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Liberty Business Review

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L I B E R T Y U N I V E R S I T Y

Lynchburg, VA

Liberty Business Review: Our Second Volume

Bruce K. Bell, Dean

School of Business and Government

Liberty University

In its inaugural issue of 2003, the *Liberty Business Review* introduced the concept of an online journal that contained academically mature articles by students at Liberty University, with the anticipation that future volumes would feature articles by faculty as well as students at Liberty and other institutions of higher learning. All articles were selected for their superior academic quality, and each embraced the Christian worldview and/or highlighted the integration of that worldview into the academic discipline.

This, the second volume of the *Liberty Business Review*, takes the next step in the bold concept of an online journal published without charge. The editorial board members of this journal wish to promote scholarship and seek to distance it from other publications that must charge fees for their products. Just as learning should not be the exclusive domain of those with resources, so access to academic journals should not be restricted.

Paul Atkinson, a 2004 graduate of Liberty University, explores the profitability outlook for small businesses. He presents some of the changing nature of small business ownership in this country and demonstrates how technology and demographics coincide to promote positive change in small businesses.

Graduate MBA students Raymond Bell, Monty Carpenter, Jason Carter, and Deborah Dyer ask whether Six Sigma remains the best approach to Total Quality Management (TQM). Examining some of the latest literature on the issue, the authors conclude that while Six Sigma is a good approach to quality, it may not be the ideal approach to TQM.

Another paper written by MBA students explored the concept of data mining, identifying a number of current applications of data mining to the modern business arena. Authors Rebecca Fay, Stafford Gill, Gabriela Guzman, Daniel Harvey, and James Headrick conclude that the ethical complexities of data mining make this a controversial and potential dangerous realm for organizational managers.

Liberty University Associate Dean Brian Satterlee co-authors a paper on outsourcing business functions overseas, investigating whether that is the best decision for the long-term good of organizations. The authors show that overall business strategy should dictate whether outsourcing is the appropriate strategy for organizations to adopt.

Sarah Smith served as a law enforcement intern during her undergraduate years at Liberty University. Combining that experience with her Management Information Systems

degree, she examines the growing problem of child pornography and other crimes that use the Internet to lure children. Her paper develops methods for collecting and authenticating electronic evidence from predators' computers and building a case that can go to prosecution and ultimate conviction.

Dr. Gene Sullivan, faculty member and chair of the Liberty University Accounting Department, co-authors a paper on a model to reduce conflict in organizations through use of leader-member exchange (LMX) theory. That model examines trust, commitment to organizational goals, and contacts between leaders and organizational members as indicators of satisfaction that may reduce conflict.

As with the inaugural issue of this online journal, the editors hope that readers are stimulated by the academic rigor of the papers presented, encouraged to reflect on the issues being discussed, and challenged to engage in the scholarly dialogue through well-researched and well-written works that may be added to the next issue of the *Liberty Business Review*.

"The purpose of the *Liberty Business Review* is to examine issues of Business and Economics from a Christian perspective and with a commitment to scholarly excellence."

High-Quality Leader-Member Exchanges Minimize the Potential for Conflict in Organizations

Dorena Della Vecchio, Ph.D.
A. Denise Stanley, Ph.D.
Gene R. Sullivan, Ph.D.
Bruce E. Winston, Ph.D.
A. Gregory Stone, Ph.D.

ABSTRACT

Using leader-member exchange (LMX) theory as a foundation, this paper builds a model illustrating how high-quality LMXs reduce conflict in organizations. From a review of the literature, the paper analyzes independent, dependent, moderating, and mediating variables in the model. Of interest and contribution to the LMX literature is the discussion of the development time factor as a moderating variable and the trust relationship and goal commitment as mediating variables that work to reduce conflict in the organization.

This paper examines the relationship that develops between leaders and members in high-quality leader-member exchanges (LMX) as a vehicle to minimize conflict. Existing research demonstrates the positive organizational outcomes of LMX (Graen & Cashman, 1975) and that the effective implementation of exchanges in the form of contacts between leaders and members serves to enhance individual job performance, satisfaction and commitment to unit goals (Dansereau, Graen, & Haga, 1975; Liden & Graen, 1980).

Although the literature links LMX to positive organizational outcomes, past research efforts do not isolate and examine the potentially significant role of LMX as an intervention strategy to reduce conflict. This paper identifies the link between LMX and conflict reduction and therefore enhances the reader's understanding of the value of LMX to leaders, managers, or anyone in a supervisory role and members as an effective strategy to reduce conflict within organizations. The paper builds a LMX model for leader-member conflict reduction based on a review of the literature related to LMX theory, role theory, and attribution theory. The model demonstrates how developing high-quality relationships between leaders and members provides an environment that minimizes the potential for conflict.

There are five distinct sections of the paper:

1. The first section identifies the leader and member characteristics that operate as independent variables in the development of the LMX model of conflict reduction.
2. The second section discusses LMX Quality, a mediating variable. It examines the role-making process used to establish LMXs and discusses the establishment of a high-quality exchange.
3. The third section demonstrates how the development time factor operates as a moderating variable concerning the quality of the exchange.
4. The fourth section identifies goal commitment and the trust relationship as mediating variables that minimize conflict in organizations.
5. The fifth section concerns the dependent variable of potential conflict reduced showing how the model operates to reduce potential conflict.

Leader Characteristics

Openness

The openness of a leader to offer individualized assistance to members affects the quality of the future LMX relationship. A study by Graen and Cashman (1975) assessed leaders' openness to offer individualized assistance to various members. Results showed that a high degree of individualized assistance characterizes high-quality exchange relationships and provides a work environment conducive to creating negotiated exchanges. In contrast, low-quality exchange relationships, with little or no individualized assistance, discourage negotiated exchanges.

Graen and Cashman (1975) identified negotiating latitude as an early-warning detector for predicting a high or low-quality exchange relationship. High-quality exchange relationships are both a function of leader openness and leader positional resources. Members should desire resources that the leader possesses. The next section examines this further showing the link between a high-quality exchange and the leader's ability to make positional resources available to a member.

Positional Resources

One part of developing a high-quality exchange relationship is the leader's control over resources or outcomes desirable to members. These resources or outcomes include things such as greater responsibility and authority, assignments with high visibility, tangible rewards such as special benefits, pay increase, or a bigger office (Yukl, 1994). Leaders willingly exchange those resources with select members of their unit for member performance and commitment that is at a level above that required by the formal employment contract (Graen & Cashman, 1975).

Members reciprocate in a number of ways by improving productivity, spending more time at work than is required by the formal employment contract, or accepting greater risk and responsibility. However, there is a major situational constraint on the leader's ability to establish high-quality exchanges using positional resources. A leader's capacity to develop high-quality exchanges depends in part on the leader's upward exchange relationship (Yukl, 1994).

Upward Exchange

Research by Cashman, Dansereau, Graen, and Haga (1976) extend LMX theory to a leader's upward exchange relationship. They found that a leader who had high-quality exchanges with his or her boss was more likely to establish high-quality exchanges with subordinates. Subordinates felt the effects of a favorable upward exchange relationship regardless of their exchange relationship with the leader. Indeed, subordinates described leaders with favorable upward exchange relationships as having more technical skill, better leadership skill, allowance for participative decision making, and providing more outside information.

Therefore, the study by Cashman et al. (1976) points out a major situational constraint on a leader's ability to develop high-quality exchange relationships. If the leader has little to offer in the way of extra benefits and opportunities, there is little incentive for subordinates to put forth the extra effort required for a high-quality exchange relationship. However, it is to the subordinate's advantage to put forth extra effort despite the leader's upward exchange relationship. The way a leader interprets information concerning subordinate behavior and performance determines how the leader will react to that subordinate. This is examined further using attribution theory.

Attributions

Green and Mitchell (1979) describe a process by which leaders attribute subordinate performance to internal or external causes. Internal causes may include the subordinate's ability or the effort put forth. External causes may include task difficulty or luck. Leaders use these attributions to select appropriate

responses to subordinate behavior. Several studies confirm the basic propositions of this model (Liden & Graen, 1980; Mitchell & Kalb, 1982; Mitchell & Wood, 1980).

However, Mitchell, Green, and Wood (1981) found that a number of systematic biases might moderate the attribution process. This causes leaders to make attributions that differ from members' self-attributions. For example, leaders may attribute poor member performance to an internal cause such as lack of ability. The member, however, may attribute his or her poor performance to an external cause such as insufficient information or bad luck. It is member attributions and characteristics that this paper explores in the following section.

Member Characteristics

Attributions

Members tend to blame external causes for their mistakes or poor performance (Yukl, 1994). Thus, leaders and members may arrive at different interpretations of mutually experienced events. "The extent to which their attributions differ may depend, in part, on the nature of their relationship" (Wilhelm, Herd, & Steiner, 1993, p. 532). It seems logical then, that a high-quality exchange will result in like attributions for leader and member.

Indeed Wilhelm et al. (1993) found that high LMXs correlated with internal attributions when members experienced success and low LMXs correlated with internal attributions when members experienced failure. Hence, it is to the member's advantage to establish a high-quality exchange. One factor that is within their sphere of influence is performance. Dienesch & Liden (1986) and Graen & Scandura (1987) found that member performance influences whether or not a high-quality exchange develops.

