely different path here. We don’t even know how we’re going to make this. So, you better have somebody there who has an idea of how this can be constructed, before you start going down the path because they may lead you down different paths.

Fritz shared a practical example of the value of concurrency. He was asked to join a team that was looking into a new product. A certain part had been “spec’d” by the design team, which was planning to make the part out of polypropylene. Although he did not yet understand the gist of the project, from his manufacturing and technical background, he asked why they chose to spec polypropylene. The main reason it was chosen was that it
was the cheapest polymer available. Fritz asked them further what they expected the polymer to do. Their plan was to bond something to it. Fritz was able to explain that polypropylene happens to be one of the most difficult polymers to bond to. So they then discussed other materials that could meet the technical requirements. By having that conversation early in the process, the team was able to get on track and bring the product to market faster.

In a March 12, 2008 presentation, Peter Fritz describes customers as the “6th pillar” of concurrency. There are many reasons to think of the customer as part of the innovation team. Customers are experts in the “subject matter,” know the “behaviors of product use,” the “competitive landscape in their markets” and they want “to stay on the cutting edge.” Fritz describes the customer’s impact on concurrency in the same presentation as the following: “reduced development costs” (because the manufacturer is looking at “real needs” vs. “nice-to-haves”; reduced “speed to market … from Concept to Launch”; “Design for Manufacturability”—one that is compatible with the available technologies; and, an “enhanced sense of urgency.”

Concurrent Engineering and Integrated Product Development creates cross-mentoring relationships from every stage of innovation, resulting in the highest levels of efficiency, with no sacrifice of creativity, and customers who feel valued, loyal and grateful for their competitive edge. Another benefit of concurrency in innovation is that it trains scientists to keep commercial potential in mind from the earliest stages of product planning and development.
Fritz described his early experience at 3M:

“One of my early mentors here at 3M … suggested, as I was beginning to do some development work, that I bring together a manufacturing engineer, a quality engineer, someone from our production planning group, and our marketer. At a minimum you should have those four other people in the room with you when you start having this discussion about where you see this thing going. I thought, ‘Well, that’s interesting. Because here I am fresh out of college essentially, and I’m hired on as a technical person, and as a technical person I’m thinking: my job is technical! Boy was that an eye-opening experience, because in that first meeting, I started hearing things that, number one, I didn’t want to hear … because they were really going counter to the direction I was going as a technical person. But what came out of that, of course, was a modification of my mindset: It’s one thing for me to think of this problem and solutions from a technical perspective, and now it’s an entirely other animal to look at that same problem through the eyes of manufacturing, the eyes of sales and marketing, the eyes of our production planning group. There are a lot of other things that you need to take into consideration.

So as I was going through the design cycle, there were frequent phone calls to different stakeholders on the team, in between team meetings, just to make sure that I understood a specific aspect of what they had said at the last meeting. I wanted to do a cross-check to make sure I had not gone too far down another path that would either make this impossible to manufacture or impossible to sell.

“So, what I see on a lot of teams that are bringing new products to market, and sometimes entirely new technologies to market, is you will have several lab people, probably
someone from product engineering, certainly someone from manufacturing, and someone from marketing, at minimum. And typically that is the core team and then they will bring in other functional experts, as needed, and when we perceive that it’s time to have the conversation, let’s say with our supply chain folks, let’s bring them on board and let them know what we’re looking at so that they can give us feedback, that we’re either going down a path that’s going to end against a brick wall, or we’re going down a freeway. And so that’s how it functions here.”

Dr. Dave Yarusso also recalls that he was expected to incorporate commercialization thinking in the earliest stages of product development: “We always had a sense that ‘you’d better be working on this … for a product,’ and have some goal and some objective in mind. It wasn’t just to do science. Even in those days, I don’t think there were very many people who were just doing science for its own sake. The culture and the mentality is all about ‘let’s looking at interesting phenomena, but let’s figure out what to do with them. Let’s play around and try to come up with something useful for them’ and it seems to be the way people think in this company. And that’s what leads to perhaps thinking about how we can use this technology in different kinds of products we can use again or we could maybe use it here or we could use it there. So to me the thing that is unique about 3M is it’s ability to focus on so many different businesses to really leverage a given technology area.” He added: “The end game was in view from the beginning.”

3M’s multidisciplinary team approach toward innovation is used in developing official projects and is used as well in products being developed on 15% time.
Peter Fritz, manufacturing manager for the Automotive After-Market Division and a 3M employee for over twenty-three years, described his own progression from arriving at 3M—assigned to what he thought was a strictly technical job—and discovering that he was receiving a business and manufacturing education while on the job, so that products would have better opportunities for marketability:

“One of the things I discovered very early on is I put my chemistry experience on hold to start listening to what the business wanted and then got better at understanding how do I integrate my technical expertise with the needs of the market place. That was, a huge eye-opening experience. And then when I made the transition to become a technical service representative where I was out working with the customer on a regular basis, that closed the gap for me in the big way, because now I was able to say, now I get it. Here are the realities of the market place and the realities of our customer base, and then looking at the 3M pieces, to say these are all the 3M technologies that are available now from a business perspective, we need to take those customer needs and – both spoken and unspoken needs – and marry them up with the best 3M technology to have a business success.”

His experience, he stressed, was not exceptional. This trained awareness of all aspects of the innovation process, especially the customer needs, is the norm at 3M. He added that “some of the more profitable divisions at 3M, excel at what I’ve described.”
Technical networking and expertise sharing through formal structures

With 20,000 patents and tens of thousands more research findings that never made it out of 3M’s labs, but are recorded in 3M’s technology database, one scientist described the experience of working at 3M as being let loose in a candy store. The human knowledge database is even more impressive. Peter Fritz describes how both can be accessed:

“We have multiple channels where you can get at technical reports. So, let’s say that you go into the technical report database, and you do a key word search, you will find out, you will be overwhelmed by the amount of information that you can find. And then you might say, well geez, I see that there are four or five individuals here who’s names keep cropping up with this particular technology. I’m going to give them a call.”

Many senior scientists have worked in various businesses of 3M for 30 years or more, all the time expanding their knowledge of the key people and technological developments in other business areas. After retirement, senior scientists like Lockwood Carlson, Spenser Silver and Art Fry return often to help on technical challenges.

The Technology Forum, or “Tech Forum” is one of the most frequently identified specific tools at 3M, in addition to the 15% rule, that contribute to the company’s culture of innovation.

In an article in the Journal of Technology Transfer (1997, pp. 57-64), Roger H. Appledorn, a retired 3M corporate scientist, describes the rationale underlying 3M’s Technical Forum:
Innovation requires technology transfer which requires communication. It’s the responsibility of the CEO to establish a clear policy favoring communication and to establish formal and informal means of communication. The Technical Forum is an example of how this can be accomplished. It was founded in the early 1950s as a way to maximize technology communication among employees and with senior management. All technical employees belong to the Forum. The Forum is governed by a Senate made up of a senator from each laboratory or technical group and officers elected by the general membership. At monthly meetings, the Senate addresses issues of importance or interest to members, such as sharing technologies and best practices among laboratories.

The Tech Forum Senate also sponsors “chapters” that are communication fora in diverse technical disciplines, roughly corresponding to 3M’s core technical competencies. Employees in a discipline are encouraged to attend quarterly meetings of their chapter, where they can hear presentations by technical experts and share information about their own research interests and technical advances. There are currently about two dozen chapters operating under the 3M Technical Forum.

The Technical Forum also sponsors an Annual Event that lasts two-and-a-half days, which somewhat resembles a very glorified science fair. Each 3M laboratory has a booth where scientists can display—via poster boards, videos and demonstrations—their most exciting new technologies or new products. All Technical Forum members and their marketing counterparts are invited to attend, to observe and discuss the entries.
Dr. Appledorn emphasizes the value of the Tech Forum in creating a culture of technology sharing, and explains how its format and success are being replicated throughout 3M:

“The Technical Forum succeeds by breaking down barriers to communication and cooperation by establishing an atmosphere of collegial cooperation among scientists, engineers and technicians wherever they are located or on whatever they are working.

“This breaking down of barriers is also the role of a number of other organizations that have been formed in the interest of communication and to share best practices. Examples include the Technical Council (comprised of all laboratory heads in the company), the Manufacturing Council (all manufacturing heads), the Marketing Council (all marketing heads), and the Executive Conference (all 3M executive personnel)” (Appledorn, 1997, p. 60).

In his interview with the author, Peter Fritz, chair of the Technical Forum from 1996 to 1997, described the Tech Forum as “part of 3Ms DNA, and it’s all about freedom of technology sharing. The way that I’ve heard it described is—you can pick up the phone and within two phone calls you will have reached the right person with the expertise you are seeking. Anytime you are in an organization that allows you that kind of freedom to share information and to get at the needed technology or even have a conversation with someone who is familiar with the technology, it means you’re that much closer to getting something workable into the marketplace.”
Dr. Yarusso explained that 3M also hosts a less extensive Spring symposium which typically will showcase technologies “that are maybe still in the crucible and need some technical help to clear a hurdle. … So, you may see technologies in different stages of development, which is meant to be a little less formal, a lot more cutting-edge, from the standpoint that there are a lot more questions than there are answers.”

A favorite example of fruitful networking at the Tech Forum among 3M scientists was the result of a conversation between Andy Ouderkirk and a scientist at a booth adjacent to his. As Peter Fritz explains it:

“Here Andy Ouderkirk is standing at the annual event and he’s presenting the technology that he’s working, and it just so happens, very coincidentally, that he is right next to another group that is also sharing an abstract on their technology. Well, what happens with the annual event is that there are ebbs and flows in the quantity of people coming through, and so what they ended up doing is having a conversation as they stood there waiting for more customers to come by. Well, the more they got into conversation, they got excited about what they saw as a potential experiment that could elevate both of their technologies to a whole different level. Now, they weren’t sure it was going to work, but the possibility it seemed to be reasonable that success would be out in front of them. And, so actually, they could barely wait for the annual event to get over so they could get back to the lab and start planning some of these experiments.”

Ouderkirk was then “experimenting with ‘flash-lamp’ treatments of films to prepare them for adhesion by applying a sudden burst of energy to a film surface, melting it to a depth of .1 micron. [He] noticed a difference in light refraction between the melted surface and
the rest of the film. He told [Jim] Jonza, a researcher in Safety and Security Systems Division, that even more variations could be created by combining several film layers that had different refractive properties. ‘And, if you could put together layer after layer of film,’ Ouderkirk speculated, ‘you could make a very interesting reflective polarizer.’ To Ouderkirk’s delight, Jonza answered quickly, ‘We can do that.’

“The two men went to work. Jonza had a special co-polymer made and demonstrated the feasibility of the first reflective polarizer. Ouderkirk demonstrated the brightness enhancement this film provided to a liquid crystal display. Mike Weber, a senior specialist in specialty materials, Film and Light Management Technical Center, provided optical calculations” (3M Company, 2002, pp. 42-43).

Their technological breakthrough made headlines, such as “Mirror is fairest of them all” (BBC, 2000). “By carefully controlling the thickness of each layer, scientists can make the reflected light waves merge and amplify. In other words, they can tune the material to intensify the reflection. The result in 3M’s case is a mirrored surface that reflects more than 99% of the incoming light,” thus breaking “Brewster’s Law” of physics which held that” when the path of light exceeds a certain angle, the mirror stops reflecting altogether” (Ibid.)

The result, Fritz explained, “is an entire optical film business that is in excess of two billion dollars in sales a year.”

3M’s Grass Roots Innovation Team (GRIT) has been called “[o]ne of the most unusual 3M networking opportunities.” The GRIT’s purpose is to “empower the creative
potential of every individual at 3M.’ This informal team includes members from within
3M but also from outside 3M. It sponsors innovation trips, movies, lectures, etc.” (Davis,
2008, p. 18).

Virtual mentoring

It is not surprising that 3M scientists would take advantage of the Intranet to conduct
virtual mentoring of employees, in the traditional sense of career advice or how to
navigate the corporate bureaucracy, and in technology sharing for problem solving or
information on developments in technology that could be facilitate innovation in another
division now or in the future.

In his article cited earlier, Dr. Appledorn describes the value of 3M’s Intranet in terms of
technology sharing and networking:

“In addition, an explosion of 3M Intranet home pages has been occurring within the
company’s technical community. They focus on best practices and technical expertise
throughout the company. These on-line resources focus on specific technology areas or
resources from many different laboratories. This system is available globally, which, in
effect, creates informal technology teams that are not bound by geographic location or
time of day. The process also enhances the personal contacts that 3M regards as so
important to effective technology transfer.”

Peter Fritz elaborated on how the Tech Forum has been able to expand its reach globally
through 3M’s Intranet:
“Today, there is a virtual element to [the Tech Forum]. And they implemented that right around the late 90s maybe 2000, where they were traveling through with a video camera and just capturing nuggets. Let’s say that the scientist will be standing there, he or she would describe the abstract of the technology and point to a couple of posters and then give their vitals, so this could be shared with our global technical audience, for example, someone in the Chinese Lab. Now typically we don’t put people on a plane and fly them here for the annual event. If they happen to be here for training or whatever they get to visit this first hand and understand what’s going on. If they are in a Chinese Lab, now again, as a global member of Tech Forum, they have this opportunity of taking a look at the virtual abstracts and say, well here’s the contact information. They can email this person, pick up the phone, call them, whatever, to start making contacts.”

Virtual mentoring has also been formalized at 3M through an Intranet site dedicated to the employee’s “career and personal development. The site provides a strategic career planning process, information to guide employees as they set goals and document contributions, access to on-demand learning modules and suites of courses, mentoring guidelines and tips for aligning career goals to 3M business goals for greater success at 3M” (“Learning & Career Growth,” 2008).

Technology belongs to 3M – Ability to maximize its applications

A corollary to the freedom to share research throughout the company is that new technologies should be explored for possible applications throughout 3M, leveraging innovations as a competitive advantage. Dr. Andrew Ouderkirk describes how the view
That technology belongs to 3M, not to the Division that developed it, fosters sharing of knowledge and innovation across all divisions and businesses:

“There is a belief in the company that technology is owned by the company, products are owned by the businesses. That’s pretty fundamental, so if technology is invented anywhere in the company, anybody in the company has access to that technology, so patents that come out of one business are technically owned by the whole company. And this really fosters people to look aggressively at what groups or businesses could use this. And then you have the technical community that’s highly motivated to mold their technologies into as many different businesses as possible.”

Moe Nozari, executive vice president, Consumer and Office Markets (in 2002), and then a 31-year veteran of 3M, tells of the early lesson he learned in maximizing the potential product applications of a new technology throughout all the divisions of 3M. Nozari had discovered a “catalyst that could be used to create urethane, a component in many 3M products, including sponge brushes for surgeons, Tartan track surfacing material for running and race tracks, and Tartan surfacing materials designed for stadiums” (3M Company, 2003, p. 31). As Nozari tells it:

“I went to my boss, George Allen, who later retired as senior vice president, Research and Development, and said, ‘I’ve finished this. What do I do now.’ His answer was, ‘No, you’re not finished. Now you go to every division in this company and show them what you’ve done and work with them to incorporate your invention into their product lines.’ That was the best professional growth opportunity for me, because I learned about the company and the wide range of skills and responsibilities that 3M people have” (Ibid.).
While Nozari emphasizes the personal benefits he received from the experience, it is also clear that he served the role as mentor-technical expert to colleagues in every division, to assist them in finding innovative ways to incorporate the new technology into existing and new products.

**Miscellaneous Mentoring Policies that Support Innovation**

*If the employee’s division is not interested in supporting his development of a particular technology, he is free to seek sponsorship from other divisions*

In an interview with the author, Dr. Ouderkirk explained that normally “there’s really only one route that innovators can take their idea through, which is their manager. Imagine the situation where you have that route, but you also have the route to take it to a much larger technical community. They say, ‘Well, I can’t say that my boss isn’t supporting it for perhaps a very good reason, but for office supplies, I think that this would be a great product.’ Maybe that person’s looking for something new—the timing is better. The corporate culture is such that there is nothing wrong with taking your product idea out of your group and taking it to another group.”

Clearly the ability to seek sponsorship throughout 3M’s divisions greatly increases the odds that an innovation will receive the funding, attention and development necessary to get a new product to market. If the technology had to remain in one business only, it could die out there for the lack of a profitable application.
As asked what role mentoring played in Dr. Ouderkirk’s decision to be both an innovator and a manager, he explained:

“Here’s an interesting example of a product of mine that was “abandoned” for presumably being unprofitable:

“I came up with one product and they abandoned it mainly because they didn’t think they could make enough money off of it. It was a lengthy profitable product. And I looked at it and I said, I think the problem is the price is way too low, but I’m not an expert. And here you’re talking about a substantial change in price. So I found the best pricing expert in the company and, you know this culture is very flexible, and he actually worked on it. They actually liked the project so much they quit their job and joined ours. And it turns out one of the best decisions in our group. So you know the technical contribution as part of the invention as far as the pricing strategy was really strong. And, how often does it happen that it’s not the invention but the pricing strategy that is wrong? So, having mentors that can look at a problem and say, you know there’s forty things that it needs to have for it to be successful, here are the ones that are really affecting your probability of success, and how many people are still making that assessment—it’s absolutely critical.”

Dual career tracks

At 3M, researchers can remain on a technical career track or follow a management career track with parallel pay structures and career advancement, depending on their particular skills and interests. By allowing scientists and engineers to be professionally rewarded for their contributions on a par with executives in management, 3M can keep employees
where they are happiest and of greatest benefit to the company as experts and mentors. The potential for upward mobility on the technical career track, with salary raises, promotions, coveted awards and even “legend” status are all the incentive researchers need to collaborate, mentor, share technology and otherwise contribute to innovative products.

Roger Appledorn explains that under the “Dual Ladder” system, “it’s possible for a research scientist to advance to the rank of Corporate Scientist, equivalent to vice president, without leaving the bench. In practice, many scientists and engineers switch back and forth on the ‘Dual Ladder’ during their careers” (Appledorn, 1997, p. 60).

Writing in R&D, Tim Studt describes the rationale and value of the dual career path this way:

“Researchers can choose to follow a technical career path or a management career path, with equal advancement opportunities. This option is offered successfully by a number of technology firms, allowing researchers to more fully develop their technical professional interests without being penalized financially for not going into management” (Studt, 2003).

*Job transfers among departments and divisions encouraged*

It’s not only through self-selection, as a result of informal collaboration made possible by the 15% rule that employees transfer from one business or division to another. Cross-training is encouraged by supervisors, even though it means losing a talented employee, because 3M recognizes the importance of cross-training. Working in different
laboratories on different technologies means that young employees are taught by more mentors and they are introduced to a larger network of experts to drawn upon. They develop greater knowledge and more skills, which make it easier to solve technical problems and imagine new markets and new products.

Dr. Andrew Ouderkirk explained 3M’s policy of free movement in an interview with the author:

“Anybody can interview for any job in the company without seeking permission from their advisor, from their current boss. So, they’re free to move around the company.”

Dr. Yarusso explained that it’s normal for 3Mers to work in two or three divisions over the course of their career. He believes it is helpful in keeping one’s mind fresh, learning new skills, and bringing new ideas and expertise to a division. The practice is, in fact, “pretty strongly encouraged.”

Perseverance is rewarded, even when against the boss’s orders

It was Dick Drew’s refusal to stop trying to invent masking tape that convinced William McKnight to institutionalize “looking the other way” when researchers are determined to persevere. The 15% rule (with no mechanism for metering or monitoring) allows both management/mentor and determined researcher/mentee to compromise. Being told to stop working on a pet project—thanks to the 15% rule—is no longer a bitter rejection of the employee’s work or value as a scientist. He knows he can continue. If anything, a stop order provides an even greater incentive to the scientist to work harder and more creatively to perfect a marketable product and prove the boss wrong.
Another favorite story of perseverance in the face of a boss’s instructions to quit is the legend of Lew Lehr, a technical service engineer in 3M’s tape division. Lehr consulted with surgeons on developing surgical drapes with adhesive backs so they would stay in place around the surgical site and reduce the risk of infection. It was not making money, and someone up the chain of command ordered it killed because he was not convinced the surgical drapes would generate sales as the medical community was very slow to adopt innovations. Lehr’s boss, Hugh Tierney, agreed they’d stop working on it, but Tierney told Lehr to go ahead and let the factory produce a six-month inventory supply which Lehr would then have to go out and sell. During that time, Lehr negotiated two large sales contracts for the drapes, one with the U.S. Air Force and one with the University of Minnesota. The perseverance and new contracts earned Lehr a promotion and led to his creating a small medical-products business within 3M. One major innovation that followed was tape to replace standard sutures for wound closure. (3M Company, 2003, p. 73).

*Genesis grants*

Sometimes researchers will come up with ideas that are worth pursuing, but their projects are not qualified for funding through regular budgetary channels, if for example, they don’t fit under their division’s business. The Genesis Program was created in 1984 to provide seed money so these projects could be pursued, “optimizing the innovative spirit at 3M” (3M Company, 2003, p. 41). In the first year alone, over sixty applications were reviewed by a panel of twenty senior scientists. Recipients can use the money for supplies, equipment or additional support staff.
Roger Appledorn explains that researchers selected for Genesis grants “are given a year to prove feasibility. Ideas that show good potential during that first year become eligible for a second year of funding up to $100,000. The grant also includes the assignment of an aide or support person to assist with the idea” (Appledorn, 1997, p. 60).

The connection between Genesis grants and innovation is obvious. How does the award of a grant relate to mentoring for innovation? Being selected for a Genesis grant by a committee of senior scientists is a tremendous affirmation of the one’s project idea and shows confidence in the recipient’s ability to achieve the best results possible in his research. This recognition and positive feedback can motivate the recipient to work extremely hard to get results that show their confidence was not misplaced.

*Sponsors and champions*

Sponsors and champions (or “super brokers”) at 3M are heavy-weight mentor-promoters who help obtain funding in various divisions for mentee-innovator’s project, so they can continue to refine technology and achieve commercially viable products.