Performance

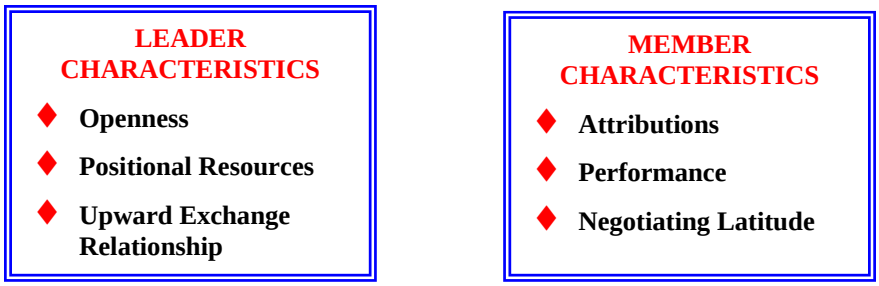
Member performance plays a crucial role in developing a high-quality exchange relationship. As previously discussed, leaders offer valued resources to members in order to secure their extra effort on task assignments (Graen & Scandura, 1987). Members then reciprocate by engaging in extra role behaviors that benefit the supervisor (Settoon, Bennett, & Liden, 1996). This process of reciprocity produces a high-quality exchange vehicle that over time builds a relationship of mutual trust and commitment between the leader and member. Such a relationship allows the member freedom to determine their role within the organizational unit. Graen and Cashman (1975) define this as negotiating latitude. The next section analyzes negotiating latitude from the member's perspective.

Negotiating Latitude

Dansereau et al. (1975) researched the link between the openness of a leader to allow members negotiating latitude in job-related matters and the type of exchange patterns that evolved. Their nine-month longitudinal study found the degree of negotiating latitude granted to members by their superiors proved useful in predicting the subsequent behavior of both the leaders and members. Similarly, Graen and Cashman (1975) identified negotiating latitude as an early-warning detector for predicting the nature and outcome of the emergent LMX. Thus, members in high-quality exchanges have latitude to determine the best way to achieve job-related tasks and negotiate their role within the organizational unit.

In summary, from a leader perspective, three main elements affect whether a high-quality exchange relationship will result: the openness of a leader to offer individualized assistance, leader positional resources and a favorable upward exchange relationship, and little or no attributional differences. From a member perspective, two main elements that affect whether a high-quality exchange relationship will result are positive member performance and negotiating latitude. Leader and member characteristics are the independent variables in the proposed model. They ultimately determine the quality of the LMX and thus reduce potential conflict in an organization. The next section analyzes the elements inherent in the actual exchange relationship, which is the heart of LMX theory.

First Level of Model Development in the Leader-Member Conflict Reduction Process



LMX Quality

The quality of the LMX operates as a mediating variable in the model. The attributes and perceptions of leaders and members influence the development and consequently the quality of the LMX (Graen & Scandura, 1987). The LMX quality determines the extent to which members become committed to unit goals and develop trust relationships with their leaders (Major, Kozlowski, Chao, & Gardner, 1995; Settoon et al., 1996). High-quality LMXs foster a high degree of commitment and trust on the part of leaders and members, which establishes a work environment where potential conflict is reduced. LMXs are established as leaders and member work through a role-making process.

Role-Making Process and Reciprocal Reinforcement

The role-making process is crucial to understanding the development of LMXs because members accomplish their various job tasks through roles (Graen, 1976). These roles are "ambiguously and incompletely specified" (Dienesch & Liden, 1986, p. 621) and "completed or defined by the organization's participants" (Graen, Orris, & Johnson, 1973, p. 396). The perceptions and attributes that leaders and members possess and bring to the role-making process influence the quality of the relationship that develops. A leader's initial perceptions concerning member task behavior influences his or her openness to establishing a quality exchange with a particular member and consequently affects the degree of negotiating latitude granted to the member in the role-making process (Graen & Cashman, 1975).

As the role-making process progresses, the personal stake of the leader in a member's performance causes the leader to exert pressure on the member using role-expectation episodes (Graen et al., 1973). Through a series of these episodes, the leader and member define their respective role behaviors. These individuals develop interlocking behaviors that enable them to construct relationship norms based on the reciprocal reinforcement that occurs between them in the role-making process. The degree to which leaders and members establish interlocking behaviors determines whether an in-group or out-group exchange develops.

In Group / Out Group Classification

"Leaders of managerial units, when faced with the task of developing new working relationships with most of the members they lead, [respond] in manners which [serve] to differentiate their units" (Graen & Cashman, 1975, p. 152). Leaders develop in-group exchanges with some members and out-group exchanges with others by differentiating among the members of their units in terms of leader behavior (Cashman et al., 1976; Dansereau et al., 1975; Graen & Cashman, 1975).

The perceptions and attributes of leaders and members influence their preference towards establishing in-group or out-group exchanges. Leader and member "expectations of each other may significantly influence the development of LMX" (Liden, Wayne, & Stilwell, 1993, p. 663). Expectations relate to such things as the availability of positional resources, the potential degree of negotiating latitude

and member task behavior. These expectations shape leader and member perceptions and influence LMX quality.

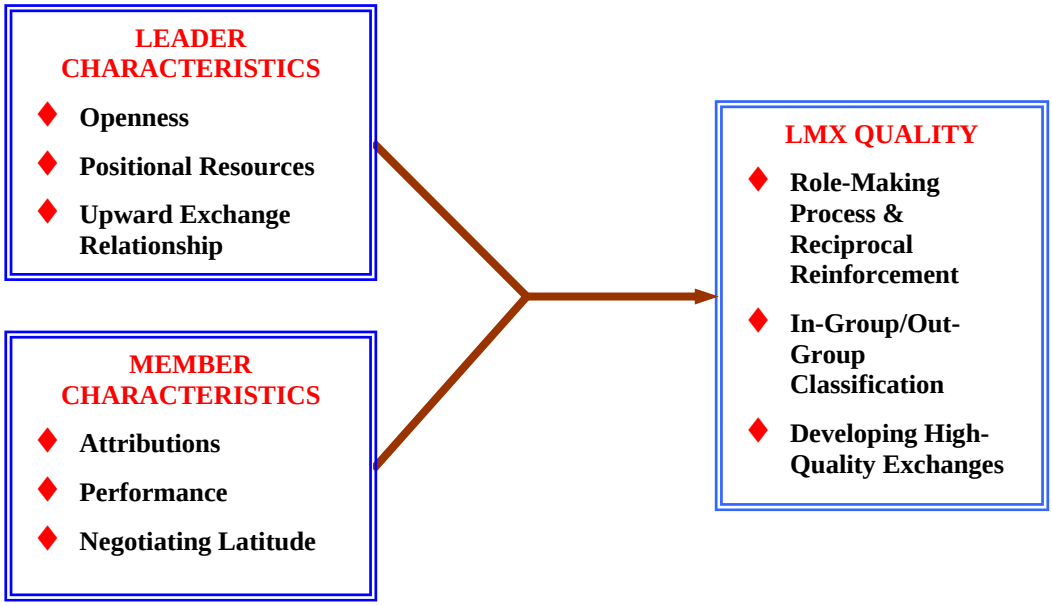
Graen & Cashman (1975) identified a leader's openness to offer individualized assistance as a factor that helps determine the kind of exchange established in a particular leader-member relationship. Members whose leader offered individualized assistance were more likely to develop in-group exchanges while members whose leader offered no assistance were more likely to develop out-group exchanges.

Development of High-Quality Exchanges

In-group exchanges produce an interlocking of behavior between the leader and member. Leader positional resources produce this interlocking behavior as leaders willingly exchange resources with select members in exchange for member performance. Members must reciprocate in order for an in-group exchange to develop. As discussed previously, members reciprocate in a number of ways.

However, a leader's ability to make positional resources available to a particular member and, in turn, the member's ability to offer something attractive to the leader determines whether an in-group exchange has the potential to develop. In-group exchanges over time result in high-quality LMXs. The development time factor moderates the quality of the exchange as discussed in the next section.