Lockwood Carlson gave a specific example of an occasion when he served as a sponsor, or “super broker” to guide the development of the Ouderkirk-Jonza optical film breakthrough:

“Well, at an early stage, 3M has a very large business mounting in optical products. It’s a multibillion dollar business, and there are a lot of reasons why it became so successful in a very short period of time. But, one of the foundational dynamics for that was the fact that there were technical entrepreneurs and innovators who really needed encouragement
to keep going, number one. And number two, needed some of this degree of separation connectivity, networking connectivity to what I call super brokers, which are people that are at the nexus or nose of the social networks, a very strong nose. And I think that I was one of them, and I ended up, kind of brokering a key—what turned out to be the key technology on Andy in this area, and helping him around the company to try different things, try different technical approaches and so forth. It’s a small part, and there were a lot of other keys, it wasn’t just me. There were several other kind of broker type people that were involved in helping this person move through the network of technologies and market needs, and eventually, in hindsight now, strike upon one of the most successful products in 3M, which is multi-layer optical film.”

There is, of course, a risk in being a sponsor, staking one’s reputation on mentoring the innovator through the necessary channels to obtain funding and the go-ahead to pursue novel potential products for unrecognized markets. Acknowledging a natural reluctance on the part of senior people to take unnecessary risks, 3M has adopted a number of incentives for sponsors:

“Sponsor incentives take many forms. At 3M, division managers have a bonus goal that 25% of their revenue should come from products introduced in the last five years. [Note: that incentive did work and later was ‘stretched’ to 30% and 4 years.] When the percentage falls and the bonus is threatened, these sponsors become amazingly receptive to new product ideas. The transfer process becomes much easier as a result” (Galbraith, 1988, p. 589).
Mentoring is a criterion on performance evaluation

Andrew Ouderkirk explained that “each senior technical leader is expected to be a mentor. So often times I’ll work with people and just say an expectation for your continuing advancement, one of the criteria, is your ability to influence marketization, and mentoring is a key way of doing that. I don’t think it’s the only way; some people are better mentors than others. And so I’m not asking everybody to be a great mentor, however, if somebody is a great mentor that would be something I would encourage. And often times I do that by setting up a formal team and giving that person an advisory role, or you can move them into management.”

Lockwood Carlson noted that the people that were not officially on the management side, but were in senior positions on the technology side … all had to some degree mentoring as part of their expectations. And as one got to the more senior positions, equivalent to one step up from a mid-level manager and upwards to the director level and so forth, there were formal expectations in the personnel evaluation process for mentoring.”

Peter Fritz added that 3M does “have these internal leadership attributes that they take a look at and I would think that [mentoring] probably falls under, “live the 3M values,” and so that would be that would be considered a core 3M value. If you are really good at it and you practice mentoring on a frequent basis that would be something that would be recognized. Now that’s on the performance appraisal side. On the more visible side, we do have something here called, the CTE and I, which is Circle of Technology Excellence and Innovation Award” which reflects the innovation payoff in successful mentoring.”
**Formal mentoring programs**

The Mentoring Special Interest Group (SIG), sponsored by the vice president, Community Affairs, is a volunteer organization that helps match prospective mentees with mentors. A “luncheon/kick-off session” is held each quarter to “launch” the new mentoring partners.

New hires in St. Paul are invited to join a new hire group mentoring program.

Dr. Ouderkirk has been as active in formal mentoring programs as he has been informally. He regularly presents a powerpoint presentation that he uses to teach both inside and outside the company. As he explained in an interview with the author:

“It goes through really trying to understand 3Ms innovation processes, and it’s saying here’s what they are, here’s how they work and why they work, and here’s why we use them and here’s some ideas about what works really well in what kind of situation.”

He also organizes breakfast meetings once a month “and we talk about business and things that people are coming up against. And often times it comes up with, how do they get something done. They want to implement a signature, create some change and they’re frustrated because it’s not easy.”

In addition, Dr. Ouderkirk is involved in another formal mentoring program. Once a year, the corporate scientists and Carlton Society winners each invite two technical employees from anywhere in the company. They have a large conference for two days where they exchange ideas of what people are working on. “We’re picking people that we think should get favor in the company and we give them time to present to all the
other corporate scientists and Carlton winners as well as each other. These are fantastic events.”

Peter Fritz told the author how he continues to benefit from “formal” career mentoring as well as informal mentoring:

“I do have a mentor that I meet with on a frequent basis and just run frequent issues by this guy and just talk about careers in general, technical things in specific. It’s just a great opportunity to bounce ideas off somebody else, so that would be the formal mentoring. The informal mentoring, are these technical people that you surround yourself with, feel very open to share insights ideas, passions, experiences, any kind of methods that they found were useful for them in say clearing a hurdle or addressing some kind of technical issue. And that happens very frequently.

*Formal mentoring/ “sponsoring” for foreign and U.S. employees serving overseas*

Since the early 1980s, 3M employees transferred overseas are assigned sponsors who will help ensure the employee “makes the most of that opportunity and, after the individual returns, the sponsor helps steer the person to the best opportunities” in 3M’s U.S. operations.

As 3M began operating laboratories far from its St. Paul headquarters, in Sumimoto, Japan for example, corporate scientists developed a pilot mentoring program (in 1996) so that Japanese researchers would feel comfortable contacting them with technical questions or career-oriented questions. They spent several weeks in Japan getting to know the researchers.
Formal mentoring through on-line courses

3M believes that “learning is a part of every employee’s job every day. 

“Continuous learning gives all employees greater opportunities to realize their potential. 
In a learning environment, the role of the employee is to be a continuous learner, the role 
of the manager is to reinforce learning and model learning behaviors, and the role of the 
company is to create systems that allow cross-functional knowledge sharing throughout 
the organization” (“Learning & Career Growth”, 2008). 

In accord with this perspective, 3M offers on-the-job training and traditional classroom 
settings. It also makes available “online learning and functional communities of practice” 
including the following: “suites of on-line supervisory/manager, business conduct and 
compliance courses; technical mini-courses in science and technology important to 3M; 
basic selling skills and product training; and on-line courses in giving and receiving 
feedback and coaching skills for all employees worldwide” (Ibid.)

Celebrating and Rewarding Innovation

Jeff Mauzy and Richard Harriman explain that an effective system of rewards can 
encourage creativity. They point to studies finding that rewards in the form of money or 
promotions tend to focus efforts on the goal rather than on creativity. Researchers may be 
tempted to bypass exploration and go straight for a less than optimal result to capture the 
prize. Such rewards also discourage information sharing with colleagues. They quote 
3M’s Geoff Nicholson: “If we gave monetary awards, people would close their 
notebooks to protect their ideas” (Mauzy, 2003, p. 124). In contrast, recognition as a
reward “encourages the curiosity-seeking, risk-taking, and connection-making behaviors coincident with creative thinking” (Ibid.)

In his interview with the author, Lockwood Carlson made a very important point regarding the role of mentoring being implicitly recognized in 3M’s technology awards:

“Of the standard awards in the technology area, almost all were dependent on mentoring, although the mentoring wasn’t explicitly awarded. We have Circle of Technology Excellence [and Innovation] Awards, which are annual awards. We have Golden Step Awards, which are for small businesses reaching a certain revenue level over a certain period of time. And these are usually the consequences of mentoring and enhancing innovation.”

The highly coveted Golden Step Awards recognize individuals, working as teams, who are responsible for achieving a certain level of sales profits within three years of the product’s market introduction. First introduced in 1972, there have been over 6,000 awardees to date.

Outstanding scientific achievements over one’s career are recognized by induction into the prestigious “Carlton Society.” The Engineering Achievement Award of Excellence and Alpha Grants for “innovation in administrative, marketing and other nontechnical areas” are also part of the recognition and rewards programs. 3M’s divisions also confer divisional awards for achievement. As Peter Fritz explained in his interview with the author:
Each “division will take in the applications that are sent in and they will look at them in three categories: there’s the individual category, there’s the team category, and then the champion. And this is, again, a very tangible way of recognizing people who have stood out, as individuals or teams that have stood out and champions that have stood out. Is a way of again bringing attention to their efforts and the way that they conduct themselves.”

Business historian Stuart Crainer noted that organizations can “transform the perspectives, aspirations, and behavior of people” (Mauzy, 2003, p. 130). The way 3M recognizes research and product breakthroughs does exactly that. 3M does not simply hand out a variety of awards for achievement in innovation. Recipients are celebrated, held up as models for the workforce, and the more prominent ones become the heroes and legends passed down from generation to generation of 3M employees.

“Award announcements on its Web site include the names of the inventors and teams involved, reinforcing the message. Banners announcing the birth of new inventions are hung throughout the company. The importance of innovation is reinforced in the minds and hearts of every employee daily. The barrage of communication feeds a developing dialogue about creativity. Employees become familiar with the topic, communities of opinion form on how to make it happen, and creativity becomes a systemic part of the company’s culture” (Mauzy, 2003, p. 131).
Conclusions

3M has done a superior job in recruiting and retaining top scientists who learn business acumen on the job. In an environment that supports collaboration and communication, their unparalleled success in bringing innovations to market is a testament to the culture they have purposefully developed and instilled.
RESEARCH QUESTIONS

How do the people championing innovation view the role of mentoring?

Sharon Grosh, the Director of Strategic Intellectual Asset Management, spoke for all the 3M employees interviewed when she praised 3M as being a remarkably “collaborative company.” This understanding of 3M as a unique place to work engenders employee loyalty, close identification of employees’ personal career goals with the success of 3M, and the employees’ sense of responsibility for maintaining the supportive 3M culture of mentoring.

The enthusiasm of 3M scientists for mentoring and their appreciation of its role in innovation was expressed best by Matt Scholz. Helping a colleague find a solution to a technical issue (or find the person within 3M with the solution), to help produce an innovative product is a supreme source of job satisfaction. He described as both “fun” and “empowering” the personal networking/mentoring that takes place at 3M in an atmosphere of mutual respect, mutual learning and common purpose—commercialization. Scholz spoke not only in terms of job satisfaction through mentoring, but quantified its value in referring to the number of patents on which he is named a co-inventor with numerous employees from across the company.

How and why is mentoring useful for innovation?

Informal mentoring within the “technical community and technical management culture” is “absolutely crucial to innovation,” according to Dr. Lockwood Carlson. This “technology networking accounts for the largest variance in innovation, plus or minus, in
a 3M-type organization,” he explained. When “anybody in the company can call anybody else and say I need your advice or help, as Dr. Andy Ouderkirk asserts, the ability to find solutions to technical problems, to envision new applications, to get support and funding to move an innovative idea to market are all enhanced.

**How is formal mentoring or mentoring training utilized?**

Because informal mentoring is so deeply ingrained in the 3M culture, formal programs tend to be narrow in scope and/or targeted to address specific populations (e.g., overseas employees).

Formal mentoring/sponsoring programs were developed to help integrate foreign employees in overseas locations into the 3M community and to smooth the transitions of American employees who work abroad, to both get the most out of their experience working for 3M overseas and to find the best opportunities within 3M once they return to the United States.

A “new hire” group mentoring program is available to employees at the St. Paul headquarters.

A monthly breakfast meeting program provides a forum for seeking mainly non-technical advice from senior scientists like Dr. Andy Ouderkirk.

GRIT, 3M’s Grass Roots Innovation Team, sponsors innovation-related lectures, movies and trips to “empower the creative potential” of every 3M employee.
A Mentoring Special Interest Group helps match prospective protégés and mentors.

Lastly, 3M offers many online courses for their employees covering, among other topics, how to give and receive feedback, coaching skills, and supervisory/management skills.

**How do mentors and protégés find each other to work on innovative projects?**

3M has put in place an impressive variety of ways that protégés can find mentors to collaborate on innovative projects. The long-standing 15% rule, as has been noted, creates the white space where employees can network throughout 3M, as well as with consumers and lead users, for technical help and advice in general on developing their own product ideas. Fifteen percent time also frees employees to discover ideas and projects throughout the company on which they would be interested in collaborating. “An explosion of 3M Intranet home pages” facilitates this process, according to Dr. Roger Appledorn.

In terms of products “officially” in development, supervisors may assign employees to cross-functional teams. The young scientist can thereby be mentored to gain an invaluable business perspective, working in a concurrency model, to learn to innovate efficiently and successfully.

There’s also an understanding at 3M that working in different divisions and even different functions (technical or managerial, for example) builds employees’ skills and expertise and strengthens the overall network, helping to create the next generation of innovative, collaborative leaders. Therefore, employees are encouraged to transfer jobs
within 3M and be mentored by others, without seeking permission from their current boss, Dr. Ourderkirk noted.

Additionally, the formal sharing of technical information through Tech Forum, chapters, monthly meetings, monthly breakfast updates scientific and technical breakthroughs, and so on, coupled with the ability of every employee to follow-up with a phone call or visit to any other employee through the open door policy, allows protégés to get to know potential mentors and select those with whom they would like to collaborate.

**How do firm factors, such as size of organization, product offerings, and type of industry affect how, when and why mentoring relationships are developed or nurtured?**

Formal mentoring programs, in the textbook sense, are not easily incorporated into technical communities, according to Dr. Lockwood Carlson. He explains that scientists tend to see mentoring, in the formal sense, as “artificial and a little Mickey Mouse.” Instead, in the labs he led and worked with, a new hire would be assigned to a senior person for a period of months simply to show the basics. But then he and other senior lab directors would “watch closely to look for natural relationships of mentoring that start to sprout.” In his eyes, “that’s the most important aspect. Not a formal imposed one, but a natural one that forms between two people, a senior person and a more junior person. And then, [you would] strengthen those, reward those, and reinforce them in ways that a technical manager can do.”
As a technology and manufacturing company with a worldwide scope, mentoring at 3M is dominated by technology information sharing and concurrent development mentoring. The face-to-face networking, exchanging of ideas and building trust that began a century ago at 3M is still highly valued and nurtured. Senior executives and scientists are proud that strong personal bonds of community exist despite the growth of its far-flung workforce. The relatively unstructured “science fair” style of the annual Technical Forum creates a family reunion atmosphere where face-to-face mentoring can take place and where prospective protégés can make initial contacts with prospective mentors. Filming and podcasting Tech Forums for employees in overseas labs expands the audience of prospective protégés to locate the mentors they seek, aided by 3M’s open door policy and technical information sharing across divisions.
LESSONS LEARNED

1. Innovation is not a top-down process that managers can order up on demand. Innovation requires giving employees the freedom to dream and pursue ideas collaboratively in an environment of mutual respect among colleagues. One of the McKnight Principles—Give good people opportunities, support them and watch them thrive—gave rise to the famed “15% rule.” This rule provides the white space where employees can explore their own or others’ innovation concepts and collaborate in their development on company time. Employees reward this trust with integrity, performing their assigned tasks well and promptly, and putting in extra hours to accommodate projects about which they are passionate.

2. Technology innovation rarely occurs with a lone scientist shouting “Eureka” in his lab. Informal, personal mentoring through 3M’s Open Door policy creates a congenial climate of networking among friends who freely impart technologic expertise, advice and wisdom. If two heads are better than one in the pursuit of innovation, 40-50,000 heads are better than two when with two phone calls or mouse clicks one can find the person who knows exactly what the innovator needs to know.

3. When a company’s products involve leading edge technologies, innovation requires a large, sustained financial investment to support product development and testing. But the “tech guys” fresh out of graduate school must be trained to think commercially for breakthrough invention to become revenue-producing product innovations. Early introduction of researchers to the business side through
participation in project teams helps keep their focus on customer needs, practical applications and profitability.

4. Closed silos and secret labs, a mentality of seeking personal or divisional credit for an innovation, stifles the free exchange of expertise that often triggers research breakthroughs. The open door policy and project teams alone cannot take full advantage of the constantly evolving expertise of thousands of current R&D staff of 3M. More formal methods of information exchange were needed to capitalize on new research findings. In a spirit of “one for all and all for one,” 3M created the Technology Forum—originally a glorified poster board science fair. Today, Tech Forum chapters in each of at least two dozen core competencies, sponsor regular meetings with presentations by technical experts and information sharing. Many such sessions are podcast to 3M labs across the globe.

5. Creativity and a job well-done may be its own reward, but nothing spurs true innovation like peer and corporate recognition in the form of celebrated and coveted awards for innovation. The 3M culture has always celebrated a pantheon of heroes and legends who (with the help of their teams) developed technologies that gave birth to entire product platforms and revolutionized the way Americans (and others) live and work. The people and stories behind the invention of adhesive tapes, Scotch tape, Post-It notes, ScotchGuard fabric protector, the first light-weight overhead projectors for classroom and business use, and optimal films to enhance brightness of LCD displays are told and retold to enculturate new employees and mentor them in what models of success look like at 3M. The company annually celebrates its new heroes and legends with fanfare and
statuary—which acts as both reward for the person and team and as a catalyst for further innovation.
CHAPTER V

Procter & Gamble: Innovating Innovation

Procter & Gamble (P&G) began as a candle and soap company almost two centuries ago in 1837. Since then P&G has grown to employ 138,000 employees in more than 80 countries who provide a full range of consumer products and services in over 180 countries.

In the early 1800s William Procter and James Gamble had both established themselves in Cincinnati, William as a candle maker and James as a producer of soap. While in Cincinnati the two, never having met each other, married two sisters: Olivia and Elizabeth Norris. Alexander Norris, the father of both girls, urged his two new in-laws to go into business together and in 1837 the two solidified their new partnership by forming their new venture, Procter & Gamble, which was finalized in October of 1837.

In the mid-1800s the invention of the electric light bulb caused a decline in the popularity of candles. In the 1890s William Alexander Procter took over as President and the company began looking towards expansion. However, this expansion was limited to operations. It wasn’t until 1917 that P&G made a definitive move to widen their product line by creating their Chemicals Division. Until then the company only had three products: candles, soap, and Crisco, which it had introduced in 1911.

The 1930s were a golden age for P&G; its investment in their new Chemicals Division began paying off as new products began coming to market. Expansion was not limited to product line, but came in the form of business operations as well when P&G entered the Far East by buying Philippine Manufacturing Company. At the same time P&G’s growth
presented a greater need for corporate structure. In 1943 P&G formed the Drugs Products Division with the purpose of dedicated sales of toilet products, a new area where P&G had expanded its product line. This was P&G’s first dedicated division, but it would not be the last.

Over the years P&G has been at least as innovative with regard to business practices (i.e. dedicated divisional structure) as it has been in new product development. They have also dedicated significant resources toward research and development of new consumer products with the goal of bettering the lives of consumers. In the 2004-2005 fiscal year, P&G invested $1.8 Billion (3.5% of net outside sales) in Research and Development (R&D Mission, 2008).

P&G knows that its employees are its most important resource/asset, and for that reason has developed around the following 5 values (Who We Are, 2008):

1. Integrity
2. Passion for Winning
3. Leadership
4. Trust
5. Ownership

At the center of P&G’s operations for the following principles (Who We are, 2008):

1. We Show Respect for All Individuals
2. The Interests of the Company and the Individual are Inseparable
3. We are Strategically Focused in Our Work
4. **Innovation is the Cornerstone of Our Success**

5. We are Externally Focused

6. We Value Personal Mastery

7. We Seek to Be the Best

8. Mutual Interdependence is a Way of Life

Comparative analysis to other large innovative companies provides even deeper insight into Procter and Gamble as a corporation. P&G holds about 1,700 U.S. patents (25,000 currently enforceable patents worldwide), which is comparatively “fair” when relative book value is considered. However, where P&G truly excels in its innovation is in operations. P&G has almost a 51% average gross margin for the past 5 years, with 4 of the past being over 50%, which is astounding. The only other company that comes close is 3M, which has still been unable to achieve such efficiency.

P&G merits in-depth study as a company that successfully mentors for innovation on the basis of its positive and its less-than-helpful practices during its long-standing dominance into the 1990s. Mentoring for innovation (even if it had not been identified as such) and high level expertise in core science and technology would have guaranteed the continued success of P&G had not the pace and quality of consumer product innovation accelerated dramatically in the 1990s, due in part to the globalization, emerging economies and the ease of IT transfer.

Unprepared for the new hyper-competitive atmosphere, certain traditional business practices within P&G made for a slow pace of innovation and a slow response to this
phenomenon. These led to declines in market share and profits. What were some obstacles to innovation efficiency?

- Discovery, not commercialization, was the prime motivating force of many in R&D.

- Fear of failure dominated decision-making at the many levels of review.

- Higher value was placed on conformity and obedience to the “Current Best Approaches” (CBAs) than on creativity.

- Packaging and advertising were uninspired.

- If one can measure the absence of something, there was an almost complete lack of attention to design aesthetics.

**Smothering Innovation**

Lisa Stilwell, who joined P&G in 1980, is currently a human resource director with responsibility for human resources for Market Research and External Relations, reporting to both P&G’s chief marketing officer and to its executive vice-president in charge of Innovation and Design, Claudia Kotchka. In an interview with the author, Stilwell summarized the transformation in innovation mentoring (and lack thereof) that P&G has undergone in the past 25 years. In the early days, R&D people were “just creating molecules that had no merit or application. And then they added some finance people to that department and actually started teaching them … saying, ‘What do you think you can do with that molecule? How many people do you think would buy whatever that might
be?’ Running them through simple math exercises and saying, ‘How long? How much time? And how much money do you think it’d take?’ Only further downstream in product development or package development would there be business-exposure mentoring for innovation.”

Under such a system there had been “tension between the business people who want to control and execute” product development that sits squarely within the five-year business plan and “a lot of creative and entrepreneurial people who want to work on tangential things. [And the business people] are constantly trying to rein that in.”

Lacking 3M’s flexibility for fostering innovation through the “15% rule,” operating in a culture that rewarded following the CBAs and discouraged non-scripted, unapproved innovation, one of P&G’s signature revolutionary products might never have made it to market had it not been for one oddball indulgent mentor. The inventor of Crest Whitestrips was ordered by his R&D line manager to not pursue his idea because it had nothing to do with the toothpaste technology of fighting cavities or tasting better. The inventor’s mentor encouraged him to continue on the side to refine the product to a point where senior people could see the value in pursuing it despite its irregular origin.

Amazingly, this phenomenal success did not produce an “Aha” moment for P&G executives. According to Stilwell, the official position is still that “we don’t want to authorize that, we don’t want people to do that, we want things to be more transparent and visible and trust that we’ll make the right decision.”
Mark Steinhardt, a research fellow with P&G for 31 years (for the last ten having “Experienced Entrepreneur” on his business card), managed to thrive in such a stultifying business model by ignoring the CBAs and following his instincts. He was able to innovate in relative isolation within the corporate structure, which largely kept him from being an irritant to his betters and a “bad example” to the young ’uns. Steinhardt admits that CBAs are essential to avoid chaos in a company the size of P&G, but adds that dogmatic adherence to the manual and myriad other protocols can smother innovation:

“If in fact you start all dressing alike, talking alike, writing alike, doing the same things, you start to sound … I’m not saying that P&G folks are lemmings, but what you see is a lot of drinking the Kool-Aid. You just see a lot of folks, if you will, having the P&G perspective, which is kind of ironic because we’ve gone to great lengths to hire and promote and train a wide variety, a diverse workforce, for the fundamental advantages of different ways of thinking. Yet we bring these folks in and then we kind of train them in ‘P&G speak’.”

Steinhardt does mentor people, and dutifully trains them in the P&G way so they can “survive” after he’s gone. But recognizing that they’ve chosen to be associated with him because of the way he does things differently, he helps nurture in them an “ability to stretch for greatness.” He teaches them to navigate the fine line between being creatively provocative and getting “voted off the island.”

His success, and the success of his protégés, comes from honing their intuition in identifying the unrecognized needs of consumers, being constantly on the lookout for
opportunities to improve consumers’ lives, which is coupled with his passion for commercialization.

Steinhardt told the author an anecdote that reveals volumes about the “old” P&G way and about Steinhardt’s Tao (which P&G is beginning to follow). Note the consumer-oriented creativity in product concept, the mentoring for innovation, the protégé’s success, and the horrified reaction of a senior research fellow who was more concerned about protocols and seniority than about a profitable new P&G product that makes consumers happy:

“In the mid 1990s,” Steinhardt related, “I was working in the toilet paper industry. … Charmin at the time was about Mr. Whipple and softness. You know, ‘Don’t squeeze the Charmin.’ So, the whole program was geared towards how do we make Charmin softer and talk about softness, and demos and all kind of good stuff. [Then I start thinking,] what’s this category? What’s this really about? Well, at the end of the day, toilet paper is about hygiene. It’s about getting yourself clean after a bathroom visit and not getting stuff on you, okay? So, if you talk about hygiene … you come to the realization that dry toilet paper is not exactly the most hygienic. In fact, the standard of excellence is a shower. How do I stay shower fresh all day long in between these different bathroom visits there?

“So, I had a couple of new individuals working for me who hadn’t yet been ‘procterized,’ so they were an open book. You could open this, you could write on their brains, and say let’s go for this, let’s go for this. And essentially – what would need to be true to take this to the next level? Now, it’s a very technical and a very cool story. But you can just imagine trying to talk the general population about getting cleaner with moisture-scented
products, and most of the people are just used to going to the bathroom and pulling dry toilet paper. So, it’s a disdainful topic to talk about. I would say it’s almost an indictment on their behavior all those years of their lives. We’ve managed to learn … what’s the right way to talk to people, to get breakthroughs in the conceptual representation. … Tom got it. He was having a blast. Here’s an individual who actually joined the company as, what we call a “T1”, entry-level technician—but a T1 that had a patent in his first year working on this stuff!

“And I remember having another person, who was a research fellow like myself, storming into my office one day. Bob says, ‘I just found out something!’ … ‘I just found out Tom’s only a T1 and I thought he was a T4.’ I said, ‘So, does that matter?’

‘‘Well…” Well, the point being was that Tom was being influenced and mentored to think for himself, not drink the Kool Aid, and he was behaving at three levels above his. That person who was looking at the organization chart every day didn’t realize that he was at that different level.

“What we’re selling in the market place today is a whole slew of products, you know, Charmin moist mates, and all. … Here’s somebody who thinks, we’re not going to work on just making Charmin softer for the umpteenth time. And we’re not going to work by just taking more sheets off when we make it softer. … We’re going to take this to the next level, and here’s an individual who … didn’t know any better. And you have to shield people sometimes from the folks above you and say, ‘We’re working on it. We’ve got it covered.’ And you deliver these way cool things to the organization.
“In this case, the person has gone on and continues to do innovative work. He’s one of the key people, for example, who put out the Puff Plus with Vicks that is doing fabulously well this season. You see these kinds of skills can rub off on people when they have faith. They trust their instincts.”

How long can a company prosper when some of its most creative and successful people are thought to be slightly dangerous and when smart young innovators have to be “shielded” from management death rays?

In *Making Innovation Work*, Davila et al. describe the declining health of P&G in the 1990s: “new product commercialization process was painfully slow. Fiefdoms had developed, and these had frustrated significant attempts at significant collaboration and change. Finally, the working relationship between the brand managers and the technology development managers was often strained and painful” (73).

P&G’s once dominant market shares in the three D’s—detergents, dental care products and disposable diapers—had lost ground, as competitors like Colgate and small start-ups (e.g., Tom’s of Maine) catered to new and unrecognized consumer needs (unrecognized by P&G anyway). One example illustrates this mentality well. The formulation, packaging and marketing of Crest toothpaste had not changed appreciably in years. For P&G, the raison d’être of toothpaste was cavity-prevention. Packaging was almost stubbornly dull and ads were variations on “Look, ma! No cavities!” Unbeknownst to P&G, consumers wanted more a lot more from their dental care products. They wanted sexy, dazzling smiles, sweet, minty breath, “organic” ingredients, and, among the older crowd, healthy gums, too. Kids’ cavity prevention was no draw for the young and
childless or to the elderly hoping to avoid gingivitis and dentures. And those with young children wanted cavity-fighting toothpaste that kids would use without coercion with, say, bubble-gum flavor. Between 1987 and 1997, Crest’s market share dropped from 39% to 25%.

P&G’s long-standing dominance in consumer goods had resulted in a cautious, process-laden, hide-bound, by-the-book approach to every aspect of business. The goal was to minimize the risk of failure. Focusing on perfecting new product technology translated into never-ending R&D before consumer product testing. That can result in the perfect product five years after a competitor’s brand has captured the new market. P&G, for example, had its own gingivitis-fighting toothpaste when Colgate’s Total hit supermarket shelves. It had been in R&D for at least six years at that point (Brooker, 1999).

Where the goal is to reduce the risk of failure, multiple levels of management review are almost guaranteed to stifle anything novel. P&G hires out of school and promotes from within, and that means that it was the P&G way or, rarely, the highway. CBAs explained the P&G way to do everything from writing memos to running market tests to approaching retailers. No additional tools, like thinking, required!

Ads for P&G products were just as formulaic, explains Brooker: “problem, solution, product demonstration.” Creating an ad outside the P&G formula earned one former brand manager a chewing out for being a “troublemaker” instead of praise for innovative thinking.
After examining the many ways P&G in the twentieth century gummed up the innovation chutes, it should be clear how much P&G also did to foster innovation, through mentoring and other practices.

**How Mentoring for Innovation Kept P&G on Top for Over a Century**

Karl Ronn, vice president for R&D in Home Care, underscored in an interview with the author, how pervasive formal and informal mentoring for innovation has been in his 27-year tenure at P&G. As he sees it, mentoring is engrained in the culture because P&G is a “promote from within company.” Employees who have been with P&G feel a natural obligation to help groom newer employees in the business of innovation:

“As we try to do new things, we often have people who are coaching people on new skills, teaching, training people, but also then there’s this mentoring and sponsoring stuff that’s going on. So, you’re trying to grow the people in the organization, and we have to grow them because there’s no ‘call up a head hunter’ to replace them. That’s not one of our options. And so I think that affects the environment. … P&G is an innovation company, and so whether Claudia [Kotchka] is talking to you about design, or you talk to somebody else on the commercial side of it, or me on the technical side of it, we’re all innovating. … I do a type of innovation that is more comparable to other scientists, if you will. I’m a chemical engineer. That type of innovation people understand, but frankly we try to innovate holistically, 360-degrees … and so we expect all functions inside P&G to innovate. Frankly, I mentor people who are outside of R&D, as well as people who are inside R&D.”
Ronn further explained that an innovation culture must be a learning culture where employees can easily seek feedback from each other:

“What you know gets in the way of your learning. … This is why you need other mentors, because they are people that you can learn lots from and they’re not the people who are just in the line doing what you’re doing. You could be suffering groupthink. You need another access point, so why not go get mentors. … You’re always changing. You’re always learning, and you need a network to help you do that. The first type of mentor that you need, is somebody who … does what you do, but does it a whole lot better. … to whom can say, ‘You know, I’m trying to do a new consumer test and I tried these kinds of ways and it hasn’t really worked for me, what do you think I ought to try?’ So, you sit down with them and you have a discussion about that. So, that’s the first mentor that you need, and that’s skill-based mentor.”

Ronn believes that to be successful innovators, employees also need to seek out mentors who have been commercially successful in P&G, someone “who knows how to get things done … who knows how to get things through the system.”

The P&G commitment to mentoring, which began about twenty-five years ago, was originally driven not by an innovation motive, but by the company’s commitment to diversity. As Ronn explains it, black women managers were then rare in corporate America. P&G’s black women managers “started working together as a group to try to figure out how we would retain and advance black women, and then, black managers, and then women managers, and then all managers” and other inclusion groups, such as Hispanics and Asian-Pacific Americans.
To encourage informal mentoring in his own department, Ronn maintains an “open office environment” that allows for colleagues to talk with him informally, without having to make an appointment.

Reverse mentoring is a phenomenon that seems to be used increasingly at P&G. Karl Ronn readily acknowledges the benefits of reverse mentoring for himself personally and for enhancing skills needed for innovation. He is grateful for reverse mentoring because, as a 1980 college graduate, he recognizes that the “world is very different today and … I have to maintain my skill base and understanding of what’s going on at all levels in the organization.” To do so, he and his managers “will have reverse mentors on various subjects.”

He also described the systemic reverse mentoring that occurred when A.G. Lafley and Claudia Kotchka began the campaign to imbue design in all aspects of P&G’s innovation: P&G “assigned presidents design managers as reverse mentors to teach them stuff, how they thought about problems and design. And those were low level people teaching presidents. We assigned all the director and vice president and above in R&D women mentors for all the men, so that they would have a reverse mentor for women.”

Additionally, A.G. Lafley has used reverse mentoring on issues, such as policy issues, to get managerial feedback on how they think about regulatory issues.

Ronn also noted the mentoring is taken into account in evaluating employees under “organizational contributions.” An employee might typically list the names of persons he or she has mentored.
In terms of “career” or “management” mentoring, Ronn may mentor only a handful of people regularly, but scores of colleagues will visit him for advice infrequently over the course of a year or two.

While emphasizing that innovation is always a team effort involving cross-mentoring, he was able to cite a specific example of a six-month mentoring process with a senior technologist whom he was sponsoring in a new product line in a very tough market. To continue his support for the innovation confidently, Ronn needed to be assured that the products were going to be winners “five, ten years from now” to make the substantial financial commitment in marketing the new product worthwhile. Ronn’s competency is in managing individuals, not in understanding the technical expertise of that inventor and how it related to a product success for P&G:

“And we stuck with it until he actually was able to articulate to me, over a period of about six months [trying to explain to me why the product would be so successful, and I finally said]: “That is a sustaining reason to win in that business.” And so, when we went to market, I was able to articulate why our market entry was going to succeed even past the first two initiatives. I know why we will win long-term and that came through a mentoring discussion—that insight. Working with him, to be able to define what his actual area of expertise was and what was most valuable for the business. So, through mentoring we were able to focus his career and, at the same time, meet my need to focus our innovation strategy, and that came out of a mentoring discussion.”

Mentoring to enhance one’s success as an innovator has played a crucial role in Bonnie Gleaves’ 20 years at P&G. Currently the R&D director for Global Auto Dish (in non-
P&G-speak: detergents for automatic dishwashers wherever marketed globally, e.g., the Cascade brand in the U.S. market), Gleaves received the mentor of the year award in 2006 from the African American R&D community at P&G, in recognition of the many, many women and minorities she regularly mentors. Yet Gleaves herself may have three or four mentors at any one time.

In the last five years, her managers developed a formal mentoring program with her, discussing her “mentorship needs,” talking about “possible candidates” and “identifying mentors” for “much more of a formal role.” She has been mentored by managers “up” the organization, by peers and by lower level staff. For example, when she was transferred to “Hand Dish” (detergents for washing dishes by hand, such as Dawn), she explained:

“I had come from a different part of the business, with a different technology, I wasn’t really very versed in the dish chemistry. So, when I came to Dish, I sought out a technical mentor to help me understand the technology, and in fact this was someone three or four levels below me.”

Gleaves provided a step-by-step account of how mentoring has contributed to innovation in her experiences at P&G. Innovation is consumer-led and two organizations within P&G, R&D and the Consumer Market Knowledge (“CMK”) organization, spend time with the consumer, “trying to understand what’s important to her,” what product benefits might interest her and what new insights of ours might be attractive and exciting for her. The two or three ideas they develop from interacting with the consumer are then presented to their P&G team with staff from marketing, design and manufacturing. And they ask themselves:
“‘How we can meet this need that the consumer has articulated. What would the brand be? What would the product be? … What would the specific consumer benefit be? And then what would the product need to do to deliver that benefit?’ So, then we start working on the product design based on understanding what the benefits would need to be, after you talked to the consumer.”

After generating an idea of the product, they take it back to the customer for her reaction. If positive, an innovation team is assembled, which now includes someone from finance, and they find answers to these questions: “What would the product need to be? What would it need to look like? How would it need to perform? How much would it need to cost in order for this to be attractive to consumers?”

The main metric used in Gleaves’ organization to determine the effectiveness of the innovation team is the “TE” or Team Effectiveness Tool. Every few months, members of the team will complete a survey with questions such as these: How well do you understand the objectives of the work? Are your views valued? Are your talents being fully utilized? Do you believe the team can be successful? Do you have concerns? HR reviews the quarterly results and helps the team improve performance.

Concurrency, cross-functional mentoring (including design) at the earliest product conception stages of the innovation process, and periodic TE evaluations, all “strengthen the proposition for consumers, strengthen the program and strengthen the project,” according to Gleaves. When assessing employees for promotion, their ease and success at this type of collaborative mentoring is taken into account.
Paul Trokhan, a P&G research fellow, Victor Mills Society (the highest rank on the technical side of P&G’s dual ladder system) and a self-confessed self-starter, described his experience of mentoring in his early years at P&G as informal and organic. People who are naturally self-reliant, he asserts, believe they don’t need advice, but they are aware of role models whom they try to emulate and they learn whom they can approach for help with a technical problem.

At his senior level and very much in demand as a mentor, Trokhan looks for certain qualities in protégés before deciding how much time he is willing to invest in them. His criteria echo those of 3M’s Andy Ouderkirk. Both men look for an attitude of “will do,” not just “can do” in their protégés. They see if the protégé is investing in himself or herself, constantly working to gain knowledge and improve skills. They look for qualities of persistence, avoiding what Trokhan calls the “virtual no” trap where anticipating the boss’s rejection of your idea prevents you from ever presenting it. The attitude of a tinkerer translates into a passion that goes beyond research for the sake of pure science. The tinkerer is satisfied only when the science becomes a commercially successful product. Humility is, of course, essential in innovation because one must be actively open to ideas from a variety of sources. And there’s a connection between humor and innovation—both are twists on the predictable, involving a moment of surprise and delight. So Trokhan believes the best innovators are those who don’t take themselves too seriously and are open to humor and delight.
Correcting the Course

Following the Crest debacle, a small group of senior executives met in 1997 to figure out how P&G could innovate better and faster and regain their positions in the consumer and financial markets. They recommended a radical course correction: increase the speed and quality of innovation by jettisoning layers of bureaucracy and smashing silos to create concurrency.

The first CEO chosen to lead the charge for change was Durk Jager. He succeeded in burning the rulebooks, smashing the silos, and liberating rebels like himself, but he also smashed egos. The missing piece may have been a lack of mentoring in the transition goals and process. (Mentoring did not appear to be one of his strengths.) During this period, staff were “distracted by the changes and confused by the new way of doing business, [and] many … had trouble performing” (Davila, 74). After 18 months, Jager was replaced by Alan G. Lafley, a veteran of 25 years at P&G, a leader with strategic vision who knew success required total workforce transformation through mentoring to make the vision their own.

The Lafley Revolution

Alan G. Lafley was appointed CEO in 2000. He succeeded in reinventing a huge, struggling, rule-bound and process-bound behemoth of a corporation into one that innovates with agility and spectacular results through Connect & Develop (going outside for product solutions, increasing their virtual workforce by two million innovators) and by integrating design into P&G’s DNA, with particular emphasis on selling not only (and
mainly) a technologically sound product, but an aesthetic and life-improvement experience for the consumer.

Such radical changes entailed mentoring thousands of employees at P&G and incorporating mentoring in every process, in product development and technology-information sharing.

Mentoring for innovation came into play in this corporate transformation in all three broad areas:

- Changing the culture, protocols, practices, rules, and mindset of 138,000 employees working in over 80 countries
- Establishing a design-centric focus aimed at giving customers the sense that a P&G product makes my life better, and
- Ramping up the speed of product development innovation through Connect & Develop.

Super-Charging the Climate for Mentoring

P&G, as earlier noted, had already been one of America’s most successful companies long before the Lafley turn-around. Top-notch science/technology and a culture of mentoring were the keys to the company’s success for a century and a half. P&G’s new CEO reorganized P&G’s corporate divisions to encourage greater collaboration and eliminated about 20,000 jobs, half in upper management. This move eliminated inertia-
minded executives who were prone to “legacy” thinking and eliminated tiers of oversight/approvals that had slowed commercialization to glacial speeds.

Lafley made market dominance through product innovation THE priority of P&G, with the goal of anticipating customer’s needs and exceeding their expectations for products that make their lives better. “The consumer is boss” is one “mantra he endlessly repeats this to employees” (Markels, 2006).

Through extensive and varied forms of mentoring, P&Gers made this goal their own.

**Design-Centric Innovation**

Lafley understood that design means much more than packaging artwork and more even than branding. Design creates a holistic experience for the consumer that adds value, creates customer loyalty and needs to be incorporated in the product itself. The goal: to put design into P&G’s DNA. Great design requires at least two things: intimate knowledge of how customers behave (how they clean bathrooms and diaper their babies) and creativity to anticipate an improvement or new product that could fulfill their unrecognized needs. Easy enough to let customers mentor P&G staff through their observations and probing questions. The tougher part was training P&G employees steeped in process thinking to embrace the somewhat chaotic creative thinking process. THAT took (and takes) multiple mentoring events. But the result is that combining cross-functional concurrency with creative-design thinking has boosted innovation speeds and successes beyond even P&G’s optimistic estimates.


**Technology-Mentoring through Connect & Develop**

Lastly, P&G’s “Connect & Develop” is a multi-dimensional approach to Open Innovation, connecting 1.5 to 2 million “outside” scientists and tech people to P&G scientists, to offer solutions to product innovation challenges. Rather than letting P&G’s highly capable 7,500-plus R&D scientists figure out solutions at their own pace and solely from available in-house expertise, Connect & Develop greatly speeds up the process of product development. Networking via Internet, often anonymously through brokers like NineSigma, researchers in academia and government, small entrepreneurs and inventors from across the globe, are invited to peer-mentor P&G scientists, suggesting potential solutions from their field of expertise. These arrangements greatly reduce the speed of commercialization.

**Rewiring P&G for Innovation**

In “The World’s Most Innovative Companies,” BusinessWeek and the Boston Consulting Group identify the innovation shift that has occurred within companies that are responding well to the accelerated pace of global innovation:

“In the 1990s, innovation was about technology and control of quality and cost. Today, it’s about taking corporate organizations built for efficiency and rewiring them for creativity and growth” (McGregor, 2006).

In 2000, A.G. Lafley assigned Larry Huston to the newly created job of vice president for innovation and knowledge. Each business within P&G added a manager, a mega-mentor,
whose job it was to ensure that the new business model would become ingrained in the culture. These culture managers reported directly to Huston.

P&G also created the new job classification of “Technology Entrepreneur” or TE. Seventy TEs were hired to be “strategic scouts” working within each business unit of P&G. Their mission is to anticipate where consumers are headed and where P&G can find solutions to meet consumers’ future desires.

G. Gil Cloyd, P&G’s chief technology officer since 2000, described the titanic shift in R&D focus post-2000: “Historically, we tended to put [R&D] evaluation emphasis on technical product performance, patents and other indicators of internal R&D efforts. Now there is more emphasis on perceived customer value” (Teresko, 2004).

This innovation focus shift could not have happened without mentoring, as Cloyd explained to the author:

“One of the most important things is the … depths to which people internalize that purpose that creates a common nation that is very energizing to people. We do want to provide products and services to improve the quality of peoples’ lives, a longer goal. And that’s something that people can really marshal around and it lets everyone get a common focus on that’s what we’re all about, conserving the winning with our consumers. We kept that consumer focus then to a very high level in terms of the research we do to deeply understand what their desires are. We talk about getting to unarticulated wants and desires and needs of consumers, things that they may not be able to verbalize, that we’ll have to use testing methods to understand what would truly delight them. And then
deliver those experiences into the market place. I think it’s been what I consider a very motivating issue that people can put a lot of passion into. A real focus to the consumer, what’s the big idea, and target the deliverer, and then there’s a variety of mechanical things that we do in terms of organization and structure and processes, so that we can keep an alignment in a well integrated approach to the innovation thrust, the various functions that need to be addressed.”