2nd Level of Model Development in the Leader-Member Conflict Reduction Process



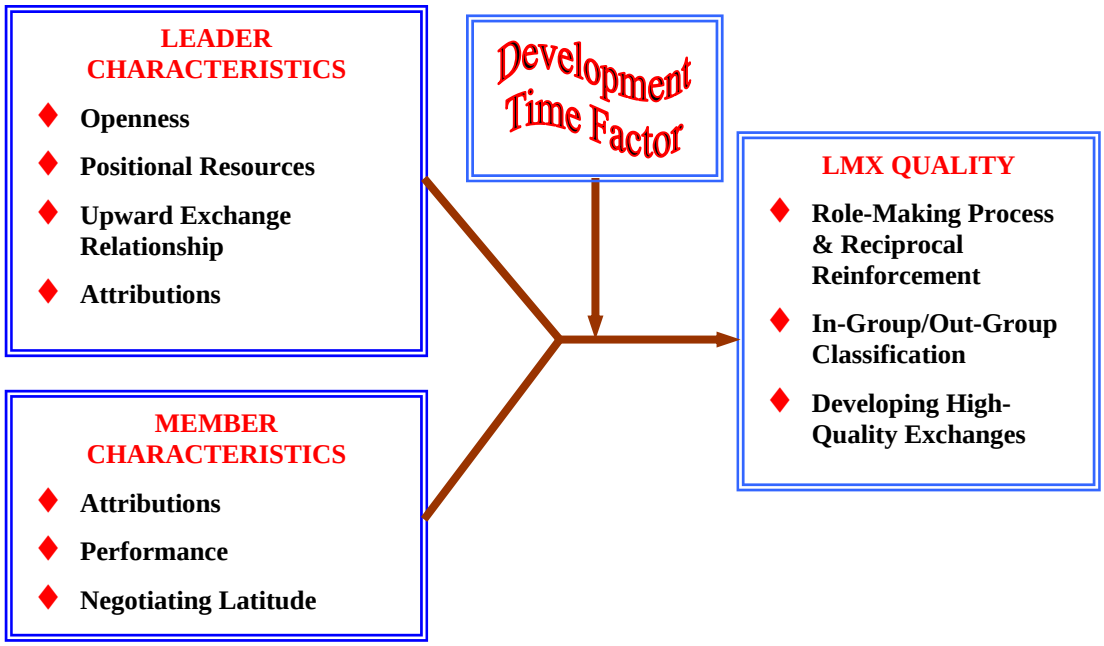
Development Time Factor

The development time factor is a moderating variable in the model because studies show that high-quality exchanges develop over time and require leaders to use their time resources which are limited (Dansereau et al., 1975). Graen & Cashman (1975) observed that some interlocking behaviors necessarily develop early on in the life of the LMX while others, such as mutual trust and commitment, develop over an extended period. These two studies used an extended period of nine months to observe and gather data related to developing quality exchanges between leaders and members. A review of the literature concerning LMX indicates such extended periods for observation and data gathering are necessary (Dansereau et al., 1975; Graen & Cashman, 1975; Graen et al., 1973; Liden & Graen, 1980).

One of the costs to leaders in establishing high-quality exchanges and obtaining member commitment to unit goals "involves the time necessary to allow, promote and support the member in

developing his role gradually over time" (Dansereau et al., 1975). If leaders and members are either unable or unwilling to engage in quality exchanges over an extended period, the quality of the LMX will suffer. The member's goal commitment and the trust relationship between leaders and members also depends upon the amount of time the LMX has been developing.

3rd Level of Model Development in the Leader-Member Conflict Reduction Process



Goal Commitment and the Trust Relationship

Goal Commitment

As stated above, the amount of time the LMX has been developing affects the member's goal commitment and the trust relationship. An employee's commitment to unit goals is a mediating variable in the model. The relationship between the leader and the member influences the member's goal commitment. High-quality LMXs increase the member's commitment to unit goals (Klein & Kim, 1998; Major et al., 1995; Settoon et al., 1996). This increase in goal commitment reduces the potential for conflict. Thus, there is an inverse relationship between a high-quality LMX and conflict in the organization. High-quality LMXs increase goal commitment and consequently reduce the potential for conflict, while low-quality LMXs decrease goal commitment and increase the potential for conflict between leaders and members.

Klein & Kim (1998) conducted a study evaluating the relationship between goal commitment and performance. Their study involved salespersons and department managers at four branches of a retail organization. Klein & Kim predicted that "there should be a significant, positive relationship between goal commitment and performance when leader-member exchange is high but not when it is low" (p. 90). The results of their study supported this hypothesis. Furthermore, regression analysis indicated that "LMX was the primary determinant of goal commitment" (p. 93). This study provides empirical support for the proposed model and its variables.

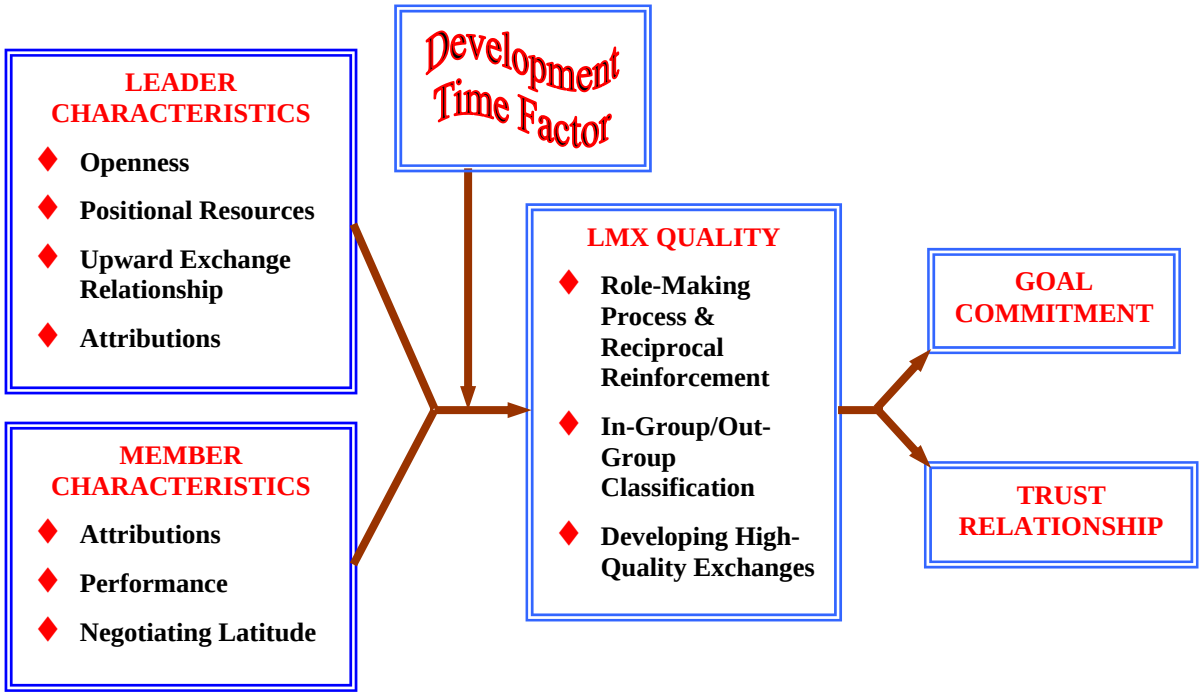
The Trust Relationship

Like goal commitment, the trust relationship is another mediating variable in the model. As the leader and the member interact with one another, a relationship develops. Some employees become members of the in-group and others become members of the out-group. According to LMX theory, leaders

give in-group members "additional rewards, responsibility, and trust in exchange for their loyalty and performance" (Vecchio, 1998, p. 328), while the out-group "is treated in accordance with a more formal understanding of supervisor-subordinate relations" (p. 328). The employees who are members of the in-group have a higher-quality LMX. As this high-quality LMX continues to exist among the leader and the member, the trust relationship is nurtured and strengthened. This trust relationship between the leader and the member is a powerful impetus that reduces the potential for conflict between leaders and members.

The independent variables (the leader and member characteristics) and the moderating variable (development time factor) influence the mediating variables (goal commitment and the trust relationship). These mediating variables (goal commitment and the trust relationship) affect the dependent variable (conflict). Increased commitment to goals and the trust relationship are products of a high-quality LMX that minimize the potential for conflict between leaders and members.

4th Level of Model Development in the Leader-Member Conflict Reduction Process



Potential Conflict Reduced

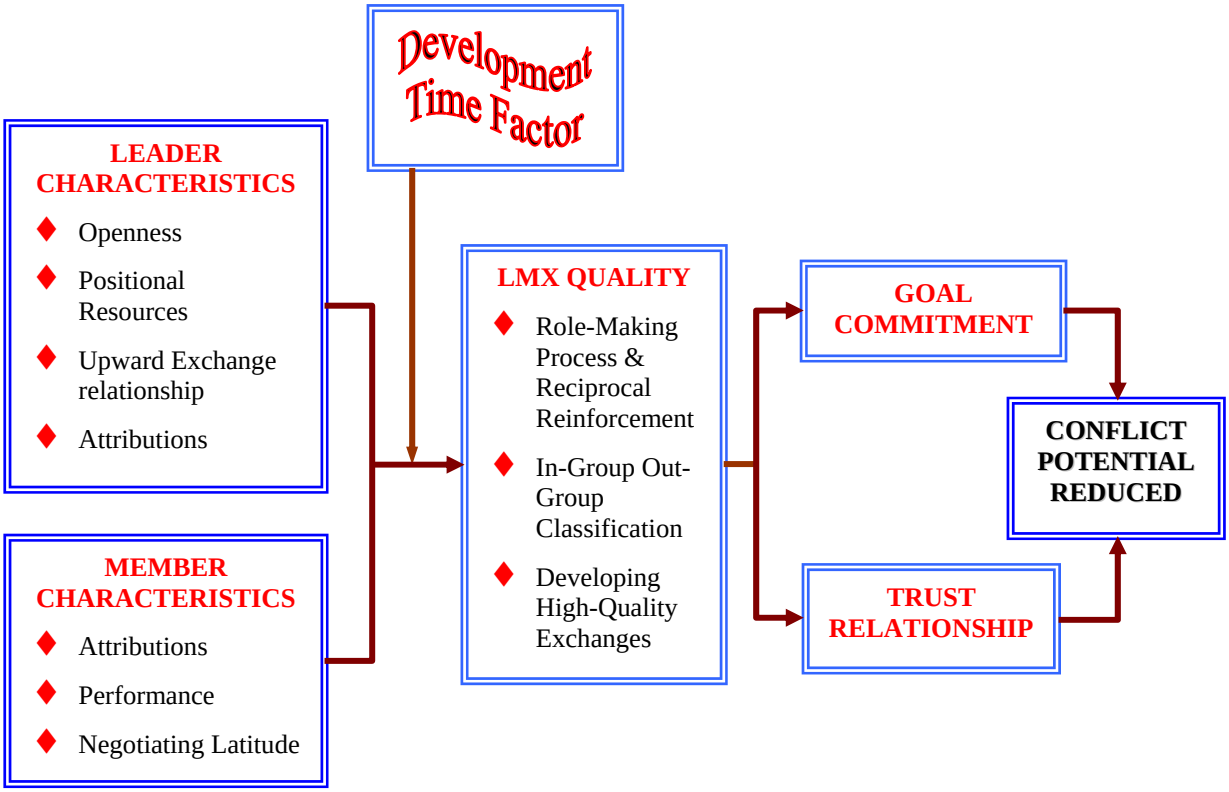
The literature shows that high-quality LMXs result in improved job performance, greater satisfaction, lower turnover, and greater commitment to unit goals (Graen, Novak, & Sommerkamp, 1982; Liden & Graen, 1980; Major et al., 1995; Scandura & Graen, 1984; Settoon et al., 1996). In addition, high-quality LMXs increase an employee's commitment to organizational goals (Klein & Kim, 1998; Major et al., 1995; Settoon et al., 1996) and strengthens the trust relationship (Vecchio, 1998). Taking LMX theory one step further, this paper proposes a model that demonstrates how high-quality LMXs can reduce potential conflict in organizations. Conflict reduction is the dependent variable and the last element of the model to put in place. Following are two empirical studies that support this proposition.