Among the “mechanical things” P&G has done in terms of organizational changes to enhance mentoring for innovation was to strive for even greater concurrency by assembling cross-functional teams—including design people—at earlier stages in the innovation process. P&G offers classes in creativity and team-building so cross-functional peer-mentoring will be its most effective.

P&G created a position of mentor to project managers (PMs), an individual outside the PM’s chain of command who can serve as a sounding board, advisor and coach to help the PM succeed. Since 2000, Scott Cameron, P&G’s global capital systems manager for the Food & Beverage Global Business unit, has mentored about twenty PMs through project completion.

A 300-course RapidLEARN program allows scientists to learn new disciplines so they can discover or recognize solutions to a technical problem outside their area of expertise.

Creating a Design-Centric Culture

When Claudia Kotchka accepted the job of vice president of Design Innovation and Strategy in 2001, she told A.G. Lafley that his goal of having a design-centric culture—
one that could produce “whole experience” products that delight consumers—within five years would not happen unless they hired experienced designers from outside. She got the go-ahead and soon planted designers with 10 – 25 years’ experience in every business unit. They now number over 250. The designer’s role has been to mentor product managers, and everyone involved in innovation, in design thinking – a creative and experiential, observational approach to problem solving that is the antithesis of the analytical, linear problem solving approach that comes naturally to scientists and people in business.

“Designers,” as Kotchka explained in an interview with the author, “automatically think differently. They don’t start with analysis. They start with the user, whoever that user is. … And they really start understanding that person’s life, not just the product’s role in that person’s life, but the whole, everything. … And they do that in small size cases … direct stenography and observations. … And then they immediately brainstorm ideas and start prototyping. And prototyping is fabulous … because … it is a visual dialogue with the consumer: ‘Would you like this, what would you like about it, what wouldn’t you like about it?’ And they’ll tell you, and they’ll help you and then go back and you change it and you take it back again. And what’s interesting is that most companies use prototypes as ‘this is what we’re going to make – this is what we’re going to manufacture,’ designers don’t use prototypes that way. Designers use them as a dialogue, a form of dialogue with the consumer, to get more information, and that’s really what they use them for. And, so, it tends to be very fast and very cheap way of innovating.”
Interestingly, Kotchka also recognized the need to have mentors for the new design-mentors when they arrived at P&G. She knew it would be a culture shock for them to enter an environment where everyone seemed to know everyone else and be put in the position of thoroughly reorienting the mindsets and thinking processes that had been nurtured through generations.

To help managers adapt to the design problem-solving methodology, Kotchka has organized workshops, brought in IDEO, the Palo Alto innovation and design firm that helps organizations “identify opportunities for growth by revealing people’s latent needs, behaviors, and desires, and visualizing ways to serve and support people.” P&G also works more with outside branding agencies to mentor P&G personnel in branding. She sends employees off to the “Clay Street Project” where they spend ten weeks learning creative thinking experientially, not analytically.

Kotchka instituted a novel “Mentor-up Program,” sending product managers off with a designer to stores and homes to really experience product appeal and consumer needs.

She recently held a “design tasting” for the top 20 P&G executives to witness the results of holistic 360-degree design in P&G product innovation.

Kotchka also put together a Design Board of outside designers from a variety of fields who meet three times a year to offer their views on P&G’s upcoming products. A.G. Lafley attends all their meetings, a sign of his commitment to incorporating design thinking into innovation.
Kotchka’s team has developed extensive metrics to develop the progress in conversion to design-centric thinking, measuring, for example, “what happened, what they’re doing, are they using [design problem-solving], how are they using it, what kind of results are they getting. … We also have what’s called a “key element assessment” where you look for what are the key elements of design thinking taking hold in this culture, and so we track those as well.” The metrics are all quantitative (and are proprietary).

**Open Innovation**

When A.G. Lafley announced that 50% of P&G’s new products would originate outside the company’s R&D labs, there were many skeptics and many within P&G who thought R&D was on the way to being out-sourced and drastically down-sized. But the new open source innovation strategy, which P&G calls “Connect and Develop” (C&D), has done neither. It revolutionized the speed with which technical solutions are discovered and developed and products hit the shelves. To the R&D folks at P&G, C&D supercharges their work. They are constantly learning new applications from the one-and-a-half to two million tech-clever people whose cross-disciplinary expertise they can draw on.

Huston, the architect of C&D, appointed C&D Leaders to “act as the internal motivators responsible for driving cultural change around the new business model” (Flanagan, 2006). C&D Leaders ensure that the newly installed “Technical Entrepreneurs” working within each business unit work seamlessly with the unit and they apply just enough guidance and leadership to ensure successful innovations which, in turn, can be used to reinforce the motivation to embrace the new innovation model.
The TEs devote much of their time to finding who are the best “problem solvers” and resources in academia, government, private labs, start-ups.

By the fall of 2006, R&D productivity had increased by nearly 60% since 2000. Investment as a percentage of sales had dropped to 3.4% from 4.7% in 2000. P&G introduced more than 200 new products in just several years partially attributable to its technical networking. In just five years, P&G had achieved its goal of sourcing 50% of its innovation outside its own labs.

Now a senior fellow at Wharton (Mack Center for Technological Innovation), Huston defined ‘innovation networks” as: “people, institutions and companies that are outside the firm. … They are intellectual assets that companies can link up with to solve problems and find ideas, while beginning to think about those assets as an extended part of their organization—and therefore quickly create top-line growth and bring new things to the marketplace” (Knowledge@Wharton, 2007).

Technology networks have now developed as infrastructures outside of companies, such as InnoCentive and NineSigma, to make finding the people with the solutions much easier. Since 2001, NineSigma Inc. has helped link P&G with outside technology through their Ph.D.-level program managers who search for and solicit technological solutions for NineSigma’s clients.

Huston and Nabil Sakkab were able to report in March 2006 that P&G’s innovation success rate had already more than doubled in less than five years thanks to C&D (Huston, 2006).
P&G also seeks technology solutions from networks such as YourEncore.com (whose pool consists of retired scientists and engineers) and Yet2.com, a virtual technology marketplace where buyers and sellers can arrange IP licensing.

In today’s world, consumers are always looking for the newest and coolest. Product lifespans grow shorter and shorter. Innovation has to be quicker, cheaper and produce a “wow” for the consumer. In less than a decade, P&G evolved from a behemoth, too sluggish for today’s innovative pace of sprinting to market ahead of all the nimbler, built-to-innovate companies, to becoming one of the world’s leaders in innovation. That transformation required changing generations’-old and no longer sure-fire R&D and business paradigms (which were still deeply ingrained in the minds of current employees). It called for a strategic vision: know the consumer so well that you can anticipate her unspoken needs and use creative design-thinking to imagine and develop a product that will delight her. And if you don’t have all the technology you need in-house, buy it outside and tweak it as needed. Just don’t keep the lady waiting.

A CEO cannot simply mandate such far-reaching changes. P&Gers up and down the line had to be mentored to understand, buy into, and apply the new goal, new design process, and the apparent loss of control. Flexibility and humility were essential to institute these changes (in a company not known for corporate flexibility and humility). Most of the credit for P&G’s phenomenal success in innovating innovation has to go to P&G’s mentors in every business unit who saw to it that the visions of A.G. Lafley, Larry Huston, Gil Cloyd and Claudia Kotchka were realized.
RESEARCH QUESTIONS

How do the people championing innovation view the role of mentoring?

G. Gil Cloyd, P&G’s chief technology officer since 2000, sees mentoring as key to P&G’s success in shifting its innovation focus from one concerned purely with technical product performance to one that looks first at customer value in a holistic sense. Concurrent innovation with a strong emphasis on design means working cross-functionally and collaboratively, without the “Current Best Approaches” guardrails of the past. A huge workforce, trained to do business in a measured, prudent, risk-averse and insular way had to adapt to a whole new innovation paradigm. Resistance to these changes at any level could have crippled the company’s efforts. Mentors were strategically used to coach, cheerlead, facilitate, and monitor the changes which permitted a successful organizational transformation.

How and why is mentoring useful for innovation?

Karl Ronn, P&G vice president for R&D in Home Care, explained that an innovation culture must be a learning culture where employees can easily seek feedback from each other. “What you know,” he observed, “gets in the way of your learning.” Mentors from outside one’s area of work counteract “groupthink” that stifles innovation. Because successful innovation requires knowledge of consumer needs, a design focus to create in the consumer a sense of life-improvement from using the product, and knowledge of what is scientifically and technically possible at a competitive price, many perspectives
and skill sets are needed. Concurrent development consisting of cross-functional peer mentoring has emerged as a winning formula for innovation.

**How is formal mentoring or mentoring training utilized?**

After 2000 P&G instituted wide-ranging institutional changes in how innovation happens, which required re-orienting employees to a design focus and ramping up the speed of innovation through greater concurrency and greater reliance on technology outsourcing.

The newly-named Vice President for Innovation and Knowledge Larry Huston, installed mega-mentors, Connect & Develop leaders, in each P&G business to ensure that the new business model would become part of the P&G culture. Technology Entrepreneurs work in each business unit to mentor managers on future consumer trends. Classes were given in creativity and team-building so that cross-functional peer mentoring could be done even more effectively. P&G assigned mentors to project managers to serve as helpful sounding boards outside the project manager’s chain of command.

Scores of experienced designers were brought on board to “reverse mentor” management in creative design thinking. Many employees were sent off to a 10-week course in learning to think creatively instead of analytically.

**How do mentors and protégés find each other to work on innovative projects?**

Prior to 2000, mentoring had always been a significant feature of the P&G culture because of the company’s commitment to promote from within and retain employees for life. Mentoring did not cross departments or functions, however, as P&G’s organizational
structure was characterized by silos. Mentoring relationships directly related to innovation developed organically and informally, according to Paul Trokhan and Mark Steinhardt, both P&G research fellows.

Since the beginning of the Lafley innovation revolution in 2000, mentoring for innovation relationships often emerge from more structured team-building by Connect & Develop Leaders and Technical Entrepreneurs.

**How do firm factors, such as size of organization, product offerings, and type of industry affect how, when and why mentoring relationships are developed or nurtured?**

Procter & Gamble’s organizational commitment to promote from within and to hire a diverse workforce contribute to mentoring being engrained in the P&G culture. Career mentoring became more formalized within P&G about twenty-five years ago when P&G’s African American women managers started collaborating to see how the company could retain and advance minorities and women in the workforce. The more systematic mentoring focus took root.

The needs and tastes of diverse end users are crucial to consumer products innovation. It is essential, therefore, that technical employees be peer-mentored by business and design experts to develop successful products that “delight” the consumer.
LESSONS LEARNED

1. Proctor and Gamble uses its strong corporate diversity as a competitive advantage to be in touch with the global market needs. Diversity at P&G takes many different forms from ethnic diversity to the diversity of roles of mentors. As Kotchka talked about in his interview with the author, P&G uses several forms of mentoring including reverse mentoring and cross-mentoring. Mentoring and diversity influence and affect the organization and the level of innovation produced.

2. Creating a product that improves the quality of life for consumers requires a focus on design innovation. Design means much more than packaging artwork and more even than branding. An understanding of consumer wants and needs is required to identify the unrecognized needs that exist in the market. By combining cross-functional concurrency with creative-design thinking to focus on the unrecognized needs of consumers P&G has boosted its successes.

3. Innovation does not have to come out of Research and Development but can be created outside the company’s labs. Through Open Innovation in what P&G calls “Connect and Develop” P&G has been able to draw the cross-disciplinary expertise’s of millions of tech-clever people. Instead of outsourcing R&D as many feared P&G was able to increase R&D productivity by 60% from the years 2000 to 2006.

4. The strong focus on the employee at P&G has helped to create a family atmosphere. Proctor and Gamble have realized that their employees are their most important aspect and because of that take time to attract and develop their talent.
Almost all promotions within P&G are from within making the culture within P&G uniquely its own.

5. Innovation is the root of the success that P&G has achieved. Under the old way of thought P&G saw its market shares in its cash cows such as Crest drop 14% from 1987 to 1997 in large part due to lack of innovation. In less than a decade, P&G evolved through its pioneering mentoring programs, R&D programs and dedication to corporate mission to becoming one of the world’s leaders in innovation.
One of America’s premier companies for over a century since it began selling tabulating machines, computing scales, card time recorders and other devices to help American business prosper, “Big Blue” occupied first place on *Fortune*’s list of America’s most admired companies for four years in a row in the mid-1980s.

By the early 1990s, fortune had turned and Big Blue had a different reason to be blue: new hardware manufacturers had eaten away at IBM’s market share so voraciously that the company faced what surviving executives now generally refer to as its “near-death experience.”

Lou Gerstner came on board to right the sinking ship in 1993. The workforce was slashed in half. By the end of 1994, IBM had $15 billion in losses accumulated over the three prior years. Those who survived the 1990s recall it with deep shame and a Scarlett O’Hara-like commitment to never go down that road again.

Samuel Palmisano, IBM’s chairman, president and CEO since 2002, enthusiastically credits Gerstner for rescuing the once proud—in the minds of some analysts “too proud”—company from break up and oblivion. Gerstner initiated a change of the corporate mix away from predominantly hardware sales (60% of the business) with only 40% in software and services in the early 1990s. By 1998, one-quarter of IBM’s $82 billion in revenues was related to helping companies capitalize on the Internet. Today, 77% of revenues are generated from software and service delivery. IBM’s “product,” as
Palmisano points out, is now essentially the competency of its people—386,000 of them at the end of 2007.

Notwithstanding IBM’s renewed financial success in the late 1990s, the organization itself was not a unified community in 2002. Many IBMers were relatively new to the company as it had quickly rebuilt its workforce, mainly through corporate acquisitions, to meet new business needs. Silos continued to exist, with predictable friction and competition between business units. Palmisano sensed that innovation was essential for business survival and that meant more than innovation in technologies. It also meant “innovating in strategies, innovating in business methods” (Jena McGregor, with Michael Arndt and Robert Berner in Chicago, Ian Rowley and Kenji Hall in Tokyo, Gail Edmondson in Frankfurt, Steve Hamm in Rome, Moon Ihlwan in Seoul, and Andy Reinhardt in Paris, “The World’s Most Innovative Companies,” Business Week, APRIL 24, 2006. Accessed online through google). The networking and cross-mentoring needed for innovation can only thrive where people are valued and listened to, where their contributions are encouraged and recognized. IBMers needed to be inspired by something other than a paycheck. Palmisano wanted to rebuild that sense of identity, community and mutual respect from the era before the “near-death experience.”

In retrospect, Palmisano’s principal tool for engineering the innovation turnaround at IBM made perfect sense. IBM’s financial turnaround was the fortuitous result of a couple of “Net-heads” in IBM’s development community who, excited by the potential of the fledgling Internet, found support for exploring its potential among other enthusiastic early adopters in IBM’s younger, lower (cooler) ranks. The small band of revolutionaries drew up a “Get Connected” manifesto with arguments for IBM becoming ’Net-centric. It never
was nailed onto the CEO’s door, but it did energize them to forge an informal intranet community. Eventually about 300 IBMers communicated with each other, under the radar. A brash promise to broadcast 1996 Olympic coverage online demonstrated to a critical mass of IBM executives that it was worth pursuing the possibilities of the Internet. Gerstner himself understood the potential immediately, but many executives remained dubious.

After the Olympics success, the Net-savvy few were given some freedom to operate above ground. They began mentoring their colleagues in key posts at headquarters on the vast potentials of the web. (Gary Hamel, “Waking Up IBM,” Harvard Business Review, July-August 2000, p. 146). They “set up an Internet lab to bring in executives from all over the company to experience the Web’s possibilities … and also started a project called ‘Web Ahead,’ which worked to revolutionize the company’s own IT systems through Internet technology” (Ibid.). One early project was to take the old “terminal-based corporate directory” and turn it into an online “Blue Pages” where, with a few clicks, employees could look up a colleague, learn what computer skills the colleague had and then find out all the names of other IBMers with the same skills. Key employees were “borrowed” from departments throughout IBM, trained in web technology, and returned to their regular work with revolutionary tools.

Given this history, it is not surprising that Palmisano turned to IBM’s intranet to begin mentoring his gigantic workforce in his innovation vision. Several earlier small “Jams” (e-mail chat sessions open to all employees) led to a huge “ValuesJam” in July 2003. For 72-hours, IBMers could log on and post and read comments about IBM’s core values. 50,000 employees did and 10,000 comments were posted. Many expressed frustration
and criticism of business practices that actually stifled innovation (cumbersome approval processes, friction between business units) and that seemed to mock the core values ("Basic Beliefs") that Thomas Watson, Sr., founder of the modern IBM, articulated in 1914:

- Respect for the individual
- The best customer service
- The pursuit of excellence.

How does IBM show respect of the individual (employee, for example), by keeping them so tied down with rules and protocols that there seems to be a lack of trust?

Palmisano read the 10,000 comments over a weekend. But rather than getting discouraged by the discontent, he saw in the passion of so many IBMers an opportunity to have them “buy in” to a way of making IBM all that he and they wanted it to be. That is precisely where Palmisano began, using feedback from the ValuesJam to update Watson’s “Basic Beliefs.” He then test-marketed the new list with 1,000 employees through surveys and focus groups. A small team analyzed the Jam and post-test data to refine the values further. Palmisano published these on the company’s intranet in November 2003:

- Dedication to every client’s success
- Innovation that matters—for our company and for the world
- Trust and personal responsibility in all relationships.
The reason for his stress on corporate values, in contrast to “managing people,” Palmisano contends, is that a bureaucracy that manages smothers innovation by “overanalyzing problems and slowing down the decision-making process” (Hemp & Stewart, 2004, p. 60, 63). IBM’s organizational matrix comprises close to 400,000 employees and 60-70 major product lines in 170 countries. Such breadth and complexity cannot be centrally managed.

“So if there’s no way to optimize IBM through organizational structure or by management dictate,” Palmisano continues, “you have to empower people while ensuring that they’re making the right calls the right way. And by ‘right’ … I’m talking about decisions that support and give life to IBM’s strategy and brand, decisions that shape a culture. That’s why values, for us, aren’t soft. They’re the basis of what we do, our mission as a company. They’re a touchstone for decentralized decision-making” (Ibid.).

Gone are the days, Palmisano points out, that a chief executive can announce to his immense global workforce, “Here are our new values!” He explains:

“We couldn’t be casual about tinkering with the DNA of a company like IBM. We had to come up with a way to get the employees to create the value system, to determine the company’s principles. … And, yes, the electronic argument was hot and contentious and messy, but … I now have this incredible mandate to drive even more change in the company” (Ibid.)

Essentially, Palmisano knew the fear of failure was not enough to galvanize a company that’s enjoying success. Why should they change their operating strategies? Their strategies are working. “Instead,” he states, “you have to galvanize them through hope
and aspiration. You lay out the opportunity to become a great company again—the
greatest in the world, which is what IBM used to be. And you hope people feel the same
need, the same urgency you do, to get there” (Hemp & Stuart, 2004, p. 66).

After the success of ValuesJam, it was only natural that IBM would turn to its intranet as
its primary innovation system and to its CIO as the leader for fostering networking and
mentoring for innovation. IBM is the only large corporation the author has come across
thus far that charges its Chief Information Officer with responsibility for innovation.

In an interview with the author, Maria Azua, IBM’s vice president of Technology and
Innovation, explained why virtual networking/mentoring for innovation succeeds:

“With regard to social networking, “the behavior of humans has changed completely.
People are more open to share and they have embraced computers and a lot of these tools
are true tools for communication. I really believe that mentoring and the new aspect of
social networking combine together … as very, very powerful agents to generate new
ideas, and as such, generate a lot me innovation in the world. … a lot of what these tools
have done is really flatten the world. I mentor people in India. I mentor people in China. I
mentor people all over the world.”

Azua and Dave Newbold, an IBM Distinguished Engineer, collaborated on an article
entitled “A Model for CIO-Led Innovation” for the IBM Systems Journal (2007). In it,
the authors describe how IBM has seen innovation explode as a result of the collaborative
networking made possible by IBM initiatives. They review the following initiatives
adopted by IBM to foster innovation through virtual networking/mentoring, which then
also allowed IBM to serve as a proving ground for new client services:
• ThinkPlace

• Technology Adoption Program (TAP)

• 2010 CIO Outlook

• CIO Technology and Innovation evaluation team model change

• Business synthesis

• Virtual platforms, a weekly Think! seminar, community conference calls IM, blogs, wiki

• Extreme Blue

• BizTech

• alphaWorks

• developerWorks

• Executive Business Institute: Strategic Innovation

• The concept of an “open ecosystem”

ThinkPlace is an internal IBM Web site launched in 2005 by the CIO team. Employees can post their innovative ideas, give and get feedback and suggested refinements, and even volunteer to work on developing an idea posted by a colleague halfway across the world. One posting can generate the right mentors from among 386,000 users. ThinkPlace is the “white space” where innovation can occur, in the way that 3M’s 15% time does. Ideas that employees see as having the potential to “grow the business, solve
existing problems, or improve IBM’s culture will automatically be considered.”

Volunteer “ThinkPlace catalysts” who are long-time IBM innovators, monitor

ThinkPlace ideas, hold weekly “innovation circles to collaborate on ideas” and bring the

best ones to the attention of IBM managers.

Technology Adoption Program (TAP) is a single IBM Intranet site that offers internal

innovators “hosting services, support for current and future offerings, and support for

community interactions” (Azua & Newbold). TAP has become a proving ground for

internal innovations to accelerate their adoption within IBM and to evaluate for client

use. A typical agreement allows free hosting for six months, at which time an evaluation

is made. Over 2,000 IBM innovators registered for access to services and hundreds set up

accounts in the first year of use. As of September 2007, 73,000 “early adopters” have

registered and downloaded innovative ideas.

An important aspect of TAP is that it draws attention to innovation as a collaborative

effort and not the result of one inventor working alone. IBM research groups also use

TAP to test how consumers react.

2010 CIO Outlook, a white paper, explains the new innovation model in terms of

achieving business goals without having to make large investments. It was designed to

convert the foot-draggers as well as to steer “the innovation process itself.”