A study by Wilhelm et al. (1993) provides partial evidence that suggests greater amounts of attributional conflict exist between supervisors and subordinates having low-quality LMXs. "That is, supervisors tend to attribute high inputs by in-group subordinates to internal factors and low inputs to external factors. Conversely, supervisors tend to attribute high inputs by out-group subordinates to external factors and low inputs to internal factors" (p. 540). These incompatible biases make it difficult for leaders to handle performance problems effectively, since members who do not feel responsible for the problems

will resent punitive action (i.e. members in the out-group). Thus, the study documents that high-quality LMXs result in less conflict than low-quality LMXs.

A study by Cleyman, Jex, and Love (1995) provides additional support for the model developed in this paper. They found that employees who perceived high-quality information exchanges with their supervisor were less likely to file grievances than employees who did not perceive a high-quality information exchange. This is consistent with the research of Deluga and Perry (1991) who found that subordinates with a high-quality exchange relationship with their supervisors were more likely to use reasoning than coalition tactics when disputes arose. Consequently, in-group members report better information exchanges with leaders than out-group members, which is another element in LMX that works to reduce potential conflict.

Last Level of Model Development in the Leader-Member Conflict Reduction Process



Conclusion

High-quality LMXs minimize the potential for conflict between leaders and members. As the leader and member interact through role-making episodes, the exchange develops over time. Several elements affect whether a high-quality LMX will result. The leader's openness to offer individualized assistance and the degree of negotiating latitude allowed are important elements that members consider when deciding to establish a high-quality exchange. Favorable upward exchange relationships positively enhance a leader's positional resources, which also figure into the member's decision. The leader's decision to establish a high-quality exchange depends on his or her perception of the member's ability to contribute towards unit goals. Minimal attributional differences between the leader and member are characteristic of a high-quality exchange.

In a high-quality LMX, the leader promotes and supports the member. The member reciprocates by accepting greater responsibilities and improving job performance. The leader’s actions increase the member’s commitment to unit goals and mutual trust builds as they develop interlocking behaviors over time through reciprocal reinforcement. The development time factor moderates the extent to which high-

quality exchanges potentially develop. The limited time resources of leaders may negatively affect the development of high-quality exchanges. However, increased member commitment to unit goals and the trust relationship between a leader and member are the products of a high-quality LMX that minimize the potential for conflict between leaders and members.

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INTERNET CHILD SEX PREDATORS: BUILDING A CASE FOR CONVICTION

Sarah Elizabeth Smith

Abstract

Building a case against an Internet child sex predator is often a difficult task for prosecutors. They must initiate a thorough investigation of the suspect's computer to gather electronic evidence that will support a conviction. They must also seek to authenticate the evidence to prove beyond a reasonable doubt that the defendant committed the crime and convince the jury that the defendant should be convicted and sentenced for his or her stated offense(s). Through careful analysis of laws regarding child pornography crimes and suggested methods for the collection and authentication of digital evidence, this thesis explains how to build a case against an Internet child sex predator for conviction.

In the summer of 1998, Carrie[1] was 16 years old when she first signed on to her new America Online screen name *BlondeChic00*. Carrie lived in a middle-class neighborhood in suburban Maryland, in close proximity to Washington, D.C. Since both of Carrie's parents worked full-time jobs, she was left alone at home each day during her summer vacation from high school. She spent her days exploring the new world of the Internet and her nights engaging in typical activities of the metropolitan teen scene such as frequenting local hot spots and nightclubs. During the summer, Carrie met online a 42 year-old man named Billy who claimed he was from Alabama. The two quickly became friends, sharing intimate online chats through Internet Relay Chat (IRC) rooms and AOL Instant Messaging. In early December of 1998 the two met at a Holiday Inn close to Carrie's home and engaged in sexual activities that lead to sexual intercourse.

In late December, Billy surprisingly visited Carrie's hometown again, expecting another rendezvous with the schoolgirl. Despite his showing of affection with gifts of jewelry and clothing, Carrie resisted his offers of sex. As a result, Billy verbally and physically abused her, eventually forcing sex with the teen. In the months that followed, Billy harassed her with threatening e-mail messages, illicit digital photographs of the girl, and eventually a website that defamed her reputation with libel and pornographic images. Billy was soon arrested and charged with several felony counts under 18 U.S.C. §§ 2422, 2423, and 2252, including rape of a minor and knowingly receiving and possessing child pornography (*United States of America v. Billy Randolph Smith*, 2001).

Carrie's story demonstrates the reality of Internet child sex predators who are using their computers to locate minors and commit numerous sexual acts with them for personal, sexual gratification. The key to finding the evidences of the crimes being committed and ultimately prosecuting these child sex predators is in the digital evidence

they produce: digital photographs, digital videos, chat logs (IRC, AOL Instant Messenger), electronic mail (e-mail) messages, and pornographic websites that enhance or contribute to the commission of illicit sex acts with minors under the age of 18 (18 U.S.C. § 2256(1)). Forensic scientists must locate the evidence on the suspect's computer and prove that he or she perpetrated the crime and violated the alleged victim(s). In Carrie's case, the digital photographs Billy had taken of her, the website he had created to defame her reputation, the threatening and illicit e-mail messages he had sent her, and the AOL Instant Message conversations they engaged in were used as evidence in court to convict Billy.

Building a case against an Internet child sex predator is often a difficult task for prosecutors. They must (1) initiate a thorough investigation of the suspect's computer to gather electronic evidence that will support a conviction; (2) use the evidence to prove beyond a reasonable doubt that the defendant committed the crime; and (3) convince the jury that the defendant should be convicted and sentenced for his or her stated offense(s).

The prosecutor bears the difficult task of analyzing the evidence to identify and locate the victim(s) harmed in the commission of the crime. This task can be impossible for prosecutors because evidence such as digital photographs and videos may have or appear to have been altered or "morphed" to change the identifying features of the victim and/or the suspect. Thus, the authenticity of digital evidence in a courtroom trial of Internet child sex predators and pornographers is in question due to the ease with which digital evidence can be altered. These alterations change the evidence and/or eliminate various elements of the crime such as identification of a suspect or victim. With the absence of these elements, a suspect will only be found guilty of possession and/or distribution of child pornography or in some instances will not be convicted at all without authentic proof of the victim's identity and a connection between the suspect and the crime. Many such cases exist in which a child sex predator creates child pornography by committing sexual acts with real children. Then, the predator morphs the evidence to change the identifying features of the victim. Eventually, the suspect is apprehended by law enforcement and receives minimal (if any) charges due to a lack of authentic evidence proving he or she committed the offense with an identifiable minor. If the suspect is not convicted, that individual is free to continue committing such horrible offenses against minors. In addition, if a victim who was physically and psychologically harmed in the production of such pornography cannot be identified in a digital video or photograph, this eliminates the possibility that he or she could be provided with restitution. Thus, this thesis explains how to build a case against an Internet child sex predator by collecting and authenticating digital evidence that supports a conviction.