CIO TI Evaluation Team Change. Before ThinkPlace and TAP, a Technology &

Innovation team used the “committee evaluation model” to select projects worth

pursuing. Using that model in 2003, four projects were selected out of an initial 28
projects submitted. Thanks to ThinkPlace and evaluation through TAP, 48 projects were selected to be pursued.

**Business synthesis** has been identified by economist Eric Beinhocker as a crucial first stage in business innovation. IBM regularly posts IBM news and executive communications such as presentations, through webcasts and podcasts, to integrate business communication needs with available technology. A new community-supported technology-tracking site provides information on emerging technologies and discusses IBM’s plans for their adoption.

Not surprisingly, IBM makes available a wide array of virtual and live platforms where employees can collaborate on refining ideas: a weekly Think! seminar, community conference calls, instant messaging (IM), blogs, and wiki.

**Extreme Blue** is an academic internship program in which small teams of graduate students—computer science and electrical engineering majors and MBA candidates—are mentored through the process of developing and packaging an idea.

**BizTech** is a program for “early tenure employees” who commit to spend 20% of their time to work on an innovation project.

**alphaWorks.** The latest innovations from IBM are available for download by IT developers and early adopters whose early input can help influence IBM’s R&D.

**developerWorks,** IBM’s resource for developers offer tools, code and education and open standards technology.
“Open ecosystem” a/k/a “open innovation,” “open sourcing” is formalized by agreements with business competitors and other interested parties for technology sharing, infrastructure building and other means of collaboration of mutual benefit to the partners and their customers.

IBM has taken measures to eliminate the many factors in an organization that can stifle innovation. “Matrix management,” Dr. Michael Perrone explained in an interview with the author, is a concept adopted by IBM to describe its ideal, less hierarchical business structure. Matrix management is aimed at counteracting insularity, closed-system thinking and silos by encouraging employees to mentor and be mentored by colleagues in different areas of the business. It doesn’t replace line management, but softens its edges. “Collaboration, lots of collaboration throughout the corporation, is another key driver to innovation,” according to Dr. Perrone, “because if you keep your head down in research, all you know are research problems. … If you engage with the rest of the corporation, you see all kinds of problems that can be solved.”

Dr. Perrone added that mentoring others is a sign of value to the corporation—virtual as well as face-to-face, and a metric on which managerial performance is based. IBM even encourages employees to take advantage of an “Individual Development Plan” to help them achieve a higher level of integration and higher skills.

Luba Cherbakov has worked with clients for most of her ten-year career at IBM, but in the past two years has had a rotational assignment in the CIO office where she leads innovation around what tend to be known as “rent to own.” Her work and mentoring demonstrate the breadth of the possible in a virtual world. Like Azua, she has virtual
protégés all around the world, including a number in Australia and several parts of the Asian Pacific. She described a recent task on which her development team members were based in New York, Washington, the United Kingdom, China, and elsewhere. They successfully worked online and on the phone to bring the project to completion in just six months. She chose her team based on responses of architects to a face-to-face workshop, interest in which was generated through TAP.

Another factor that smothers innovation which IBM works hard to eliminate is the fear of failure. Dr. Perrone attributes much of IBM’s success at innovation to a deliberate mentoring-out of the fear of failure. Calculated risk-taking is rewarded.

Face-to-face mentoring is also, of course, encouraged in a variety of ways. Azua spoke of a number of metrics used to measure managerial mentoring, including surveys and measurements of participation disseminated through blogs and wikis.

A database with all the master inventors allows innovators to post and submit their ideas to the invention review board. The board then facilitates mentoring by suggesting to whom the innovator can go for guidance in the expertise he or she needs to move the idea along.

Sara Mouton Reger joined IBM as an organizational change consultant in 1995 when the company was still downsizing and struggling to recover from its “near-death experience.” Mouton Reger was able to experience very personally the cracks in IBM’s new employee mentoring system. Much of what she needed to know and do in her new job and with respect to general employee orientation was not documented, and she had to stumble along, learning things belatedly because her manager was also new to the company. The
lesson was not lost on Mouton Reger. When employed by IBM in the practices section, she ensured that a buddy system matched each new employee with a mentor-buddy to get them acclimated. If the new employee was reporting to a relatively new manager, she also made sure that “the manager got the buddy system as well.”

Among Mouton Reger’s early career insights when working at Ernst & Young, was that when organizations merge, close attention is paid to financials and functions, office locations and procedures, but little thought is given to the purely human, cultural equation. She did about 800 hours of work necessary to be certified as a “level three certified organizational change management specialist.” The training served her well at IBM where she has been über-mentor to tens of thousands of new IBM people annually.

Another early insight of Mouton Reger while at IBM is that certain people exist in every enterprise who are “networkers.” By personality, and often by job function as well, they just seem naturally to get to know everyone else in their organization. Mouton Reger developed a 100% virtual model, “Network the Networkers,” to facilitate workforce integration. Her team structured about six phone calls to get the conversations going between networkers in both workforces, exchanged bios, and everyone had an opportunity to chat over the phone. The transition was almost unbelievably smooth.

As a final aspect of IBM’s approach to mentoring for innovation, its system of rewards deserves attention. Rewards are a form of mentoring because they motivate employees to perform their job in ways that will yield awards and they act as positive reinforcement of “good” behavior models. The majority of IBM’s awards are to recognize teamwork, networking and mentoring as relates to business and product innovation. The rewards
program has a name—“New Blue: Focused to Win”—and a purpose: to reward “winning behaviors” of “speed, commitment, focus, passion for the business, teaming, and knowledge sharing” (and not merely the results of these behaviors) (Bob Nelson, “IBM: A Case Study in Alignment,” 2003).

- **Thanks!** lets “one employee to spontaneously recognize a peer for providing out-of-the-ordinary assistance” with a gift up to $25 in value.

- **Bravo!** Permits recognition (as high as $2,500) for “individual or team behavior or results beyond normal job and performance expectations” (Ibid.)

- **Technical Recognition** recognizes invention achievement, outstanding innovation, and outstanding technical achievement, with up to $25,000 per award.

- **Knowledge Advantage** gives recognition to individuals who share knowledge, lessons learned, and key insights with others (up to $25,000 each).

- **Execute Now!** provides up to $10,000 for “truly outstanding contributions.”

- **One Team!** enables recognition for outstanding work done by a formal or informal team with awards up to $10,000.

- **Win IBM!** “includes awards and contests (up to $10,000) targeted at specific targets and measurements, and allow IBM management to selectively drive performance and recognize individual teams who have a significant impact on the business” (Ibid.)
Non-monetary awards are also encouraged via, personal handwritten notes on “IBM Thanks! Award Cards” to recognize “specific project accomplishments.” Executives are also invited to give out awards reflecting their personalities and interests—time off for a golf game, a day at a spa, flowers, champagne, and so forth.

Conclusion

What can we take away from IBM’s transformation over the past decade? Few companies have a workforce as large, diverse and far-flung as IBM’s. Certainly, product innovation in manufacturing requires leadership to nurture collaborative attitudes and practices in the workforce. But when the product is the workforce itself—its ability to problem-solve, to network effectively and quickly for solutions—mentoring is all the more crucial to success. Mentoring a diverse workforce of nearly 400,000 people in 170 countries can be accomplished successfully through the very media at which IBM excels—virtual networking. Using the company’s intranet ThinkPlace as a device for virtual team meetings, an innovation can be identified, refined, supported to grow, and be test-marketed on its own employees at a fraction of the cost and time normally associated with product rollout. Unveiling an idea to such a huge audience may appear to be a disincentive to full disclosure, but IBM reduces that disincentive by reducing the fear of failure and incentivizing open participation in virtual-IBM land.

By establishing clear, coherent values, by approaching employees with trustful expectation that they will do their jobs excellently and giving them the tools to network for innovation, Samuel Palmisano created an engaged and highly successful workforce for the 21st Century. Proofs that virtual mentoring is working are IBM’s 15th consecutive
year, in 2007, of being issued more patents (3,125) than any other company and its $98 billion in 2007 revenues.
RESEARCH QUESTIONS

How do the people championing innovation view the role of mentoring?

IBM executives see mentoring as an essential “sign of value” to the corporation, recognizing its vital role in fostering innovation. Several interviewees took pride in explaining that they mentor IBM colleagues through virtual mentoring in a number of countries across the globe. One explained that a project she worked on was completed successfully and quickly by an international team that never met face to face, collaborating by sharing their expertises via e-mail and phone calls (across time zones and language barriers) over six months.

The value IBM places on mentoring is evident in that mentoring is a metric on which managerial performance is evaluated, on the systems IBM has put in place to facilitate technical mentoring, and on the rewards program which recognizes the role of mentoring—New Blue: Focused to Win. These include the “Knowledge Advantage” award to recognize individuals “who share knowledge, lessons learned and key insights with others,” “One Team” recognizing outstanding work done by a formal or informal team, and “Win IBM!” for teams that have had a significant impact on business.

How and why is mentoring useful for innovation?

As IBM’s Dr. Michael Perrone describes it, “Collaboration, lots of collaboration throughout the corporation, is another key driver to innovation because if you keep your head down in research, all you know are research problems….if you engage with the rest of the corporation, you see all kinds of problems that can be solved.”
If two heads are better than one, thousands of heads, properly managed, are vastly better than two. The IBM Technology Adoption Program offers IBM innovators hosting services and support for community interaction so that thousands of employees can evaluate new products and services, in essence test-marketing them for IBM clients. The peer-mentoring feedback helps get finished, glitch-free products to market all the sooner.

IBM’s commitment to open sourcing, referred to as “open ecosystem,” involves technology sharing and collaboration with innovators outside IBM for the mutual benefit of all collaborators in finding solutions to technical problems and getting products to market faster.

**How is formal mentoring or mentoring training utilized?**

Each new employee is paired with a mentor-buddy to become acclimated to IBM and the requirements of his or her new job. If the new employee reports to a relatively new manager, IBM also makes sure that the manager gets a mentor-buddy as well.

IBM has adopted the paradigm of “matrix management” in place of the traditional hierarchical, insular silo structure of management. Employees are actively encouraged to mentor and be mentored by colleagues in different areas of business.

Because IBM’s workforce typically grows through the acquisition of other companies, with hundreds and thousands of employees joining IBM with a degree of trepidation, Sarah Mouton Reger developed a virtual model for efficient workforce integration called “Network the Networkers.” The model introduced key networking people at IBM to their counterpart networkers in the acquired company through an exchange of bios and about
six structured phone calls. The networkers were able to mentor their colleagues to make for a smooth transition.

**How do mentors and protégés find each other to work on innovative projects?**

Mentors and protégés at IBM generally find each other through intranet initiatives designed for mentoring for innovation. “ThinkPlace” is an internal IBM web site introduced in 2005 where employees can post their innovative ideas, give and get feedback and volunteer to work on developing an idea posted by an IBM employee on the other side of the world. So-called ThinkPlace catalysts (long-time innovators at IBM) monitor the postings and automatically consider any ideas that have potential to grow IBM’s business, solve an existing problem or improve IBM’s culture. The best ThinkPlace ideas are passed on to IBM managers.

Among virtual and live platforms where employees can collaborate on developing ideas for innovations are a weekly Think! seminar, community conference calls, IM, blogs and wiki. In addition, innovators can submit their ideas to an invention review board which, thanks to an IBM database of “master inventors,” can advise the innovator where to go for guidance in the area of expertise needed.

**How do firm factors, such as size of organization, product offerings, and type of industry affect how, when and why mentoring relationships are developed or nurtured?**

As a world leader in the software and IT service industry, with some 400,000 employees doing business in 170 countries, it makes sense that most mentoring at IBM would be electronic. IBM’s vice president of Technology and Innovation, Maria Azua, explains
that virtual networking—which would have seemed unthinkable a generation ago—
flourishes today because “mentoring and the new aspect of social networking combine
together … as very, very powerful agents to generate new ideas, and as such, generate a
lot more innovation in the world.”
LESSONS LEARNED

1. Companywide Innovation and mentoring is not only available for small firms but is obtainable for the largest of companies. With close to 400,000 employees, IBM has been able to implement a successful and important virtual mentoring system that allows for communication and interaction between all of its employees. Through its use of technology, IBM has proved that size should not be an impediment to creating mentoring and innovation among all employees.

2. Internal communication between employees worldwide is a powerful agent in creating a sense of identity, community and mutual respect. A comfortable and safe environment that allows a free flow of ideas must be created in order for innovation and open communication to thrive. IBM has been able to create a community and use its size to its advantage through ThinkPlace. Using ThinkPlace, employees can post their innovative ideas, give and get feedback and suggested refinements, and even volunteer to work on developing an idea posted by a colleague halfway across the world.

3. Online social networking will play an important role in the future of worldwide mentoring and innovation. Social Networking has allowed IBM to flatten the world by giving all employees equal access to each other. IBM executives located in the United States currently successfully act as mentors to employees in China, India and all over the world.

4. The management style of a company can affect its ability to communicate and impede innovation. The existence of multiple business areas without interaction or communication between them will create an insulated environment and silos.
hindering an open flow of ideas. IBM has created “Matrix management” with the goal of softening the edges of line management and creating an environment of collaboration throughout the company.

5. Establishing clear, coherent corporate values provides the foundation for networking and innovation. IBMers found their corporate values to be stifling and were able to express this in email chat sessions opened to all employees. This led Palmisano to refine the corporate values using employee input and create buy in a new way of thinking. This simple yet significant change has served as the groundwork for the innovation and mentoring programs that are currently thriving.
CHAPTER VII

Whirlpool: Innovation Mentoring

Whirlpool Corporation (Whirlpool) began operations in St. Joseph, Michigan in 1911 as the Upton Machine Company, a manufacturer of electric, motor-driven wringer washers. An early association with Sears—producing its house brand (today called Kenmore)—guaranteed survival through the depression.

Whirlpool’s history bears a resemblance to its pre-2000 products: sound, well-managed, nondescript, nothing memorable. There were no P&G “Colgate Total” debacles and no IBM “near-death experiences.” On the basis of quality, dependability and price, Whirlpool became an industry leader with such brands as KitchenAid, Kenmore, Whirlpool, Amana, Jenn-Air, Roper, Bauknecht, and Maytag, which it acquired in 2006.

One has only to walk through an appliance department at Sears, Lowe’s or any big retailer to recognize that home appliances are essentially commodities. The differences in product performance are not evident. One sees row after row of white boxes, punctuated occasionally by a black or silver box.

Major home appliances are necessities with long product lives (typically 15 years for a refrigerator) and zero status appeal, so the consumer rarely gives them a thought until the motor begins to sound louder than usual or food spoils a little faster than it should. The 1990s brought stagnation to the home appliance industry and the realization that companies could cut staff and corners and strive for supply chain efficiencies only up to a point. According to Whirlpool’s current CEO, Jeff Fettig: “From 1997 to 2002, our aggregated growth rate was a negative 3.4%. From 2002 through 2005, we’ve turned that
from a minus 3.4% to plus 5%” (Rowell, 2007). There had to be a way to distinguish one’s product lines to boost sales and instill brand loyalty, the goal of any consumer product company.

Innovation was not new to Whirlpool. The company produced the first automatic washing machine, “a clothes dryer that sensed when the clothes were dry enough, foam insulation for refrigerators and freezers, appliance design by computer simulation, solid-state electronic controls, washers and dryers to launder permanent-press garments properly, a household trash compactor and personal hygiene systems for the Mercury, Apollo and Space Lab programs” (Cutler, 2003). But all these innovations originated slowly, the old-fashioned way, by the fusion of scientists and tinkerers in R&D.

In September 1999, Whirlpool’s then chair and CEO, Dave Whitwam—a Whirlpool employee for 31 years, the last 12 as chair and CEO—announced that innovation—deep, systemic, embedded innovation, would become a core competence at Whirlpool. Product innovation alone does not guarantee staying ahead of competitors. They can easily copy products, perhaps with a lower cost or greater flair. The lesson learned from Toyota’s decades of dominance in the auto industry was that system-wide process or organizational innovation could not be easily copied and affords a more enduring competitive edge.

Whitwam’s new vision was “Innovation from Everyone and Everywhere” (Snyder & Duarte, 2003). Whitwam put Dr. Nancy Snyder in charge of the corporate transformation, as corporate director, Strategic Process and a vice president the following year. Snyder sought the help of Strategos, a strategic innovation consulting company based in Chicago
and the beginnings of a plan were sketched out. Through Snyder’s work (with assistance from Strategos), Whirlpool became an innovation leader. Whirlpool revenues and its market dominance continue to climb, with net sales of $19.4 billion, a 7% increase in 2007 over the 2006 figure.

Whirlpool defines innovation as “a creative idea focused on a customer touch point that:

- Creates unique and compelling solutions valued by the customer.
- Creates real and sustainable competitive advantage.
- Creates extraordinary value for Whirlpool shareholders.
- Comes from everywhere and anyone.”

Innovation embedment was a gradual process of trial and error and step-by-step expansion. For a major corporate transformation to succeed, people’s behaviors need to change dramatically (but not all at once). It is not enough to have the backing of the CEO and CIO – there needs to be ownership of the vision, competency and enthusiasm at every level of the company. Eventually Whirlpool’s plan included all of the following initiatives:

- Innovation Team(s) or “I-teams”
- I-Boards
- I-Mentors
- Innovation E-Space
• I-Pipe

• I-training for everyone: Mandatory E-learning innovation curriculum

• Executive compensation scheme one-third based on what comes out of his innovation pipeline

• I-metrics

• Tools for Sustaining Innovation

• Knowing the customer

Each of these initiatives individually played a role in enabling mentoring to occur to support innovation leading to Whirlpool’s successful transformation.

**I-Team**

Snyder assembled a group of 75 employees from across the company—from foreign and U.S. offices, from vice presidents to directors, secretaries and assembly line workers—to brainstorm on innovative product ideas. In her interview with the author, Dr. Snyder, now vice president, Leadership and Strategic Competency, described their early work:

“Those first seventy-five worked for about a year on these innovation projects, but basically were trying to learn the tools. […] About a third of them would run new businesses [within Whirlpool] when they came out of the process itself. About a third of them would go back to their jobs and be what we might think of as part-time I-Mentors, because they were so highly trained.”
Only one blockbuster product line emerged from their work, the Gladiator Garage Works, modular garage accessories and appliances for men. Gladiator has become the most significant non-appliance revenue producer in Whirlpool’s history. Dr. Snyder admits that most of the rest of the ideas were “outlandish” and beyond Whirlpool’s industry. Although the “I-Team” is now defunct, throughout the company, small cross-functional groups of employees working on a project together are called I-teams (lowercase t).

**I-Board(s)**

The original I-Team was replaced by an I-Board (later three regional I-Boards and today there is an I-Board for each major business unit) with a greater competency to set goals, review innovation ideas, and allocate seed capital as appropriate. The Boards have been instrumental in shifting the focus of innovation gatekeepers away from “big ideas with clearly defined financial payoffs to recognizing the value of nurturing a large number of nascent good ideas (an “I-Pipe inventory) through initial progressive funding of $25,000 increments” (Stopper, 2007).

**I-Mentors**

Over 1,200 Whirlpool employees around the world have now been trained as I-Mentors. They are primarily self-selected, and tend to be people who are curious, who like challenges and who are themselves more gifted at innovation facilitation than inventing. The job is as much skill-based as it is relationship-based.

The role of I-Mentors was delineated by Gale Cutler as follows:
“• Actively seek out new business ideas from within the organization (usually by working one on one or with small groups).

• Drive the expansion of single ideas into multiple opportunities.

• Work with individuals or teams in the development of business plans, focusing on customer benefit and revenue generation.

• Work with individuals or teams on the development of experiment plans to test the appeal and feasibility of potential new opportunities.

• Understand the ‘seed money’ process and assist innovators in accessing seed money.

• Cultivate an environment within Whirlpool that has a ‘bias for action’ and drive a ‘speed to market’ mentality.”

Dr. Snyder describes the training of I-mentors as consisting of one week in the classroom where they “learn the tools,” followed by a four- to six-month intersession where they go out and actually try to create innovations and to apply the tools and they are mentored in the process. They come back for another week of classroom work, and then they go through a peer certification process.

I-Mentors’ assignments typically occur through an informal process. Ideally, the process is organic, where someone knows someone else and they discuss a project informally and the I-Mentor is interested enough to want to help. A second way I-Mentors are assigned is “department by department,” according to Dr. Snyder. She gave this example: “If I run the KitchenAid brand and I have ten I-Mentors on my staff, I give them assignments or
they create assignments given the strategy of the KitchenAid brand.” Lastly, according to Dr. Snyder: If “you’re on an innovation team and you need help, you either go on-line and find an I-Mentor—if you don’t know one or don’t have one in your area—or you go to the regional innovation board” and ask for its recommendation of I-Mentors one could contact. It is significant that I-Mentors can refuse requests for help. If not “enthusiastic and interested,” the team will have to look for someone else. When they agree to mentor, they need to be “passionate” about the project from the beginning.

Obviously, personal I-mentoring is crucial to Whirlpool’s success in innovation and its financial bottom line. If the I-mentors get bored or too busy and slack off on their skills, Whirlpool will lose a vital tool. The company has devised several ways to keep this core competency from slipping away. Every two to three years, I-Mentors return for recertification.

Snyder is currently involved in working with one hundred or two hundred I-Mentors on developing innovation tools for strategy and business decisions. As she stated in her interview with the author, “a very non-product kind of implementation. And [the I-mentors] are absolutely instrumental in that. We basically bring a business team together, we go through a leadership process, but we also teach them innovation to solve their business problems. The I-Mentors are the heart and soul of that. They are absolutely the reason that that program has been a tremendous success.”

Dr. Snyder is very conscious of the need not to let this competency slip away:

“If you lose focus, for some period of time, on the I-Mentors …it’s really a big problem because you (meaning the organization) has shifted its priority, shifted its focus, and
without keeping in constant attention to the I-Mentor population—to keep them together, to keep them trained, to keep them working on really exciting projects, it loses steam and then you’re going to have to go back in and get that reenergized and refocused. … You really have to have a kind of alumni system, to keep them together, keep them sharing best practices, and keeping learning curricula for them. … You want to keep the alumni [I-Mentors] strong and moving forward, and tapping into this really valuable asset.”

Sean Lindy who works on Dr. Snyder’s team as senior manager of global innovation and strategic development, tells about his training as an I-mentor in an interview with the author:

“In training we had three different times when we got together. It was a total of eight days. … There was about a month and half we’d do three days, the next one was two or three days, month/month and half, and then the final version. What we would start to do is, we would start on the front end of innovation, so, web-smashing, looking at trends, really looking at who the Kitchen Aid customer is, developing some of these [insights]—what are the high level benefits? You are really the ideating portion of innovation. And we would learn it in the classroom and then we would go apply it to this specific solution for Kitchen Aid, differentiation in Kitchen Aid refrigeration. In the second session, we would talk more about more business case type opportunities: who are the suppliers we need to go at, what is the economic engine we’re going to use to maximize this solution, what are the risks? ... some of those kinds of things. And this is where I think our stories differentiate. I think a lot of companies will look at ideation and it’s about ideation and there is an IBM commercial out there that they keep seeing these great groups that are doing Yoga and stuff and all the lights are on and they say “What are you doing?” and
they say, “We’re ideating. Leave me alone.” That’s the focus of people in IBM. Well, what about execution? A lot of people can sit in a room and ideate the hard part and the reason why a lot of that doesn’t turn into other things – the fact that they’re not sitting around and being given the skills and the time and the input to create a robust business plan around it. You have to ideate and then have someone else create the business plan, but there’s going to be a loss of knowledge in the transfer there. So, we’re now teaching people, we’re teaching people to do these business cases. And then the last session, and the months in between, we would work as a group.”

**Innovation E-Space**

Like IBM’s ThinkPlace, Whirlpool’s Innovation model provides a community-wide forum for posting innovative ideas, where one can get feedback, such as encouragement, refinements and suggestions. This corporate-wide virtual bulletin board is part of an even more comprehensive knowledge communication system. Innovation E-Space is decidedly pro-active. “Random insights are systematically generated and shared to spark ideas.” The home page links employees to all the tools and resources they could want—“from insight libraries and innovation templates to I-Mentors. It provides ‘an informal social system that works below the hierarchy level,’ Snyder says, “and it uses technology to enable that” (“Whirlpool’s Innovation Maker”, 2006).

**I-Pipe**

I-Pipe is a big-picture tracking device of the innovation pipeline from “concept to scale-up.” It offers product details and helps management focus attention on areas of need.
I-training for Everyone: Mandatory E-learning Innovation Curriculum

Every employee of Whirlpool now must enroll in a mandatory E-course on business innovation which increases understanding of the process and how to facilitate and support it at the departmental level.

Executive Compensation Scheme

Tying one-third of the compensation of executives to what comes out of his innovation pipeline, in terms of both revenues and asset values in the pipeline, was, according to Whirlpool’s new CEO Jeff Fettig, “the big breakthrough that allowed us to scale this up.” Early on decisions were made that most of the reward for innovation should be recognition and the sheer fun of being on a successful team. Monetary rewards can end up skewing the projects that move forward or simply pushing mediocre ideas into the I-Pipe to look busy. It was seen as particularly important that executives would not be rewarded based on metrics that measured anything other than revenues. The value of the innovation to Whirlpool and its value for the innovator ought to coincide. There is only one exception I’ve been able to determine: modest compensation (a TV) is given to all I-Mentors who complete certification.

I-metrics

Early metrics in the first several years measured numbers trained. Thereafter, Whirlpool attempted to measure the effectiveness of I-mentors by some standardized, quantifiable metrics, but none proved satisfactory. The primary measure is now revenues generated from new innovations (and overall) and asset values in the I-Pipe. Performance reviews
and informal surveys are other tools for open-ended evaluations of how I-Mentors, I-teams and executives have performed.

**Tools for Sustaining Innovation**

In an interview with the author, Sean Lindy explained that the role of his team, under Nancy Snyder, is “to create the process’s management systems and enablers to make it easy and sustaining for other people to create innovative outputs.” This, they understand, is key to sustaining Whirlpool’s competency and strategic advantage over its competition.

Lindy adds that each year a survey is sent to all I-Mentors, asking how much time they’ll want to dedicate to I-mentoring in the next year and how involved they want to be.

**Focus on Close Knowledge of Customers**

In his description of his I-Mentor training, Lindy explained that training was very customer-oriented, striving to have an in-depth knowledge of customers’ needs, even before the customer knows them. Lindy sees that all the mentoring and innovation has yielded benefits to the company much more broadly than simply successful new products, but in fact, the changes, such as customer orientation, improve the chances of achieving a stream of successful new products:

“Five or ten years ago, you might not have been able to go up to most people, even in the ad center here, and say ‘Who is the Kitchen Aid customer?’ Now, you can come up to me and I can say they are the home enthusiast, they are male or female, they enjoy the process of cooking even in the hobby form, they like entertaining people specifically in the kitchen. It’s not a ‘I’m going to hide back here and present to the dining table. They
want people in their kitchen. They don’t want products to do the work for them. Don’t give them a microwave that does all the work for them. They enjoy the process. So, those kinds of things and these other intangible benefits are really massive on how they have transformed Whirlpool.”

Another example Lindy provided in his interview with the author, has to do with the application of innovation-thinking to a completely unrelated business question:

“I walked into a meeting room that we had scheduled it for two to three, and there were people still in there at 2:01, so I knocked on the door. It was my old finance group that I had been a part of. I talked to them and noticed on the wall, one of our innovation tools that benefits exploration. It’s one of those things to see what your customer’s looking for, how we can meet them, with what are they dissatisfied, those kind of things. Now walking into this finance meeting, I’m surprised that someone’s facilitating people through this tool. I asked: “What in the world are you guys doing?” They had set up a meeting to bring a subset of our old group together to determine how to best meet the expectations of our internal customers, and they were using financial tools to really look at where we are really providing value and what is the angst that our CFO or our marketing people are feeling around this reporting process? What ways can we help that out? It’s a really interesting look when you’ve got finance people looking at their processes, by utilizing innovation tools, skills and behaviors.”

What are some of the measurable outcomes of Whirlpool’s systemic Mentoring for Innovation?
• Duet at $2,000 is Whirlpool’s most expensive washer and dryer (sold almost always as a unit). In the premium front-loading washing machine category, Duet captured 20% of the market in just three years. It’s a design-rich, environmentally friendly brand (using far less water than conventional washers), and something consumers simply want to have without waiting for their own washer to expire.

• Appliance Suites – Whirlpool coordinated the look and feel of KitchenAid appliances, such as toasters and coffee makers, when research showed that consumers like to have their small portable appliances coordinate.

• Going Upscale worked for Duet and also for KitchenAid’s waffle iron. Out with the $99 version and in with an iconic waffle iron that, at $399, is selling rapidly: production cannot keep up with demand.

• Another example of going upscale is an automatic dishwasher with a high-intensity area which can scrub baked-on foods from cookware and utensils—the Kenmore TurboZone. It’s a quiet model due to extra insulation and has a fashionable stainless steel front panel, allowing it to retail for over $1,100.

• The Pla (pronounced “play”) apartment or loft-size refrigerator in bold orange and silver. It’s a hit among young adults in Brazil who eat most of their meals out and need room only for a couple of six packs and leftover pizza.

• Another kitchen appliance that could be a huge seller among younger adults is a refrigerator with a built-in console and recharging station (the “Central Park Connection”) for an MP3 player, a digital photo album, a DVD/CD player, etc.
RESEARCH QUESTIONS

How do the people championing innovation view the role of mentoring?

Clearly Whirlpool executives are sold on mentoring for innovation. The company recognizes that this competency gives Whirlpool a strategic advantage not easily copied by competitors. Offering unique, innovative products in an industry that had been considered stagnant, continues to improve Whirlpool’s sales and income figures. Net sales, for example, increased 7% from 2006 to 2007, to a record $19.4 billion. Interestingly, the “big breakthrough that allowed us to scale this up,” according to Whirlpool CEO Jeff Fettig, was tying one-third of executive compensation to revenues and asset values in the executive’s innovation pipeline (“I-pipeline”). The compensation scheme incentivized the adoption of mentoring for innovation at the top levels of each business.

How and why is mentoring useful for innovation?

Innovation mentoring at Whirlpool keeps project teams focused on the entire innovation process from idea to sales. It is not enough to have a group of employees “ideating,” as Sean Lindy, senior manager of global innovation and strategic development, points out. The hard part is working with the ideators to develop a robust business plan so the idea becomes a successful product in the market. The process requires a broad variety of skills and expertise. When personnel involved at each step of the process don’t mentor each other concurrently, but hand off the project from one function to another, knowledge is lost at each hand-off and innovation proceeds by fits and starts. Concurrent, cross-functional mentoring sparks creativity and problem solving and guides the project away
from blind alleys at early stages of development. The process greatly reduces development to market time.

**How is formal mentoring or mentoring training utilized?**

The formal, extensive program of training and deploying I-Mentors is at the core of Whirlpool’s innovation model. I-Mentors undergo periodic recertification and priority has been placed on maintaining this core competency. I-Mentors are currently working with Dr. Nancy Snyder, vice president, Leadership and Strategic Competency, in developing innovation tools for strategy in non-product business decisions. She expressed Whirlpool’s priority to “keep [I-Mentors] together, to keep them trained, to keep them working on really exciting projects … keep them sharing best practices, and keeping learning curricula for them.” It’s crucial for Whirlpool’s continued success to keep the force of I-Mentors “strong and moving forward.”

**How do mentors and protégés find each other to work on innovative projects?**

Over 1,200 Whirlpool employees chosen to be trained as Innovation Mentors (“I-Mentors”). They are dispersed throughout the company. “Ideally” the process of pairing an I-Mentor to a protégé or a team is organic and informal, based on personal knowledge of the mentor’s strengths. I-Mentors are assigned to departments and can either be assigned to work with a project team or create their own project team. When a project team needs help from an I-Mentor and doesn’t have one available in its area, the regional innovation board can recommend I-Mentors. I-Mentors are free to reject projects.
A company-wide bulletin board provides a forum, like IBM’s ThinkPlace, for posting innovative ideas, giving and getting feedback, encouragement, and refinements. This opens up the mentoring-protégé pairing process to all employees.

How do firm factors, such as size of organization, product offerings, and type of industry affect how, when and why mentoring relationships are developed or nurtured?

Informal product innovation mentoring no doubt existed among Whirlpool’s scientists and tech people (the “tinkerers”) throughout Whirlpool’s history. Given the long product life of major appliances and the fact that end users of products like washers, dryers and dishwashers often are not the purchasers (home builders and prior occupants may have purchased them) and that perceived brand reliability governed the purchase decision, the traditional focus had been on technical excellence and not appealing to the consumer needs and tastes. To break out of that business model and begin inviting customers to buy attractive products (at premium prices), mentoring relationships had to form between the technical community and those who understood consumers and all the implementation steps in the product-to-market cycle. Whirlpool’s I-Mentors are the key to facilitating this process of cross-functional exchange.
LESSONS LEARNED

1. In today’s market, stagnation will be harmful to a company’s growth no matter the level of quality of product. After its founding in 1911, Whirlpool became an industry leader on the basis of quality, dependability and price. However, quality was no longer enough to sustain growth in order to grow there needs to be innovation. Before an innovation program was started at Whirlpool, from 1997 to 2002, the aggregated growth rate was a negative 3.4%. After the innovation program was implemented, from 2002 through 2005, the growth has gone from a minus 3.4% to plus 5%.

2. Product innovation alone does not guarantee staying ahead of competitors. They can easily copy the product, perhaps with a lower cost or greater flair. To create something more than simply product innovation Whirlpool announced a deep, systemic, embedded innovation program that would become one of its core competencies. Whirlpool has implemented innovation at almost every level by including the following initiatives: Innovation Team(s) or “I-teams”, I-Boards, I-Mentors, Innovation E-Space, I-Pipes, I-training for everyone: mandatory E-learning innovation curriculum, executive compensation scheme one-third based on what comes out of his innovation pipeline, I-metrics, tools for Sustaining Innovation and an emphasis on knowing the customer.

3. Ideating is more effective and efficient when the person who is ideating also has the skills and knowledge to execute the idea. When one person ideates and then has someone else create the business plan, there’s a loss of knowledge in the
transfer there. To combat this loss of knowledge Whirlpool is teaching people to do business cases as well as ideate.

4. The key to maintaining Whirlpool’s competency and strategic advantage over its competition is sustaining innovation. One brief period of innovation is not enough; to create a sustained level of innovation Whirlpool has formed a team to create the process’s management systems and enablers to make it easy and sustaining for other people to create innovative outputs.

5. The key to innovating products that will be successful is having a close knowledge of the customers. Whirlpool enforces this within its I-Mentor training program. In an interview with the author Sean Linley explained that the training is very customer-oriented and encourages mentors to strive to have an in-depth knowledge of customers’ needs, even before the customer knows them. This allows Whirlpool to create products that are not only innovative but also popular.
CHAPTER VIII

DISCUSSION AND CONCLUSIONS

Overview

To summarize the study, we will begin with an overview of the purpose and procedures. Then a comparison section will cross-analyze the findings of the four cases presented. Finally, concluding statements will address the contributions the present study is making to the field.

Purpose of the Study

The purpose of this study was to assess the role of mentoring in the innovation process within four major U.S. firms considered to be among the most innovative in the world. Using the five research questions, interview question sets were developed. From the 23 interviews, themes emerged, as highlighted in each firm’s case study. In addition, five lessons learned per case were developed. For clarity of organization and presentation, answers to the research questions were blended throughout the cases.

CASE ANALYSIS AND COMPARISONS

Innovation Oversight and Leadership

Three of the four firms named an executive accountable for the innovation process. When asked who was responsible for innovation at 3M, participants interviewed from the firm consistently responded, “Everyone.” The other firms seemed to have the innovation champion in their strategic area of core competency. Procter & Gamble, a consumer goods company, is focused on packaging and customer engagement. Claudia Kotchka,
the VP of Design Innovation & Strategy, oversees branding and design efforts throughout the company, even going so far as to have designers mentor engineers and product development teams in design principals. IBM has primarily become a service company with tens of thousands of consultants throughout the world. Their Chief Information Officer, Nick Donofrio, heads up the innovation efforts with a team of other lifetime IBM employees. His entire leadership team is comprised of IBM Master Inventors.

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<tr>
<th></th>
<th>3M</th>
<th>Procter &amp; Gamble</th>
<th>IBM</th>
<th>Whirlpool</th>
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<tbody>
<tr>
<td>Innovation Oversight</td>
<td>No one assigned, all accountable</td>
<td>VP of Innovation Design &amp; Strategy and the CTO</td>
<td>Chief Information Officer</td>
<td>Corporate VP of Leadership and Strategic Competency Creation</td>
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<tr>
<td>Innovation Focus</td>
<td>Leverage existing technologies; reinforcing core</td>
<td>Design focus Diversity initiatives Customer delight</td>
<td>Service focus Innovation thinking with business model &amp; Customer</td>
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<td>Mentoring Programs &amp; Facilitation</td>
<td>Open Door Policy On-line courses</td>
<td>Embed designers Train in design-think Embed Tech Entrepreneurs</td>
<td>Virtual mentoring engine</td>
<td>I-Mentoring I-Mentor Mandatory E-course on bus inno for all</td>
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<td>Concurrency</td>
<td>Teams from ideation-delivery &amp; end-user focus</td>
<td>Design embedded throughout cycle</td>
<td>Business synthesis</td>
<td>Innovation embed through cycle</td>
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<td>Learning and Knowledge Sharing</td>
<td>Tech Forum Chapter meetings</td>
<td>Connect &amp; Develop ramps up internal R&amp;D</td>
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<td>Mentoring Reinforcers</td>
<td>Part of performance evaluation, Culture</td>
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<td>BizTech Rewards Buddy System</td>
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<td>Innovation Reinforcers</td>
<td>15% Rule Concurrency Awards</td>
<td>Qualitative metrics—key element assessment, 50% products from C&amp;D</td>
<td>Exec Business Inst. Open ecosystem Exec compensation</td>
<td>I-metrics Exec. compensation</td>
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<td>Tenure</td>
<td>Most lifers</td>
<td>Almost all lifers</td>
<td>Most lifers</td>
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<tr>
<td>WorthNoting</td>
<td>No silos-tech belong to 3M -- leverage</td>
<td>Mentor, Coach, Sponsor</td>
<td>80,000 IBM “consumers” are proving ground</td>
<td>Tools for sustaining innovation</td>
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Both Kotchka and Donofrio were described by their colleagues in terms one would use to describe a transformational leader: inspirational, knowledgeable, supportive, enthusiastic, visionary. Innovation initiatives under the guidance of managers who display transformational leadership qualities will increase learning (Mavrinac, 2005; Yukl, 1989), organizational commitment, job satisfaction (Godshalk & Sosik, 1998; Scandura & Schriesheim, 1994), and they will be able to facilitate change more effectively than a leader with a more transactional style (Dess & Picken, 2000).

Finally, Whirlpool gave the reins to a Ph.D. in organizational behavior to steer the innovation initiatives. Dr. Nancy Snyder is Corporate VP of Leadership and Strategic Competency Creation, charged with creating a major organizational shift toward getting every employee in the habit of sharing ideas throughout their tenure. No idea is too small, and the rewards are great. She works on making connections and building a community of trust (Wanberg et al., 2007; Kanter, 1983), building organizational commitment.

**Innovation Focus**

Many employees at 3M cited its incredible ability to leverage core technologies. Through Tech Forum and the many other events and programs to keep the scientists and researchers communicating and sharing their projects—discoveries as well as hurdles—solutions to technical problems and new product applications are discovered. Through an extraordinary level of networking, an open door policy and culture of “all for one and one for all” the person within the 3M community with the expertise to help solve a problem is rarely more than two phone calls or e-mails away. Many 3M scientists may have asked the very same questions over the course of their careers (Allen et al., 1988).
Dr. David Yarusso noted that “what is unique about 3M is its ability to focus on so many different businesses to leverage a given technology area.” He added: “The end game was in view from the beginning.” 3M’s multidisciplinary team approach toward innovation is used in developing official projects and is used as well in products being developed on 15% time.

P&G’s design-centric focus is aimed at giving customers the sense that a P&G product “makes my life better.” When one’s goal is to delight, a joy surrounds the development process (Amabile et al., 1996).

“The New Blue: Focused to Win,” an IBM slogan linked with a plan to become the “best company in the world” is its innovation focus. The “winning behaviors” rewarded are “speed, commitment, focus, passion for the business, teaming, and knowledge sharing” (and not merely the results of these behaviors) (Nelson, 2003).

IBM was the first major U.S. corporation with the vision to see the unlimited business potential of the Internet and to move the company from its hardware commodity business to a software and service focus. With the understanding that the creativity of its people was the product and that “managing people” stifles innovation and undervalues their worth, IBMers agreed on core corporate values that would guide their business conduct and provided virtual avenues to unlock their creativity (Kanter, 1983).

Working in a stagnant industry not known for products that elicit emotions, Whirlpool shifted the focus of its innovation gatekeepers away from “big ideas with clearly defined financial payoffs to recognizing the value of nurturing a large number of nascent good
ideas (an ‘I-Pipe inventory’) through initial progressive funding of $25,000 increments” (Stopper, 2007).

Whirlpool made a commitment that systemic, embedded innovation would become a core competency. With the goal of developing “creative idea(s) focused on a customer touch point,” they reached out to the customer to create an emotional appeal, yes, even with washing machines. I-Mentor training involves in-depth knowledge of customer, asking themselves, for example, “Who is KitchenAid customer?” Discovering that she likes entertaining in the kitchen, considers cooking for friends a hobby and skill she likes to show off, KitchenAid came out with suites of color- and design-coordinated products. Upscale products, like $399 retro waffle iron, has sold faster than their production facility could handle. By listening to the consumer to get a complete understanding of her lifestyle, habits and aspirations, Whirlpool was able to hit an emotional chord and create a relationship (Landry et al., 2004; Rogers, 2004).

**Mentoring Programs and Facilitation**

At 3M no new major mentoring program was needed. 3M had fostered a culture of mentoring throughout its entire history. The company defines collegiality. An open door policy did not have to be invented; it was present from the beginning. Senior staff acknowledges with gratitude the mentors who helped them along their career paths at 3M. They seem to relish being able to return the favor with younger staff.

Technological sharing leads naturally to informal, organic mentoring as relationships are developed (Pierce, 1983). 3Mers in R&D know hundreds and hundreds of colleagues by
P&G, in contrast, had to be completely reinvented in terms of focus and innovation processes, from a “fascination with the science” orientation (with only secondary regard to the consumer) to asking what product would excite the consumer and create brand loyalty (with sound science as only part of equation). The P&G workforce had to be weaned away from the organizational efficiency model with its conservative, risk-averse methodologies; barriers to innovation had to be broken down (Mumford et al., 2002), and the best approaches tossed out, including the detailed prescription for writing memos (Amabile et al., 1996), and the only acceptable formula for advertising (problem, solution, demonstration).

P&Gers had to embrace the freedom to be creative and be trained to engage in design-think, letting creativity develop innovation in place of linear, deductive thinking. P&G had to become totally customer focused, incorporating design-thinking into every aspect of product at every customer touch point as a means of pleasing the customer.

At IBM, formal mentoring was thought not to be needed for its highly professional, creative workforce, but a vision and identity were seen as valuable means of inspiring employee commitment, drive and loyalty. Prior to IBM’s transitioning to an IT software and service company, innovators within IBM had difficulty getting senior executives to understand the potential of the Internet. Showing the marked risk-aversion of large, successful companies, Internet-promoters had to develop an intranet “beneath the radar” and strategize how they could demonstrate its potential by hosting Olympics coverage on the Web.
When Samuel Palmisano was promoted to IBM’s Chairman and CEO New, he was determined to harness the idealism and creativity of IBM’s younger workforce through the debate about IBM values, forging a corporate identity they could be proud of.