The History of Child Pornography in the United States

Child pornography, defined as "the sexual representation of a minor's body[2] or a minor engaged in sexual behavior with the goal of sexual arousal," (Pornography, 2004, ¶ 1) has existed in the United States since the 1960s and 1970s, when magazines and videos featuring young children in sexually explicit poses were commercially produced

in Europe and Asia and mailed to interested individuals in the United States (Pornography, 2004). The first Federal ban on child pornography, the Sexual Exploitation of Children Act of 1977, came as a response to the ever growing industry of soft pornography (magazines and photographs of pornographic images of minors). The Act specifically stated: "No person shall utilize a minor to engage in sexually explicit conduct for the purpose of producing any visual depiction of such conduct with the requisite knowledge that it was or would be transported in interstate or foreign commerce" (18 U.S.C. §§ 2251-2253). In short, the Act banned the production, possession, or distribution of all child pornography. With the passage of this Act, the Federal Government specifically stated that child pornography is not covered under the First Amendment right to free speech and is placed on the same level as adult pornography.[3]

The problem of child pornography escalated throughout the 1980s[4] with printed materials and videos being purchased and traded through the U.S. mail system. As more and more obscene materials were confiscated through the mail, the United States Postal Inspection Service teamed with the Federal Bureau of Investigation (FBI) and the National Center for Missing and Exploited Children (NCMEC) to form task forces that would combat child exploitation in any form. With the onset of the World Wide Web in 1993, pedophiles --"individuals with reoccurring sexual arousals, desires, or fantasies involving sexual impulses toward a pre-adolescent child or children" (Gore, 1998, ¶ 1) -- around the world began trading and purchasing child pornography electronically (Pornography and Internet, 2004, ¶ 3). In response to the ever-growing increase of the use of the Internet as an exchange medium for child pornography, Congress passed the Child Protection and Obscenity Enforcement Act of 1988, which, for the first time, made it unlawful to use a computer to transport, distribute, or receive child pornography.

The introduction of digital cameras in the 1990s made it easier for pedophiles to create and distribute their own pornography using innocent children and a secluded basement "studio." Pictures could be taken with a digital camera and stored on a disk or memory stick and downloaded to the suspect's computer for transmission in seconds. As the amount of child pornography materials circulating in the United States was increasing, the number of *actual* child sexual abuse and exploitation cases was also on the rise. In the late 1990s, pornographers even began creating and distributing "virtual porn" made with computer-generated images of children or altered images of real children. Virtual porn is created using basic graphic file editing programs such as Paintbrush or more sophisticated programs, such as Adobe PhotoShop, Corel, or Morpher, and usually involves changing the identifying features of the victim (if the image is of a real child), such as hair and eye color.

In 1996, Congress passed the Child Protection and Prevention Act (CPPA), which added to the definition of child pornography, "any visual depictions of what *appears* to be a minor engaging in explicit sexual conduct, even if no actual minor was used in producing the depiction" (Cohen, 2003, p. 11). This Act prohibited computer-generated or "virtual child" pornography that was created using a computer but no actual living child (Wasserman, 1998). However, in 2002 in *Ashcroft v. The Free Speech*

Coalition, the Supreme Court held that the government may not criminalize such action because the production of "virtual child" pornography does not sexually abuse an actual child. The Court rejected the government's argument that virtual child pornography encourages pedophiles to abuse children and instead provided First Amendment protection for computer-generated pornography even if it appears to be a real child but was created using a graphics program such as PhotoShop (Cisneros, 2002).

The most recent legislation regarding child pornography was enacted in 2003, when President George W. Bush signed into law the Prosecutorial Remedies and Other Tools to End the Exploitation of Children Today (PROTECT) Act. This law once again banned virtual child pornography by amending the definition of child pornography to include images of real children, images that are indistinguishable from real children, and images created to appear that an identifiable minor is engaging in sexually explicit conduct (Cohen, 2003).[5]

Today, Federal legislation makes it a felony to produce, possess, or distribute child pornography, regardless of whether a real child is used in the production of such material or not. It is also illegal for an adult to have sexual relations with, or to sexually exploit, a minor. Child pornography, sexual predation, and pedophilia exist as some of our society's most serious problems. These practices have also contributed to other crimes such as child prostitution. The mere existence of child sexual predation depraves social values and annihilates the innocence of childhood. With a proper investigation, including the authentication of convicting evidence and a well presented case, sexual offenders and exploiters of children will be properly apprehended and serve as a deterrent to other would-be criminals.

Building a Case against an Internet Child Sex Predator

Building a case against an Internet child sex predator requires the presentation in court of clear and convincing evidence that supports a conviction. Constructing such a case involves a proper knowledge of Federal legislation and case law detailing the laws against child pornography and pedophilia, a precise investigation of the suspect's computer (and other possessions, depending on the crime), and a thorough collection of evidence, and authentication of the collected evidence that supports the suspect's conviction.

Discovering the Predator

In an interview on January 6, 2004, Ray Smith, National Program Manager of Child Exploitation for the United States Postal Inspection Service, stated that child sex predator investigations usually begin in one of two ways: from a "tip" from a member of the community or through undercover operations inside an Internet chat room. A member of the community might observe a neighbor spending unusual amounts of time with a neighborhood child and will phone police with a tip. An Internet Service Provider

(ISP) may notice one of its subscribers downloading and trading child pornography and will immediately notify police.[6] Parents of suspected victims might also notice unusual behavior from their children, such as an instant attachment to an adult "friend," or a sudden change in attitude or lack of interest in childlike activities. Parents will usually phone police in these instances.

The most common way for law enforcement to be made aware of a criminal sexual offense is through undercover operations in an online chat room or by intercepting a virtual message conversation.[7] Agencies such as the FBI and the U.S. Postal Inspection Service have specially trained investigators who "scan" chat rooms and search for potential predators. Each investigator takes on a new identity and engages in conversations with other chat room members that are present. Occasionally, investigators will play the role of a child and will quickly befriend a suspected predator. After an extended period of getting to know one another, the suspect will usually arrange to meet his or her new "young" companion for a rendezvous. When the suspect arrives for the meeting, investigators will use a decoy to meet the suspect but will soon thereafter arrest the suspect for his or her intent to sexually harm a minor.

In other instances, the investigators will play the role of a pedophile and will offer to "trade" materials (e.g., illicit photographs and videos) via the Internet in exchange for "new" materials from other pedophiles and pornographers (this is commonly called a child pornography ring). Smith also noted during the interview that when he portrays a pedophile, he will ask for photographs of children engaged in specific poses and sexual acts, in order to "prove" to the others that he is knowledgeable and "enthusiastic" about child pornography and that he wants to enhance his image collection. Thus, Smith notes that it is easy to establish an undercover connection with a suspected sex predator simply by offering to trade photographs with him or her. Pedophiles have an addiction to collecting these obscene photographs for their own sexual arousal and to desensitize their young victims.

Once investigators establish communication with a suspected child sex predator either by portraying a victim or another pedophile, they will seek to find the suspect's Internet Protocol (IP) address, a 32-bit binary address represented as four decimal numbers separated by periods.[8] An IP address identifies any computer or device that is located on a Transmission Control Protocol/Internet Protocol (TCP/IP) network. With the IP address, the investigator can determine the suspect's ISP and subpoena the ISP for information on the suspect.

Once law enforcement personnel determine that a person or persons might be engaging in the production, possession, or distribution of child pornography, they request a search warrant from a magistrate judge to search the offender's work and/or home computer, to subpoena the offender's ISP or Network administrator in cases where the offender used a Local Area Network (LAN), Wide Area Network (WAN) or Metropolitan Area Network (MAN) to access the Internet for information, or to search other possessions (house, car, place of employment, etc.) if necessary. Once the search warrant has been issued, the investigation can formally begin.

Finding the IP Address

Since nobody really owns an IP address, an investigator must go through several steps to locate a suspect. IP addresses are commonly found in e-mail headers and computer log files. For example, if a suspect visits a chat room or a website, the web server for both will record which IP address visited the site and at what time the visit occurred (Casey, 2000). Once the IP address is determined, the investigator can find the owner of the IP address at the appropriate registrar's database.

Registrars around the world assign groups of IP addresses to organizations, and each organization is responsible for allocating their block of IP addresses. In order to determine which organization is responsible for a given IP address, the investigator must search the appropriate registrar's WHOIS database. For example, whois.arin.net and www.networksolutions.com maintain databases of IP addresses assigned to organizations in the United States. Once investigators have an IP address, they can contact the Internet Service Provider (ISP) through which the suspect connected to the Internet. The ISP will be able to supply the investigator with additional information about the suspect.

Subpoenaing the ISP

Once an investigator has determined the suspect's IP address and his or her ISP (such as AOL or Yahoo!), the investigator may subpoena the ISP for information regarding the suspect's account. Provided the suspect did not hack into the account or pay for the service using a stolen credit card, the ISP will have billing and other information for the individual who used the account to access the World Wide Web. This information includes log-on and log-off times; a history of the offender's downloads while using the ISP to connect to the Internet; e-mails the suspect sent and received (containing headers that identify the suspect), personal homepages, copies of chat or Instant Messaging conversations; and digital images or photographs that were saved to the ISP's server. In an interview on January 6, 2004, Dan Dorman, Postal Inspector Program Manager of the Digital Evidence Unit of the U.S. Postal Inspection Service, cited that "information provided by ISPs is considered more reliable and authentic because of the fact that most ISPs are disinterested third parties." However, he went on to say that, "[like digital evidence] there is always the possibility that a person at the ISP altered the information before providing it to law enforcement." Another concern with relying on information from an ISP is the fact that in many instances, so much time has transpired since the creation of the data that the ISP may have purged that data from its records. Monique Ferraro, a staff attorney at the State of Connecticut Electronic Evidence Unit, believes that information from an ISP generally has proven reliable and authentic and will continue to be utilized until proven otherwise.[9]

Examining the Computer for Evidence

Once the suspect's IP address has been found, the ISP determined, and the suspect located, a search warrant may be issued for the investigation of the offender's home and/or office PC to discover digital evidence that will support a conviction. It is important to remember that a chain of custody log for the computer and other related physical parts must be documented during each phase of the collection of digital evidence and the remainder of the investigation. Investigators and scientists that handle the evidence must record in the log their full names, dates and times of possession and any notes or comments made on the evidence. If this procedure is not followed, the evidence will be considered mishandled or tainted and will not be admissible in court.

The investigation of an individual's computer involves the examination of the central processing unit (CPU) and its internal components and external storage devices (floppy disk, CDROM, Zip disk, USB Flash Drives, external hard drives, and other equipment as deemed necessary by the forensic investigator). It is always advised in the field of computer forensic investigation to make an exact duplication of the data being investigated before the examination process is begun, thus avoiding accidental modifications or erasures of evidence. This rule stems from the empirical law of digital evidence collection and preservation which states: "If you only make one copy of digital evidence, that evidence will be damaged or completely lost" (Casey, 2000, p. 53). It is also appropriate to have several computer forensic investigators present at the time of the examination to ensure accuracy and integrity throughout the investigation.

Collecting the Computer's Hardware

When collecting hardware from a computer, one should turn off the computer completely before attempting to examine it. The best way to turn off the computer is by unplugging all of the power and data cords from the back of the computer, rather than by using the computer's power switch. This preventative measure is taken just in case the computer's startup sequence is rigged to reformat its hard drive at the touch of the power switch. The computer should then be seized and digital evidence collected by employing the *independent component doctrine* that "investigators should only collect hardware for which they can articulate an independent basis for search or seizure" (Casey, 2000, p. 51). Unnecessary components of the computer system should be ignored if they lack contribution to the investigation. If it is decided that an entire computer system should be examined, then the collection of all of its peripheral hardware, such as printers and external drives should also be collected from the scene.

When investigators have seized the entire contents of a computer system, the following steps should be taken to ensure careful extraction and preservation of digital evidence:

1. Investigators must obtain all logon names and passwords required to access the computer and its associated programs. For example,

an investigator would need to obtain a logon username and password for a suspect who regularly connected to the Internet using an ISP.

2. All parts seized from the computer should be turned over to the computer forensic scientist and the chain of custody log should be updated accordingly.
3. A bitstream copy of digital evidence from the hard drive(s) should be made. Bitstream copies duplicate everything in a cluster, including anything that is in the computer's slack space; whereas, other methods of copying a file only duplicate the file and leave the slack space behind (Casey, 2000).
4. The computer should be booted with a backup, duplicate, copy, or image of the original hard drive, and should use another operating system that bypasses the existing one and does not change data on the hard drive.

Once the computer has been seized and properly prepared for examination in a computer forensics laboratory, forensic scientists can begin searching the computer for digital evidence. This search includes utilizing file management programs, such as Windows Explorer, operating system searches, command prompts, scanning software and other tools, to (properly) collect digital evidence that is admissible in court.

Retrieving Digital Evidence

Digital, or computer-based evidence, is defined as data files, electronic mail, and background information that are created and stored in digital form whenever a computer is used to accomplish a task (Feldman, 2003). Investigators may retrieve digital evidence from a suspect's hard drive by searching Windows Explorer for specific files or by using more advanced software such as Guidance Software, Inc.'s "EnCase." EnCase allows forensic examiners to easily manage large volumes of computer evidence and view all relevant files, including "deleted" files, file slack, and unallocated space. EnCase is popular with Federal investigative agencies such as the FBI and the United States Postal Inspection Service. The following describes the different types of digital evidence that should be retrieved from a computer's hard drive using EnCase or another digital data retrieval system.

Data Files

Data files can include active data, replicant data, backup data, and residual data. Active data are information on a computer that are readily available and accessible to users. In a case involving an Internet child sex predator, active data usually include, but are not limited to, word-processing documents and spreadsheets, databases, e-mail messages of correspondence with the victim(s), illicit digital photographs and videos, e-

calendars showing planned visits with victims, and address books listing victims' home addresses. A list of all active data can be easily viewed through file manager programs such as Windows Explorer (Windows 95 or higher) or "list file" commands in DOS (Feldman, 2003).

Replicant data include "file clones," created by software programs' automatic backup features that create, and periodically save, copies of the file being worked on by a user. Replicant data include any type of digital evidence that was *automatically* backed up to another location. The backup files are created and saved in order to help users recover data lost due to a system crash or power loss or other type of computer malfunction (Feldman, 2003).

Backup data are information copied to removable media in order to provide users with access to data in the event of a system malfunction. Backup data can be stored on any of the following: removable hard disk, floppy disk, CD Rom, USB jump drive, memory chip or stick, or Zip disk (Feldman, 2003).

Residual data are information that appears to be gone (as a result of deletion), but are still recoverable from the computer system. Residual data include "deleted" files and data existing in other system hardware (i.e., buffer memories of printers, copiers, and fax machines). In the case of an Internet child sex predator, the suspect will try to delete communication (e-mail, chat logs and digital photographs of his or her victim) to destroy convincing evidence. Until data are overwritten or wiped, they can be restored through use of undelete or restore commands contained in many systems' operating software or through specialized programs (Feldman, 2003).

Electronic Mail

Electronic mail, or e-mail, has become one of the fastest growing means of communication in the world today. Approximately 31 billion person-to-person e-mails were sent each day in 2002. This number is expected to grow to 60 billion each day by 2006 (Johnston, 2002). In addition, the average office worker in the U.S. sends and receives between 60 and 200 e-mail messages each day (Craine, 2002). These statistics demonstrate that e-mail users are growing exponentially each year. E-mails are also becoming valuable digital evidence for investigators and lawyers alike. E-mail has several characteristics that make it an excellent source of evidence:

- Most people use e-mail informally and candidly.
- Many people, including child sex predator suspects, believe that e-mail messages are impermanent.
- E-mail is more difficult to get rid of than most users believe. Permanently deleting messages on most e-mail systems is usually a two-step process and many users only complete the first step. E-mail is easily copied and forwarded, thus making distribution of a message nearly impossible to control. Finally, undeleted e-mail may be captured on system backups. (Feldman, 2003)

Background Information

Background information includes audit trails, access control lists, and non-printing information. Audit trails and computer logs create an electronic trail regarding network usage. Audit trails typically contain information about who, when, where, and how long a suspect was on the system. In addition, an audit trail may indicate when and by whom a file was modified and when and by whom files were downloaded to a particular location, copied, printed out, or purged (Feldman, 2003).

Access control links limit users' rights to access, view, and edit various files. Access control is typically implemented in a business environment in which various people are given different permission to view and modify certain files. According to Feldman (2003), if litigation centers on a particular file or group of files, identifying who had access rights to the files and the type of access each person was allowed can establish data ownership/authenticity of files.

Non-printing information includes data that are attached to files but are not printable. An example of non-printing information that is helpful to forensic scientists and investigators is the date and time stamp attached to every file. Feldman (2003) adds that some word-processing programs store revisions to documents, thus allowing the viewer to follow the thought process of the author as a document is edited.

Encrypted Evidence

In many cases, evidence encountered by a computer forensic scientist in an Internet child sex predator case will be encrypted. Encrypted evidence is computer data that has been translated into a secret code that can only be read with a secret key or password. Encrypted data are called *ciphertext*; unencrypted data are called *plain text*. Internet child sex predators generally encrypt the more incriminating communications and stored data because they are often exactly the evidence that investigators seek. Practical approaches for computer forensic scientists to retrieve encrypted data include using password recovery toolkits, locating unencrypted copies of data, guessing, or obtaining encryption passphrases (Casey, 2002).

Weak encryption. Child sex predators often use simple encryption processes to conceal their presence. For example, one common form of simple encryption used by intruders is to Exclusive OR (XOR) each byte against the value 255 (0xFF), effectively inverting every byte in the file. Many applications, including Microsoft Word and Excel, use XOR to encrypt passwords that individuals can select to protect their files. These passwords can be easily recovered using tools such as Access Data's Password Recovery Toolkit and NTI's Advanced Password Recovery Software Tool Kit (Casey, 2002).

Strong encryption. Evidence that has been strongly encrypted with a secret and/or public key encryption scheme is much harder for investigators to access. For example, when a suspect uses an encryption algorithm such as DES, it is theoretically

possible to try every possible key to decrypt a given piece of ciphertext, but this approach requires significant computing power to run through the vast number (2^56, over 72 quadrillion) of potential decryption keys and can take an excessive amount of time (Casey, 2002).

An obvious weakness of strong encryption is the plaintext file, which may still be retrievable. If the plaintext file was deleted, it is easily removed from the computer's hard drive. If it was stored in memory or backed up to external media, it may still be possible to retrieve the data. If a file was encrypted using EFS, a temporary copy of the plaintext was made in case a problem is encountered during the encryption process and might have been stored in a paging file (pagefile.sys) prior to encryption. In one instance, a suspect used PGP (Pretty Good Privacy) to encrypt Microsoft Word documents. Although the original documents had been deleted, fragments of the files were scattered around the disk in deleted MS Word temporary files and were later found by searching for Microsoft Word Headers (Casey, 2002).