Whirlpool followed a very systematic, step-by-step process to move the company from science-inspired, slow-paced innovation to an approach that facilitated speed to market and exciting products that drive tremendous growth. The first attempt at an Innovation Team showed that a huge group could not easily sustain creative thinking. Small groups, working around product/consumer needs with an I-Mentor to coach the cross-functional committee members emerged as the best approach.

Concurrency

The movement by each of the companies studied to follow concurrency principles has the benefits of decreasing risk of project termination, increasing the opportunity for market success, and producing more innovation from team members (Akgun et al., 2005; Allen et al., 1988; Cohen & Levinthal, 1989; Judge et al., 1997).

3M is a science-driven technology and manufacturing company, but from the beginning of their employment, technical employees are introduced to the business dimension to keep them focused on a successful innovative product, rather than on pure science. Projects are teamed by scientists and engineers, as well as manufacturing, finance, marketing and sales personnel (who know consumer needs thoroughly). 3M’s Peter Fritz espouses the “pillars of concurrency,” which keeps everyone’s eyes focused on the commercialization prize—integrating strategy, people, process, tools, technology and
consumer from concept to launch. The end result is a great-selling product that arrives
fast to market.

P&G used to create products at a pace dictated by advancements in science (think
terrapins) and used the art department and marketing people as the last station on way to
consumer, as an afterthought. Before design innovation became the corporate focus, a
half-dozen shampoos were sold in identical-shaped bottles. P&G’s focus is now on
design concurrency, which thinks in terms of whole product and usage. Cross-functional
peer mentoring is a major plus as design people educate the scientists and vice versa.
P&G complements this with radical technological concurrency. Through Connect &
Develop, P&G can tap into about 2 million experts worldwide to find solutions to tech
issues in days instead of years.

IBM’s intranet platforms ThinkPlace and Technology Adoption Program allow for 100%
concurrency. Volunteer “Think Place catalysts” monitor TP for great ideas. All IBM
personnel, whatever their expertise or stage of product/service development, can add their
suggestions to proposals to harness maximum input from every part of company,
globally. Employees can test out new services through alphaWorks and developerWorks
to provide “customer” input, feedback and suggestions for improvement before it
launches.

Little concurrency existed at Whirlpool before 1999 and it was Dave Whitwam’s plan to
introduce innovation into every process and function of the corporation. Concurrency is
achieved through I-teams, led by I-mentors who now look for unique and compelling
solutions offering value to the customer which will give Whirlpool competitive advantage and sustain profits.

**Learning and Knowledge Sharing**

The informal open door policy, connecting one protégé to a mentor and all his contacts is effective but definitely time-intensive. Constant knowledge-sharing and learning was going on within divisional and corporate labs, but not among the whole 3M scientific community.

3M recognized the value in formalizing information exchange through the Technology Forum annual event (the glorified science fair) and then through educational opportunities that grew out of Tech Forum – monthly chapter meetings, monthly speaker breakfasts, and eventually the virtual tech forum broadcast to its laboratories worldwide (Allen et al., 1988).

P&G innovation had suffered due to little knowledge sharing outside discrete labs working on their discrete product lines at their own slow pace. A.G. Lafley, who took the reins in 2000, reorganized corporate divisions (which had been silos) and eliminated 10,000 jobs in upper management to eliminate inertia and legacy thinking (Andrews & Farris, 1967; Farris, 1972; Kanter, 1983).

Lafley grew the R&D workforce of 7,500 employees overnight to 1.5 to 2 million “outside” inventors/entrepreneurs worldwide through Connect & Develop – technology sharing via Internet using brokers like NineSigma. Greater concurrency in-house is also spurring innovation.
It’s no surprise that the giant whose newly reincarnated software/service business revolves around the Internet, would use the capabilities of the Internet (properly-speaking intranet) to maximize learning and knowledge sharing. Beginning with its “Jams”—as in the pivotal ValuesJam where for 72 hours all IBM employees could post messages on one mega-companywide message board—IBM has thrown up a wide variety of platforms for knowledge sharing within the far-flung company and embraced technology sharing with outside companies, including competitors, for even greater innovation.

Some IBM platforms for learning and information sharing are: ThinkPlace, Technology Adoption Program, Think! Seminars, community conference calls, IM, blogs, wiki, BizTech, alphaWorks, developerWorks, and IBM’s Executive Business Institute: Strategic Innovation courses (Rogers, 2004; Wuyts et al., 2004).

Whirlpool has designed an Innovation E-Space, a rough equivalent of IBM’s ThinkPlace and 3M’s non-virtual Technology Forum. The role of trained and certified I-Mentors is to work with new concurrency teams (where learning occurs and knowledge is shared relative to specific projects) to impart the process knowledge for innovation that is seen as key to Whirlpool’s success as an innovative 21st century company (Subramanian & Youndt, 2005).

**Mentoring Reinforcers**

At 3M, mentoring is a component of performance appraisal, but because informal mentoring is so embedded in 3M’s culture, it hardly needed to be reinforced. Every employee interviewed has multiple stories of 3M colleagues who mentored them and
others with tangible results. They seem to cherish the personal, social aspect of mentoring as something that gives real meaning to their careers and to their lives.

Stories of champions and sponsors who fought for an innovation that was almost shut down because it didn’t fit into one division’s product line also reinforce the heroic status of mentors.

P&G began hiring and mentoring a diverse workforce in the 1980s because it was the right thing to do and because leadership knew that diversity of gender, race, age, competencies, would lead to synergies and better understanding of consumers. These mentoring programs were initially career-oriented and skills-oriented, and in a sense paternalistic in direction. Today P&G has a formal mentoring program that encourages employees to seek career and knowledge mentors at many levels of the organization.

A “Team Effectiveness” tool has been developed to measure the level of interaction, openness and effectiveness of the mentoring that occurs on the Innovation teams. The emphasis on concurrency and design-centricity constantly reinforce cross-functional mentoring.

New product successes (all the result of I-team/concurrency cross-mentoring) are held up as models to all.

Face to face mentoring is encouraged at IBM, although the vast majority of mentoring occurs on the intranet. IBM has instituted a number of metrics to measure managerial mentoring, including surveys and measurements of participation disseminated through blogs and wikis. Its rewards program features a broad variety of rewards that recognize
mentoring behaviors, such as, “New Blue: Focused to Win,” Thanks!, Bravo! and Knowledge Advantage.

Whirlpool closely tracks the productivity and interest level of trained I-Mentors and is developing metrics to measure mentoring in more precise ways than revenues from innovation. Performance reviews and informal surveys are tools for open-ended evaluations of how I-Mentors, I-teams and executives are performing.

**Innovation Reinforcers**

Perhaps the most interesting finding in this area was the number of counterintuitive programs, policies and norms 3M has in place. Both the 15% Rule and the open door policy would seem like major distractions, deterring people from getting their assigned job done. Instead, those activities, in addition to many others, give employees access to mentors, networking opportunities, and the feeling that they are part of a larger team (Kaye & Jacobson, 1996; Pierce, 1983; Tarao, 1997). These activities also support increased job satisfaction and organizational commitment (Allen et al., 2004; Chao et al., 1992; Scandura & Williams, 2004). Through these actions, both hierarchical mentoring and peer mentoring are facilitated, supporting a culture of continuous learning (Bryant, 1997; Lorenzet, 2005). That ever-increasing knowledge-sharing capability leads to greater employee self-esteem (Lankau & Scandura, 2002), which can lead to increased risk-taking (Jassawalla & Sashittal, 1998) and more innovation (Lefebvre & Lefebvre, 1992).
The 15% Rule gives employees freedom to keep their intellectual curiosity alive, increasing autonomy (Graen & Scandura, 1987), which may be related to increased innovation (Scott & Bruce, 1994).

**Tenure**

Tenure may appear to be an odd aspect of innovation. One thinks of long-tenure/seniority as something that might stifle innovation – the caricature of senior executives locked into legacy thinking, turf protection, not inclined to rock any boats and try new things because retirement is a few years away. Some senior executives may be inclined to “manage” personnel from the old-days and models of management, rather than cross-mentoring and unleashing creativity in the workforce.

In a corporation where technology is a vital component of the business, the senior “know how” is a tremendous asset to the company. When a CEO sets a policy of encouraging mentoring, of staff development and information-sharing, senior staff rise to the challenge, creating almost a family atmosphere. And senior executives come to value what they learn about cutting-edge developments from the recent graduates on their teams.

Tenure is a sign of loyalty to the organization, and a tremendous asset in itself, that can be mentored through modeling to younger staff. Loyalty breeds innovation, perseverance, extra effort, and a desire to receive recognition for contributions.

3M’s historic open door policy and 15% time are especially valuable in connecting those with the greatest accumulated knowledge with less experienced staff. Through long
tenure, many senior people at 3M have worked in different divisions on different technology platforms and have a broad and deep understanding of science. Many long-tenured staff at 3M are among Carlton Society members and the corporate heroes and legends. Younger staff relish their close working relationship to these heroes and try their utmost to emulate and impress them.

P&G’s policy to promote from within, expecting almost all employees to be lifers, translated into a mindset that senior staff was responsible for grooming the next generation of P&G leaders. Commitment to career mentoring began 25 years ago and grew out of P&G’s commitment to increasing workforce diversity (women and minorities). P&G effectively uses formal and informal reverse-mentoring (upmentoring) to keep the seniors fresh and consumer-oriented.

Sam Palmisano’s new direction for IBM—moving to Internet software and service from hardware – was widely embraced by the younger workforce who could see the potential in the new technology and were eager to innovate. Senior staff initially may have been stuck in legacy thinking and uncomfortable with the new direction. Strong leadership from the CEO and tying executive compensation to customer satisfaction, plus an intense desire among long-tenured staff to avoid the debacle of the 1990s, permitted the move from silo management to matrix management. Connect & Development was resisted by tenured executives who had a mentality that if it wasn’t created at IBM, it’s not worth looking at. The quick succession of success stories from C&D open innovation, won over the tenured executives quickly.
Tenure could have been a problem for Whirlpool which had been operated in a traditional manufacturing mode for a century. The turning point in accepting the new innovation model for Whirlpool came when executive compensation was tied to revenues generated from the innovation pipeline.

Proposed Model for the Role of Mentoring for Innovation at Large Firms

Based upon the results as reported, I propose a model of the role of mentoring in the process of successful innovation for large firms. I will define each construct and hypothesize relationships between and among the variables.

Firm size is defined as the number of paid employees. For the purposes of this model, large firms will be defined as those with 1000 or more paid full-time employees. This
number is consistent with the literature (Fujiwara-Greve & Greve, 2004), although the U.S. Census Bureau, the Canadian Census, and other governmental agencies typically consider firms with 500 or more paid employees as being large.

Formal policies, rules, and oversight refers to documented procedures, policies, paperwork, and levels of bureaucracy that may slow or stifle the innovation process. The firm's size should have a negative effect on formal policies, with an increase in size also increasing the number of documented policies. Managing more than 1000 employees requires that formal (written) rules and policies be in place to standardize procedures and minimize special treatment (and lawsuits). Large firms tend to have bureaucracy in place that may inhibit creativity (Kamien & Schwartz, 1975).

Schumpeter (1942) posited that large firms had an advantage in innovating over smaller firms because of their financial resources. I will add that large firms that have mechanisms in place for knowledge and idea sharing have an advantage in the exponential amount of additional data to be gathered and disseminated by and to each employee who participates in the maintenance and storage of tacit knowledge and new ideas.

The leadership in large companies with successful innovation initiatives may have a positive effect on maintaining a laissez-faire approach to many policies that may restrict innovation. If the vision of the leader is to increase innovative output, he or she will promote and support activities that will help employees meet those goals (Kanter, 1983; Plaskoff, 2005), which may involve giving more freedom to researchers and scientists.
Leadership has been found to have a positive effect on creating and sustaining a culture of knowledge sharing. Much of the research about learning organizations contends that it is a top-down process (Dovey, 1997; O'Regan, Ghobadian, & Sims, 2006; Scarbrough & Swan, 2005). Leaders have to set the vision and communicate it properly to mobilize the organization toward a knowledge sharing initiative (Dovey, 1997; Judge, Fruxell, & Dooley, 1997).

The concept of average tenure is important as it relates to the length of worker employment within the firm. Having a large percentage of employees who have been with the company for many years, sometimes decades, has a positive effect on a culture of knowledge sharing as it is ingrained and passed down as a norm in the organization (Ouchi & Johnson, 1978; Tang, Kim, & O'Donald, 2000). Long average tenure rates may imply strong organizational ties which may be evidenced through extensive social networks. Understanding the people involved and the systems in place reinforces participation in knowledge sharing activities.

Long average tenure rates usually imply organizational commitment to some degree. Long tenure rates have been found to be positively related to a desire to maintain organizational values (Schmidt & Posner, 1983) and firm status quo (Staw & Ross, 1980). The converse is also true in that having high levels of organizational commitment increases one's likelihood of remaining in the firm.

Long tenure increases an employee's confidence in his or her ability to do the job. In a climate conducive to innovation, this may manifest itself in increased risk-taking and
behaviors that challenge the status quo, especially as employees learn how to navigate through policies and around gatekeepers.

The relationship between human resources functions and a culture of knowledge sharing is very important. The human resource functions I will focus on are recruiting, training, and retention of employees. HR professionals must work with other leaders in facilitating the culture that supports a learning organization (Scarbrough & Swan, 2005; Souder, 1987). Recruiting employees who will have both strong technical and social skills and considering person-team/organization fit is a key ingredient for innovation (Judge, Fruxell, & Dooley, 1997). One must also attempt to recruit for diverse backgrounds and perspectives to increase innovative output (Ostegaard, Kristinsson, & Timmermans, in press; Williams & O'Reilly, 1998). Training employees to participate in a larger community of innovation rather than focus on their own lab increases knowledge sharing and innovative output as well (Allen, Katz, Grady, & Slavin, 1988; Judge, Fruxell, & Dooley, 1997), and that aspect of a learning organization breaks down barriers and increases trust between and among employees, decreasing competition. Finally, retaining technical staff is best done through facilitating and supporting experimentation and scientific inquiry with open communication lines to ensure immediate access to information and resources. A culture of knowledge sharing helps retain innovators, especially through close ties that may take the form of mentoring relationships. HR functions are also involved in mentoring for innovation strategies. Often times the HR department organizes formal mentoring programs within the company, specifically with the goal of acclimation and retention of new hires in technical fields. Training of mentors to facilitate innovation (Cutler, 2003) or pairing a successful inventor with a
protégé of the same ethnic background (Pierce, 1983) are key roles HR can play in supporting mentoring for innovation initiatives.

HR functions are pivotal to innovation. The creation of the dual ladder system to maintain technical employee motivation (Sheppard, 1958), the support and maintenance of a climate conducive to innovation and the recruitment and retention of applied scientists can be a firm's core competency.

For this model of large firm innovation, human resource functions will often have a negative effect on formal policies, as large firms often are less flexible in their policies and procedures than smaller firms (Cohen & Klepper, 1996) and HR professionals are cognizant of legal ramifications of not following standardized procedures for recruiting and training. Formal policies may also have a negative impact on human resource functions in that individuals may have special circumstances or needs that may not be properly addressed because of policies requiring standardization. Organizational structure, reward systems, salary bands, and hiring policies are often created as a company-wide strategy, leaving HR professionals little room to negotiate with star recruits and players.

Organizational culture will be negatively affected through the introduction of formal policies that may inhibit innovation. The direct result will manifest itself in the perceptions and reactions that will be evident in the climate. If policies are in place restricting resources (tangible or intangible), a climate that had seemed supportive of radical innovation through collaboration and risk-taking will adjust to start introducing small incremental changes in product design or functionality.
Formal policies may have a negative impact on the employee’s trust in the organization. He or she will not feel like a valued member of the firm if time clocks are introduced, or if Internet usage is monitored. Policies like the 15% rule at 3M are a great exception to this postulate.

Formal policies may prove to have a negative effect on mentoring for innovation. An example may be in performance appraisals that require mentoring as a prerequisite to promotions or salary increases. A technical person with poor social skills may do more harm than good in attempting to use coaching to increase the self-confidence of his or her protégé. With the introduction of a mentor-training workshop, problems with a policy like this may be easily monitored by HR, which may be able to work more closely in developing the mentor's skills.

Formal policies are often perceived to restrict freedom, therefore having a negative effect on innovation. Requiring outside approvals, paperwork at every stage of experimentation, and multiple levels of bureaucracy can cause frustration. Ideas may be abandoned if support for risk-taking is withheld.

A positive climate has been found to increase mentoring behaviors (Clutterbuck, 2004). As such, in a climate that facilitates freedom and the candid sharing of ideas (Orth, Wilkenson. & Benfari, 1987), mentoring for innovation is a likely outcome.

An employee with strong organizational commitment wants to help the firm achieve its organizational goals (Brashear et al., 2006). Mentoring for innovation is a manifestation of that desire as one may want to impart his or her knowledge and skills, including
understanding the political process of innovation, to other members of the organization (Levinson et al., 1978; Mullen & Noe, 1999).

An employee having trust in the organization (both in the consistency of the system and his or her role in it) and the individuals in the environment should have a positive effect on mentoring for innovation. If expectations have been met or exceeded, generally trust develops (Young & Perrewe, 2000), which is considered an antecedent to mentoring (Kram, 1985). Trust in the firm to maintain the relationship and trust in a protégé to reciprocate not only trust, but also time and commitment, must be present for mentoring for innovation to occur.

The presence of employees with high self-esteem will have a positive effect on mentoring for innovation efforts. Those confident innovators will feel comfortable in their roles and embrace the opportunity to prepare the company’s next generator of innovators (Levinson et al., 1978).

A climate that supports open communication, sharing of new ideas, knowledge transfer, developing employee skills, and where management supports and encourages risk-taking are imperative prerequisites for innovation to occur (Kanter, 1983; Susanj, 2000).

Having employees with high levels of organizational commitment is considered the most important factor in a firm’s innovative output (Tichy & Devanna, 1986).

By opening communication and cooperation among employees, trust facilitates innovation (Webber, 2002) and employees who report trusting their management also report being more open to sharing ideas (Ferrante, 2006).
An employee must have confidence in his or her ability to experiment with new ideas and not give up even with repeated failures to be successful in innovative projects (Mascitelli, 2000).

Culture of knowledge sharing has a positive effect on innovation in that learning about successes and failures in science and technology between and among teams, labs, departments, and units leads to higher levels of innovative output (Allen, Katz, Grady, & Slavin, 1988). Innovation feeds back to strengthen a culture of knowledge sharing as innovative product and service introductions to market created through those means serve as examples of success of idea sharing which may increase the likelihood of more collaborations.

Innovation has a positive effect on firm size as additional successful introductions of new products or services to the market may require additional employees to develop, sell, market, or other planned growth with the revenues derived through the innovation.
CONCLUSION

These findings support that technical and design workers (where innovation is a core competence) view the mentoring relationship differently than the traditional view of mentoring. That offers benefits to the human resource practitioner in understanding the need for a variety of mentoring programs to coexist to target organizational strategies as well as departmental development. Another take-away, consistent with the literature (Keele, Buckner & Bushnell, 1987; Kram, 1985; Noe, 1988; Scandura & Williams, 2001), argues the effectiveness of informal mentoring. Throughout the study, almost all of the mentoring involved in innovative tasks and discovery was informal, with the exception of what was reported at Whirlpool. This is a key finding to start understanding the mentoring for innovation concept more clearly, and management should develop a climate that supports and facilitates the development of informal mentoring relationships, as we have seen at 3M and IBM. The goal is helping the creation and sustaining of more innovation, and this study suggests that the process seems to be more successful when mentoring pairings occur naturally instead of when management pairs people through formal programs. The chemistry argument stands! If this information is available to managers with non-technical backgrounds, this may offer an important insight in better understanding and managing their technical staff.

The participant group and other executives within large firms will be able to use the results to assist them in better managing value creation processes within their organizations. This study offers hope to those concerned that having a lot of employees means a lot of bureaucracy and a loss of agility. We have seen throughout the cases that
the entrepreneurial spirit is alive and well. They will also be able to use the findings as justification for recruitment or training of executives and key players within departments (especially R&D and design) to create or develop procedures to support a climate for innovation, where mentoring will naturally flourish. Finally, many suggestions were offered concerning the many ways to intrinsically motivate and reward employees to participate in both formal and informal mentoring initiatives and increase innovative output. I hope that the Theory X manager takes note of the work ethic, loyalty and energy that these employees show as a result of an environment where they feel trusted and valued. While the employees at the companies profiled are special people, the firms to which they are devoted created a place that attracted and retained these individuals for decades. If that reciprocal relationship can be realized in an organization with hundreds of thousands of employees, maybe there is hope for us all to keep the entrepreneurial zeal alive regardless of firm size.
REFERENCES


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


Appendix A

Methodology for Each List Used in Targeting Participants

Methodology for “Champions of Innovation” (CoI) List

Published by Business Week on June 19, 2006

No Methodology was given.

Methodology for "Most Innovative Companies"

Published by Business Week on April 24, 2006

The BusinessWeek-Boston Consulting Group 2006 senior management survey on innovation was distributed electronically to executives worldwide in early 2006. In February surveys were sent to the largest 1,500 global corporations, determined by market capitalization in U.S. dollars, with instructions to distribute the survey to their top 10 executives. The survey was also accessible on several Web sites: the BCG Innovation Institute, BusinessWeek, Knowledge© Wharton, and the Nightly Business Report. Survey participation was voluntary and anonymous, and the survey was closed in April, 2006.