When recovered evidence from an encrypted file is found, it may not always be possible to confirm that the recovered evidence is *identical* to the encrypted file(s). However, this issue is resolved by searching a database of known files for characteristics of pre-encrypted files such as names and original file sizes. Consider the case of *United States v. Hersh (2002)*:

> Encrypted files were found on a high-capacity Zip disk. The images on the Zip disk had been encrypted by software known as F-Secure, which was found on Hersh's computer. When agents could not break the encryption code, they obtained a partial source code from the manufacturer that allowed them to interpret information on the file print outs. The Zip disk contained 1,090 computer files, each identified in the directory by a unique file name, such as 'sfuckmo2,' 'naked31,' 'boydoggy,' 'dvsex01,' 'dvsex02,' 'dvsex03,' etc., that was consistent with names of child pornography files. The list of encrypted files was compared with a government database of child pornography. Agents compared the 1,090 files on Hersh's Zip disk with the database and matched 120 file names. Twenty-two of those had the same number of pre-encryption computer bytes as the pre-encrypted version of the files on Hersh's Zip disk. (Casey, 2002, ¶ 27)

An additional source of unencrypted data is Random Access Memory (RAM). In his article entitled "Practical Approaches to Recovering Encrypted Digital Evidence," Eoghan Casey (2002) describes how to recover evidence from RAM:

> If the contents of an application window (such as Outlook's e-mail composition window) are encrypted using PGP, a copy of the plaintext is oftentimes held in memory by the application. Similarly, when PGP is used to encrypt or decrypt text on an operating system such as Windows 2000 (or later), a copy of the plaintext is held in memory by PGPtray for an indefinite period. The memory of

this process can be dumped to a file using a program like pmdump and searched for unencrypted data. (Casey, 2002, ¶ 29)

In addition, the secret key has also proved an effective method for decryption of strongly encrypted evidence. If an easy to remember key such as the suspect's birth date or phone number is used, it may be possible for someone to guess it and gain access to the data. If a difficult to remember key is used, it is probable that the suspect had to write down the password in a location where it could be referenced each time the data are decrypted. This action would prompt an investigator to search the area surrounding the computer for any small slips of paper containing the suspect's passphrase. Also, it is possible for a witness to have observed the suspect typing the secret key. Thus it is important for the investigators to interview all persons who may have been present with the suspect at the time of the encryption or during decryption of the file(s) (Casey, 2002).

After all necessary digital evidence has been acquired from the suspect's computer, the processes of examination and authentication must occur concurrently. When examining evidence, investigators and forensic scientists must seek to find the identity of the victim and must link the suspect to the victim and the crime, thus proving it *authentic evidence* that the suspect *did* commit the crime. Evidence that is proved genuine will be admissible in court and will contribute to the prosecution's case.

Authenticating the Evidence

Fed. R. Evid. 901(a) states: "Before a party may move for admission of a computer record or any other evidence, the proponent must show that it is authentic. That is, the government must offer evidence sufficient to support a finding that the [computer record or other evidence] in question is what the proponent claims" (Searching and Seizing Computers and Obtaining Electronic Evidence, 2002, § 5). Investigators who seize digital evidence from computers can testify in court that the evidence was authentic at the time it was discovered. In most Internet child sex predator cases, digital evidence may be the only source of evidence for conviction; therefore, all care should be taken to preserve evidence and prove its authenticity (National Center for Forensic Science, 2003).

Maintaining the Chain of Custody

One of the most important elements in proving the authenticity of digital evidence in court is the ability to show the exact chain of custody of the evidence from the time of discovery. The following questions should be asked of both law enforcement agents and employees of private corporations (e.g., IT staff, security, ISP employee(s), etc.) and carefully documented prior to trial to show the care taken to preserve the evidence's chain of custody:

1. What types of digital evidence have been collected?

2. When was the evidence collected?
3. Where was the evidence when it was collected?
4. Who handled the evidence?
5. How was the digital evidence collected and stored?

In addition to carefully maintaining a log of the persons who handled the evidence, the above questions should be answered completely and should be readily available if an opposing party were to question in court the authenticity of the evidence presented (National Center for Forensic Science, 2003).

Manipulated and Computer-generated Evidence

Since computer records can be altered easily, opposing parties in court often allege that computer records lack authenticity because they had been tampered with or altered after their creation. For example, Robert Sylvester Kelly, better known by music fans as Grammy award-winning hip-hop singer R. Kelly, was charged with 21 counts of child pornography in 2002. (As of the writing of this thesis, this case entitled *State of Illinois v. Robert Kelly,* is being heard by the Illinois Supreme Court.) A digital video of an alleged Kelly engaging in sex with an underage girl is a main source of evidence for the prosecution. The defense argues that the image of Kelly in the video is actually a "morphed" image placed in the video by someone else, in hopes of framing Kelly and damaging his music career (*State of Illinois v. Robert Kelly*, 2002). The courts have responded to such claims of alteration with considerable skepticism. In *United States v. Whitaker* (1997), the Seventh Circuit Court stated, "Absent specific evidence that tampering occurred, the mere possibility of tampering does not affect the authenticity of a computer record" (Kerr, 2001, ¶ 12). In *United States v. Bonallo* (1988), the Ninth Circuit Court established that "the fact that it is possible to alter data contained in a computer is plainly insufficient to establish untrustworthiness" (Kerr, 2001, ¶ 12).

In cases like that of R. Kelly, the evidence must be *proved* to have been tampered with. To prove the video of Kelly is authentic, the prosecution will have to examine the magnetic marks left by the recorder and not part of the visual image itself to determine:

- If the recording is the original or a copy;
- Which buttons were depressed in the process of making that recording and where they are relative to the video images being presented;
- If part of the original recording was covered by recording over it at a later time;
- If the recorder presented is actually the one used to make the tape being evaluated;
- The answers to many other case specific questions, such as Kelly's whereabouts on the occasion of the recording. (Lodge, 2004, ¶ 38)

If Kelly cannot prove he was somewhere other than with the victim when the video was recorded, and if the prosecution determines the tape to be an original and authentic copy,

then Kelly will probably be convicted of sexually offending a minor and creating child pornography.

Considering that the courts admit digital evidence despite the possibility of prior alterations, the burden of proof rests on the prosecutor to prove the authenticity of the evidence *and* connect the suspect to the victim and the evidence in question. A serious problem faced by prosecutors today concerns the authenticity of photographs that have been manipulated.

Through a process known as morphing, pornographers and child sex predators can transform scanned images of children into pornographic images by adding or changing distinct features. They can also use techniques such as 3-D modeling to design computer images that are almost indistinguishable from real photographs. Programs such as Morpher 3.0 and Digital Darkroom possess the capabilities to "mix" two pictures of human bodies in a specific way so that the resulting compound image shares the properties of both originals. Computer-savvy pedophiles also use a well-known program, such as Paintbrush, or high-quality image studios, such as Adobe PhotoShop, Barco Creator and Corel, to *alter* images of children by digitally removing their clothes and arranging them into sexual positions. In many instances, pedophiles scan into their computers magazine images of fully-clothed young girls and digitally remove their clothing, adding genitals and other distinct features to their bodies.

Authenticating a morphed image involves careful examination and consideration of many details. The edges of a digital photograph should be examined for jagged or sharp edges. In many cases of manipulation, the final picture will end up with jagged edges where features were cut or pasted (Grumet, 1997).

The shadowing in the photograph must also be examined. If there are two images with lights coming from different areas in the picture, the morphed image will result in shadows pointing in two different directions. Even if they are pointing in the same direction, one shadow may be darker than the other. If anything in the photographs is changed or moved, the shadows will look completely unrealistic (Grumet, 1997).

Photographic film grain must also be examined. When a picture is taken, there is a certain amount of graininess, or coarseness, depending on when, where, and how it is taken. If two images are pasted together, the grains of the two pictures will not match. Because noise varies the pixel, the noise filter helps create random patterns of lighter or darker pixels, thus creating the illusion of a more average film grain. If forensic scientists apply noise on top of an image that has been altered or morphed, they will be able to mask some of the changes, inconsistencies and imperfections by smoothing the picture out and making it more consistent (Grumet, 1997).

The above techniques are specific to photographs that have been morphed. However, various other methods of authentication can be used for morphed photographs as well as other types of digital evidence found in Internet child sex predator cases.

Using hash values to determine authenticity. In an interview on March 11, 2004, Chris Trifiletti, investigator for the FBI, cited one of the best methods for authenticating digital evidence as comparing the MD5 hash values of each file retrieved from the suspect's computer. An MD5 hash value is a 128-bit (16-byte) number that uniquely describes the contents of a file. It is essentially a digital fingerprint that identifies a file just as human fingerprints are unique to each individual. An MD5 hash value is generated by an algorithm that is so complex and precise that the odds of two different files sharing the same hash value is two to the 128th power. By these odds, a person would be more likely to win the grand prize in the Powerball lottery 39 times before running across two different files with the same hash value. In instances where a picture appears to have been manipulated, its hash value can be compared to an original copy, thus establishing its authenticity (Guidance Software, Inc., 2004).