The survey consisted of 19 general questions on innovation and an optional 8 questions that focused on innovation metrics. A total of 1,070 executives answered the survey. Of those, 46% were from North America, 30% from Europe, and 16% from Asia or the Pacific region. To avoid vote-stuffing, respondents were asked to identify the most innovative company outside their own industry. For a full list of the top 100 companies, go online to businessweek.com/innovate.
Methodology for "Most Innovative Companies"

Published by Business Week on May 4, 2007

The BusinessWeek-Boston Consulting Group 2007 list of the World’s Most Innovative Companies is based on a senior management survey about innovation and was distributed electronically to executives worldwide in late 2006. In October, surveys were sent to the 1,500 largest global corporations, determined by market capitalization in U.S. dollars, with instructions to send the survey to their top 10 executives in charge of innovation. We also distributed the survey to senior management members of the BusinessWeek Market Advisory Board, an online panel consisting of BusinessWeek readers, and via the Knowledge@Wharton e-mail newsletter. Survey participation was voluntary and anonymous, and the survey closed in March, 2007. The survey consisted of 20 general questions on innovation and an optional 12 questions focused on innovation metrics.

A total of 2,468 executives answered the survey. Of those indicating their location, 77% were from North America, 12% were from Europe, and 9% were from Asia or the Pacific region. A larger share of North American voters this year may explain some movement in the rankings of some companies on our list.

Analysis and data provided in collaboration with the innovation practice of The Boston Consulting Group, BCG-ValueScience, along with Standard & Poor's Compustat data and company reports, and the Delphion patent database. We broke ties by comparing one-year total shareholder returns between 12/30/05 and 12/29/06. In ties between a
public and a private company, we assumed the private company's shareholder return to be equal to the average return of the public companies on the list, or 19.6%. Ties remain only where two or more private companies receive the same number of votes.

Methodology for "Most Admired Companies for Innovation"

Published by Fortune on March 19, 2007

America's Most Admired Companies 2007: How we pick the Most Admired Companies

The Most Admired list is the definitive report card on corporate reputations. Our survey partners at Hay Group started with the FORTUNE 1,000 - the 1,000 largest U.S. companies ranked by revenue - and the top foreign ones operating in the U.S. Hay sorted them by industry and selected the ten largest in each. To create the 63 industry lists, Hay asked executives, directors, and analysts to rate companies in their own industry on eight criteria, from investment value to social responsibility. Only the best are listed as most admired: A company's score must rank in the top half of its industry survey. Ranks for the rest of the contenders are available online only.

To create the top 20, an overall list of Most Admired Companies, Hay Group asked the 3,322 executives, directors, and securities analysts who had responded to the industry surveys to select the ten companies they admired most. They chose from a list of companies that ranked in the top 25% in last year's survey, plus those that finished in the top 20% of their industry. Anyone could vote for any company in any industry. The difference in voting rolls is why some results can seem anomalous; for example,
Southwest Airlines is one of the top five Most Admired Companies but is second in its own industry.

A total of 616 companies in 68 industries were surveyed over the fourth quarter of 2006. Due to insufficient response, the results of 29 companies in five industries are not reported: health care, pharmacy and other services; home equipment, furnishings; precision equipment; tobacco; and printing. Thus, 3M is No. 14 on the overall list even though its industry - precision equipment - did not have enough responses to merit a category.

Methodology for "The Wired 40: Most Innovative Companies in the World"

Published by Wired Magazine in their March, 2007 issue

No methodology was given
Appendix B

Sample Email for Interview Request

Dear Dr. /Mr./Ms. Name of Potential Participant:

I am a Ph.D. student at the University of Miami studying the role of mentoring in the innovation process. Name of Company has done list of accolades or reasons for “Most Innovative” distinction. I would like to do a short case study on how Name of Company uses mentoring in its R&D and product development processes.

I would be very appreciative if you would be willing to give me 30 minutes of your time for a short interview on your experiences, either by phone or in person. I have appointments set up to interview a wide variety of people both in industry (Jonathan Ive from Apple, Claudia Kotchka from P&G, Maria Azua at IBM, Nancy Snyder at Whirlpool, a start-up from MIT called Myomo, etc.) and academia (Sherwin Greenblatt and Lou Golding from MIT Mentoring Services, Dr. Charles Cooney from the MIT Deshpande Center, Tina Seelig at Stanford Ventures). I am hoping to finish my interviews by the end of March, 2008.

Again, your insights would offer a wonderful unique dimension to my research. Please let me know if you would be willing to contribute. Feel free to call me at your convenience with any questions or concerns you may have.

Any guidance you can offer is greatly appreciated.

Best wishes,

Susan Amat

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Appendix C

Phone Script and List of Questions

Hello Dr. /Mr./Ms. Name of Potential Participant! Thank you very much for finding the time to speak with me. I’m going to give you a little background on what I am studying and then we will go right into the questions.

I am a Ph.D. student at the University of Miami and I am interested in how Name of Company uses mentoring in R&D and product development departments. I am going to ask you about your experiences and I would love specific anecdotes about products you were involved in developing. Do you have any questions?

What is your title?

How long have you been in this position?

(Only for CIOs)Was the position created for you?

What is your history with the company previous to this position?

What is it about Company Name’s culture which allows innovation to thrive?

Is there a formal mentoring program within your department/company (depends on participant’s position)?

(If there is a formal mentoring program) What is the matching procedure?

(If there is a formal mentoring program) How are results monitored and measured?
(If there is a formal mentoring program) What incentives are in place to reward participation?

How does informal mentoring manifest itself?

How do the mentor and protégé find each other?

Is informal mentoring monitored and measured?

What incentives are in place to reward informal mentoring?

Can you please give me an example of a product or innovation that was created or improved because of a mentoring relationship?

How do you view the role of mentoring in the innovation process?

What role has mentoring played in your career as a _________?

Do you have any final thoughts about this topic?
Appendix D

Participant Biographies

3M

Dr. Lockwood Carlson
- Current position: Retired
- Education: PhD in Physics and Math
- Years at the Company: 39 years
- Background in the Company:
  - Developing new technologies to develop new businesses or extend current businesses
  - Laboratory leadership positions
  - Finished career at the top of the technical ladder – equivalent to an R&D Vice President or IBM Fellow
  - Venture capital and new business acceleration or development

Peter Fritz
- Current position: Manufacturing Manager
- Education: University of Minnesota-Twin Cities – Bachelor’s in Chemistry
- Years at the Company: 23 years
- Background in the Company:
  - Lab – technical work
  - Tech Service
  - Product Manager for two different divisions (service conditioning products and we also had the coded abrasions division)
  - Black Belt Isoprogram Manager/Process Engineer
  - Manager of Technical Education (2 years) worldwide
  - Manufacturing Manager
- Current department: Automotive After Market Division
- Special Info: President of Concurrent Product Development

Sharon Grosh
- Current position: Director of Strategic Intellectual Asset Management (since 2003)
- Education: Chemistry and Biology Degrees
- Years at the Company: 30 years
- Background in the Company:
  - Technical roles (10 years): Polymer Chemicals and Bio Materials
  - Pharmaceuticals (14 years)
- Current department: Strategic Intellectual Asset Management
- Special Info: Golden Step Award - she did the original deal between 3M and outside company in support of that
Dr. Andrew Ouderkirk
▪ Current position: Corporate Scientist
▪ Education:
  o Received his Bachelor’s Degree in Chemistry from Northern Illinois University.
  o Earned Ph.D. in Physical Chemistry from Northwestern University
▪ Years at the Company: 21 years
▪ Background in the Company: Led the team developing 3M’s Multilayer Optical Film (MOF) Technology.
▪ Current department: Optical Systems Division
▪ Special Info:
  o Worked at DuPont and Allied Signal before 3M,
  o 2005, elected into the National Academy of Engineering
  o 2004, received ACS Creative Invention Award for the development of MOF technology.
  o 2003, received the Finance and Commerce Innovator of the year award
  o 2000, received the Fast Company Fast 50 Award for the issuance of over 95 patents.

Dr. Jayshree Seth
▪ Current position: Division Scientist
▪ Education: n/a
▪ Years at the Company: 15 years, Joined 3M in the summer of 1993
▪ Background in the Company:
  o Personal and Revision Products Division (at the time called: Disposable Products Division)
  o Adhesive and Tapes Division
  o Personal Care Division
▪ Current department: Industrial Adhesives and Tape Division

Dr. Matt Scholz
▪ Current position: Corporate Scientist (3 or 4 years)
▪ Education:
  o University of Michigan – Bachelor’s in Chemical Engineering with a biology emphasis
  o University of Minnesota – Ph.D. in Chemical Engineering
  o Thesis on Mammalian Soap Bio Reactors
▪ Years at the Company: 25 years
▪ Background in the Company:
  o Same Division
    ▪ Ocular, keeping the eye inflated during surgery and interacting with lenses
    ▪ Orthopedic Group (eight or nine years)
    ▪ Infection Prevention Solutions in Hospitals
  o Current department: Health Care Group
▪ Special Info: 100+ patents
Dr. David Yarusso:

- Current position: Division Scientist within the Commercial Graphics Division
- Education: Ph.D. from UW/Madison Department of Chemical Engineering
- Years at the Company: 25 years- Joined 3M in 1983
- Background in the Company:
  - Industrial Tape Division (7 years)
  - The Adhesive Technology Center (7 years)
  - Packaging Systems Division
  - Commercial Graphics Division
- Current department: Commercial Graphics Division
- Special Info: Worked with a time indicator level: Determines if a package had seen too much heat for too long
IBM

Peter Andrews
- Current position: Innovation Strategist for the IBM Executive Business Institute and Consulting Faculty Member
- Years at the Company: 18 years
- Background in the Company:
  - IBM Research
  - World Wide Web involvement for IBM
  - Software Group
  - Consulting Group: Interface between IBM Global Services and IBM Research
  - Executive Business Institute
  - IBM Academy studies
- Current department: IBM Executive Business Institute
- Special Info: Mr. Andrew saw the first iteration when IBM premiered its first external page, in fact I had an article on that page

Maria Azua
- Current position: Vice President of Technology and Innovation (2.5 years)
- Education:
  - University of Puerto Rico – Bachelor’s in Math and Physics
  - University of Miami – Master’s in Computer Science
  - Florida Atlantic University - MBA
- Years at the Company: 20 years
- Background in the Company: Occupied several technical staff and management positions before she assumed her current executive position.
- Current department: CIO’s Office
- Special Info:
  - IBM Master Inventor
  - Distinguished Engineer
  - Has issued over 45 patents
  - Named one of the "100 Most Important Hispanics in Technology and Business for 2006" by the Hispanic Engineer and Information Technology Magazine
  - Received the HENAAC Award for Outstanding Technical Achievement from Hispanic Engineer National Achievement Awards Corporation.

Luba Cherbakov
- Current position: IBM Distinguished Engineer and member of the IBM Academy of Technology, Office of the CIO.
- Education:
  - University of Maryland College Park – Bachelor’s in Computer Science
  - The George Washington University – Master’s in Computer Science
- Years at the Company: 10 years
- Background in the Company:
Dr. Michael Gschwind
- Current position: Floating Points Architecture and Architect for the Next Generation Blue Team System
- Education: Technische Universität Wien – Masters and PhD in Computer Science
- Years at the Company: 10 years
- Background in the Company: One of the initiators and a leading contributor to the Cell Broadband Engine system architecture
- Current department: Floating Points Architecture and Architect for the Next Generation Blue Team System
- Special Info:
  - IBM Master Inventor,
  - IBM Super Computer Project with the government: IBM and Department of Defense, high performance computing initiative
  - Faculty member of Princeton University

Sara Moulton Reger
- Current position: Program Executive (little under six months)
- Education:
  - Colorado State University – Bachelor’s
  - University of Northern Colorado – MBA
  - CPA
- Years at the Company: 13 years
- Background in the Company:
  - Organizational change consultant
  - Also a practice leader to develop a practice, a consulting practice, of organizational change management folks, and, did that originally within our industry group for Telecom, with actually Telecom and Utilities back then
  - 1997: Moved to do the same thing in the Industrial Sector
  - 1999: Global Leadership for the Competency of Organizational Chief Management and the community for that
- Current department: Services Research group at the IBM Almaden Research Center
- Special Info:
  - 2002: announced the P2VCC acquisition
  - Came from Ernston Young where she was a Senior Manager, the role right before partner
    - Level three certified organizational change management specialist (level three certified organizational change management specialist (800 hours of work to get that certification)
- Finance at Storage Tech that is now owned by Sun
- Consulting at Douloute
- Author of “Can Two Rights make a Wrong?”

**Dr. Michael Perrone**
- Current position: Research Staff Member, Manager and Master Inventor
- Education: PhD in Physics, consulting experience in the industry
- Years at the Company: 15 years
- Department: Cell Solution Department
Dr. C. Gil Cloyd
- Current position: Chief Technology Officer
- Education: check online- Doctor of Veterinary Medicine
- Years at the Company: 33 plus years
- Background in the Company:
  - Product safety area
  - Research and development for the pharmaceuticals
- Current department: Office of the CTO
- Special Info:
  - Led research and development activities in Asia
  - Technical Innovation Leader of the Company – by The Beauty Industry Report

Mickey Dugas
- Current position: Principal Researcher
- Education: Chemistry left Memphis State without a degree
- Years at the Company: 30 years
- Background in the Company:
  - Memphis at Buckeye Cellulose: Developing pulps for the different paper products
- Current department: Products Research
- Special Info:
  - Finding uses for the empty toilet paper rolls
  - Fancy holders for bounty paper towels in the bathroom

Bonnie Gleaves
- Current position: Director, R&D Director for Global Auto Dish (eight months)
- Years at the Company: 20 years
- Background in the Company:
  - Associate Director for Hand Dish Globally
- Current department: Global Auto Dish

Claudia Kotchka
- Current position: Vice President of Design, Innovation and Strategy (since September 2001)
- Education: Ohio University - B.B.A.
- Years at the Company: 30 years
- Background in the Company: Occupied over 20 positions for different brands in management or advertising before becoming Vice President.
- Current department: Design Innovation and Strategy
- Special Info: Named a “Champion of Innovation” by Business Week, June 19, 2006.
Karl Ronn
- Current position: Vice President for R&D, Home Care (six years)
- Years at the Company: 27 years
- Background in the Company: same place all 27 years
- Department: Home Care

Lisa Stilwell
- Current position: Human Resources Director (overall responsibility for Human Resources for Market Research and External Relations)
- Education: Duke University – Degree in Engineering
- Years at the Company: 27+ years
- Background in the Company:
  - Product Supply
  - Product Manager: various assignments in production, warehouse, supply chain, customer service, line alterations and that area (10 years)
  - Human Resources was in 1994 – Finance Organization
  - Health Care Business Units
  - Geneva – Beauty Care Role – HR governance
  - Supporting the marketing function, design function and market research function
  - Supporting a business unit, multi-functional beauty care operation business unit
- Department: Market Research and External Relations

Mark Steinhardt
- Current position: Research Fellow (10 years) “Experienced Entrepreneur”
- Education: Engineering undergrad and M.B.A.
- Years at the Company: 30+ years
- Background in the Company:
  - Toilet Goods Division
  - Health and Beauty Care
  - Oral Care Products
  - The Paper Division
  - Corporate New Business Development
  - P&G Future Works
  - Fem Care Business
  - Pharmaceuticals Business
  - Home Care out of Fabric and Home Care
- Department: Floating
- Special Info: Dry Paint, Bella and Burch

Dr. Paul Trokham
- Current position: Research Fellow, Victor Mills Society (18 years)
- Education: Undergrad in Chemistry, Ph.D. in Chemical Engineering
- Years at the Company: 35 years
- Background in the Company: Started working in Miami Valley before there was a dual ladder system, before technical ladder existed
- Department: Tissue/Towel Technology Development
- Special Info:
  - Two years, fourteen months and four days of that in Vietnam
  - Charter Member of the Victor Mills Society
  - Recipient of IRI's coveted 2006 Achievement Award
  - Most prolific P&G inventor- invented Bounty
Whirlpool

Sean Lindy
- Current position: Senior Manager of Global Innovation and Strategic Development
- Education: Marketing and physics Undergrad, MBA in Marketing and Finance
- Background in the Company:
  - Financial analyst
  - Channel Finance
  - Global Innovation
- Department: Global Innovation and Strategic Development

Dr. Nancy Snyder
- Current position: Vice President of Leadership & Strategic Competencies
- Education:
  - West Virginia University - Bachelor's degree in Sociology
  - West Virginia University - Master's degree in industrial relations
- Years at the Company: 20 years
- Background in the Company: Creating and implementing enterprise strategies that facilitate leadership and competitive knowledge and innovation
- Department: Leadership and strategic competencies
- Special Info:
  - Spent several years as an independent management consultant.
  - Published in the Journal of Product Innovation
  - Lectured around the world, including Dubai's Innovation Forum, Harvard, Penn State University, Motorola, NASA, and Wharton School of Business
  - Board member of First Tee of Benton Harbor, a non-profit organization which uses golf to teach at-risk youth character development and life skills.
### Appendix E

**Quantitative Comparison of Innovation Metrics**

<table>
<thead>
<tr>
<th></th>
<th>3M</th>
<th>IBM</th>
<th>Whirlpool</th>
<th>P&amp;G</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Current</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Patents (from filings)</td>
<td>4,608</td>
<td>586</td>
<td>2,278</td>
<td>1,697</td>
</tr>
<tr>
<td>Employees (from filings)</td>
<td>76,239</td>
<td>355,766</td>
<td>73,682</td>
<td>138,000</td>
</tr>
<tr>
<td>Patents/employee (higher = better)</td>
<td>0.0604</td>
<td>0.0016</td>
<td></td>
<td>0.0309</td>
</tr>
<tr>
<td>Book value (in millions of $)</td>
<td>$ 24,694</td>
<td>$ 121,823</td>
<td>$ 14,009</td>
<td>$ 138,014</td>
</tr>
<tr>
<td>Bookvalue/patents (lower = better) ($/pat)</td>
<td>5</td>
<td>208</td>
<td>6</td>
<td>81</td>
</tr>
<tr>
<td><strong>All based on Five-year averages</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gross margin</td>
<td>49.40%</td>
<td>39.64%</td>
<td>19.06%</td>
<td>50.91%</td>
</tr>
<tr>
<td>Average sales growth rate</td>
<td>8.44%</td>
<td>4.17%</td>
<td>12.21%</td>
<td>13.80%</td>
</tr>
<tr>
<td>Return on assets (net income/total assets)</td>
<td>16.30%</td>
<td>8.04%</td>
<td>4.97%</td>
<td>10.43%</td>
</tr>
<tr>
<td><strong>Current</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Solvency: current ratio (curr assets / curr liab)</td>
<td>1.907</td>
<td>1.309</td>
<td>2.377</td>
<td>1.937</td>
</tr>
<tr>
<td>R&amp;D budget as %sales (from filings)</td>
<td>5.60%</td>
<td>6.23%</td>
<td>2.17%</td>
<td>3.50%</td>
</tr>
<tr>
<td>PE ratio (price per share / EPS)</td>
<td>16.17%</td>
<td>16.11</td>
<td>9.2</td>
<td>20.39</td>
</tr>
<tr>
<td>Current liabilities (in millions)</td>
<td>$ 12,947</td>
<td>$ 93,095</td>
<td>$</td>
<td>$ 5,893</td>
</tr>
<tr>
<td></td>
<td>$ 71,254</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix F

Five Year Growth Rates

Five Year Revenue Growth

<table>
<thead>
<tr>
<th>YEAR</th>
<th>3M</th>
<th>IBM</th>
<th>Whirlpool</th>
<th>P&amp;G</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003</td>
<td>11.63%</td>
<td>9.79%</td>
<td>10.53%</td>
<td>7.80%</td>
</tr>
<tr>
<td>2004</td>
<td>9.76%</td>
<td>8.04%</td>
<td>8.57%</td>
<td>18.51%</td>
</tr>
<tr>
<td>2005</td>
<td>5.78%</td>
<td>-5.36%</td>
<td>8.30%</td>
<td>10.38%</td>
</tr>
<tr>
<td>2006</td>
<td>8.30%</td>
<td>0.32%</td>
<td>26.28%</td>
<td>20.23%</td>
</tr>
<tr>
<td>2007</td>
<td>6.71%</td>
<td>8.05%</td>
<td>7.35%</td>
<td>12.10%</td>
</tr>
</tbody>
</table>

Five Year ROA Growth

ROA = income/assets (ability to leverage human capital)

<table>
<thead>
<tr>
<th>YEAR</th>
<th>3M</th>
<th>IBM</th>
<th>Whirlpool</th>
<th>P&amp;G</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003</td>
<td>14.60%</td>
<td>7.55%</td>
<td>5.92%</td>
<td>11.98%</td>
</tr>
<tr>
<td>2004</td>
<td>15.61%</td>
<td>6.94%</td>
<td>5.22%</td>
<td>12.60%</td>
</tr>
<tr>
<td>2005</td>
<td>15.08%</td>
<td>7.32%</td>
<td>5.14%</td>
<td>11.45%</td>
</tr>
<tr>
<td>2006</td>
<td>18.41%</td>
<td>9.08%</td>
<td>3.94%</td>
<td>8.66%</td>
</tr>
<tr>
<td>2007</td>
<td>17.81%</td>
<td>9.32%</td>
<td>4.61%</td>
<td>7.44%</td>
</tr>
</tbody>
</table>

Five Year Pre-Tax Margin Growth

<table>
<thead>
<tr>
<th>YEAR</th>
<th>3M</th>
<th>IBM</th>
<th>Whirlpool</th>
<th>P&amp;G</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003</td>
<td>49.07%</td>
<td>37.04%</td>
<td>22.74%</td>
<td>48.96%</td>
</tr>
<tr>
<td>2004</td>
<td>50.24%</td>
<td>36.94%</td>
<td>21.65%</td>
<td>51.22%</td>
</tr>
<tr>
<td>2005</td>
<td>50.83%</td>
<td>40.09%</td>
<td>21.29%</td>
<td>50.88%</td>
</tr>
<tr>
<td>2006</td>
<td>48.90%</td>
<td>41.89%</td>
<td>14.71%</td>
<td>51.45%</td>
</tr>
<tr>
<td>2007</td>
<td>47.94%</td>
<td>42.24%</td>
<td>14.90%</td>
<td>52.03%</td>
</tr>
</tbody>
</table>