Identifying the author of computer-stored documents. The Department of Justice reports that "although handwritten records may be penned in a distinctive handwriting style, computer-stored records consist of a long string of zeros and ones [called binary digits] that do not necessarily identify their author" (Searching and Seizing Computers and Obtaining Electronic Evidence, 2002, § 5). This proves to be critical for investigators and prosecutors when they try to figure out exactly who authored a particular e-mail or created a particular digital image or photograph. For example, e-mails can be sent anonymously, and Internet Relay Chat (IRC) channels permit its users to communicate under false IDs without ever identifying their real names. In addition, the offenses may be committed using a public computer (such as a library computer) and evidence may be stored on a public server (such as an AOL, MSN/Hotmail, or Angelfire server), thereby making it more difficult to locate an IP address or ISP account information. Thus, it is easy to see why the authorship of digital evidence is often challenged, for his or her real identification may never be revealed. To best identify the author of a computer-stored document, investigators must use circumstantial evidence to connect the suspect to the evidence.

In the case of *United States v. Simpson* (1998), prosecutors sought to show that the defendant had conversed with an undercover FBI agent in an Internet chat room devoted to child pornography. The government presented a printout of the chat conversation between the agent and a man known as "Stavron " (the defendant). In the conversation, Stavron had mentioned his real name, home address, and telephone number. The tenth Circuit Court argued that if digital documents give circumstantial evidence beyond any doubt that the individual assumed to have authored or created the document did, in fact, participate in the offense, then the document is indeed authentic. In *United States v. Siddiqui* (2000), the 11th Circuit Court held that e-mail messages were properly authenticated when messages included the suspect's e-mail address and nickname, and when the suspect followed up the message(s) with a phone call.

Evidence that may raise the most questions regarding its authorship and authenticity is that from websites, especially those created from public computers and stored on public servers. In *St. Clair v. Johnny's Oyster & Shrimp, Inc.* (1999), the court held that evidence from a web page could not be authenticated, since information from

the Internet is "inherently untrustworthy." However, corporate or Federal websites may be admitted based on their trustworthiness. Depending on the circumstances and obtainable information, websites may or may not be admissible in court as digital evidence.

Additional methods for proving the authenticity of digital evidence. Proving authenticity of digital evidence is difficult for most investigators and prosecutors because they lack the necessary skills to trace the history of the evidence. Journalist Deborah Radcliff (1998) wrote an article for *Computer World* and *CNN* entitled "Hacking Away at Kiddie Porn." In the article, she states that the best resource for law enforcement and prosecutors in investigating cyber crime is to use the skills of hackers to find and trace digital evidence. Two such hacking groups known as Ethical Hackers Against Pedophilia (EHAP) and Hackers Against Kiddie Porn (HAKP) have assisted investigators in finding evidence and proving its originality and authenticity.

Another way to prove authenticity of digital evidence is by using authentication software. For example, Kwan Software Engineering, Inc. developed a system known as VeriPic™ Digital Photo Authentication system. VeriPic™ software was created to verify the authenticity of digital photographs stored in a digital camera's memory for court evidence and was even tested at a number of police departments before its release. The VeriPic™ system works with popular brands of digital cameras, by authenticating the pictures that are stored in the camera's memory. The software analyzes the digital photographs and writes into the pictures certain parameters that characterize the photos. After analysis, the photo can be saved onto a computer's hard drive in a standard file format and can be used with all popular digital photo computer programs. For court procedures, VeriPic™ can look at the photographs with their stored parameters and tell if anyone has changed the photos since they were taken with the camera (VeriPic, 2000).

In an interview on January 6, 2004, Dan Dorman, Postal Inspector Program Manager of the Digital Evidence Unit for the US Postal Inspection Service, cited programs such as Hash.exe (Maresware) and EnCase, which use mathematical calculations to verify the authenticity of digital evidence retrieved from a suspect's computer. Peter J. Constantine, Senior Examiner for Data Discovery, Inc. stated in an interview on January 6, 2004, that "an examiner's visual review" is the best method for authenticating digital evidence, especially digital photographs and videos. He also referred to such secondary methods as date/time stamps and byte counts, although no method of authentication has ever proved 100 percent reliable in the examination of digital evidence. Until technology advances faster than the capabilities of cyber criminals and enough individuals have received appropriate technical training, investigators will have to rely on authentication software, the expertise of hacking groups, and their own visual examination skills to authenticate digital evidence.

The Conviction and Sentencing

After all digital evidence has been collected and authenticated, the prosecutor must present the evidence in court and use it to prove that the defendant committed the alleged crime. The evidence in some cases will be easy to retrieve and authenticate, thus obviously proving that the defendant committed the crime. In other cases, however, the suspect will have committed the crime with such skill that not even the sharpest forensic scientists could authenticate the evidence and connect it to the suspect. For this reason, it is crucial for prosecutors to carefully construct their case to prove to the jury that the evidence *is* authentic and that it connects the suspect to the victim and the crime scene.

If the prosecutor presents a convincing case, the suspect will be convicted of committing the alleged offense. After the conviction is announced, the offender will be sentenced based on the facts presented in the case and the intensity of the offense. The offender may receive a light sentence of less than a year in jail, or if the crime necessitates, he or she will be sentenced to many years in Federal prison. Rarely, will a convicted offender receive life imprisonment for his or her offense(s). In fact, in many cases, the offender is released from prison on parole within a few years of the conviction, and is free to continue committing such disturbing acts on innocent children.

Conclusion

It is important to remember that the offender's sentence cannot atone for the long-term suffering and painful memories experienced by the victim(s). Oftentimes, many victims are haunted by their experiences throughout their lifetime. The sexual predation of a minor and the creation, possession, and distribution of child pornography have three devastating effects on child victims. First, pedophiles and child sex predators use real or computer-generated pornography to stimulate and whet their own sexual appetites, which arguably results in the viewer's becoming desensitized to the sexual exploitation of children. In a survey conducted by the FBI, 87 percent of girl child molesters and 77 percent of boy child molesters admitted to regular use of hard-core child pornography. By viewing the explicit materials, the offenders become sexually aroused and must "live out" their fantasies by violating children. These predators become addicted to performing such obscene acts on children and continually seek new victims to satisfy their "appetite."

Second, real and computer-generated child pornography is used by child sex predators to seduce children into sexual activity. In her article entitled "The Criminalization of Virtual Child Pornography," Debra Burke (1997) explains that the danger that children can be coerced into sexual activity by viewing other child participants is just as great whether the predator uses pictures of actual children or computer-generated images. In many instances, sexual predators use child pornography (oftentimes of the child's friends, peers, or role models) to entice the child by lowering his or her inhibitions and instructing the child in various sexual practices. In addition,

predators in past cases have used morphed images of a victim's own likeness to blackmail the child into silence or sexual submission.

Third, the use of children as instruments of sexual arousal and ultimate gratification has a detrimental effect on the moral fiber of society as a whole. Sexual encounters during childhood can stunt a child's development in his or her mental, physical, and emotional capacity and can have negative effects for this rest of the child's life. "Sandra," a 30 year-old victim of child sexual predation, remains haunted by her experiences even in adulthood (Burke, 1997). As a young child, when Sandra had to live with extended relatives she was forced to pose nude for pictures and was repeatedly raped from the time she was four until she was 15. To this day, Sandra cannot bear to have her picture taken and regularly sees a counselor. Sandra's relationships are completely different because of her experiences, and she is frightened constantly at the thought of her past (Burke). If society does not catch and convict the child sex predator, our children may someday suffer the consequences by becoming his next victims.

Methods to create and distribute digital child pornography are advancing faster than individuals gaining the knowledge to investigate them. While many Internet child sex predators are prosecuted for their wrongdoings, many still remain free because investigators and computer forensic scientists lack the necessary skills and technology to discover and authenticate convicting evidence. If criminal investigators and forensic scientists do not possess more technical skills than the predators that are violating children, these criminals will remain free and continue committing their crimes. Society has an immense need for individuals who possess computer expertise and vast technical knowledge to gather convicting evidence that will place Internet child sex predators behind bars for life.

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Appendix A

The Traci Lords Story

As a young child at the age of 10, Traci Elizabeth Lords was raped by a 16-year old friend and later molested by her mother's boyfriend. By the age of 15, Lords had become an overdeveloped, under-loved girl who yearned for her mother's attention and a father's affection. At 15, Lords was taken to a local talent agency by her mother's ex-boyfriend, where she could launch her career into "stardom" as an actress, something Lords had always dreamed of. The agency was in the business of producing pornographic films; and to participate, Lords would have to pose nude. But after having been convinced (by her mother's ex-boyfriend) that Marilyn Monroe launched *her* career by posing nude, Lords agreed to the low-paying but "promising" job. In order for Lords to legally appear nude in the films, she presented her agent with a falsified birth certificate showing her age to be 21.[10]

For three years, Traci Lords starred in over 20 pornographic X-rated films. While on camera, she exhibited a variety of nude poses and engaged in sexual acts including coitus. She made less than $40,000 for her work before she was eventually found by the FBI in 1986. Lords testified in an interview with *CNN* news anchor Larry King that she was "stoned on cocaine" during many of her video shoots. Lords is unable to remember many of her experiences for the amount of drugs she ingested during her days as a porn star. She also recalls feelings of immense stress and pressure from the business – even to the point of attempted suicide on several occasions (Whitworth, 2003).

After suspecting Lords' to be underage, the FBI confronted her in 1986 and questioned her about the pornographic films in which she starred. At the time of the interview she was 5-foot-7, weighed 90 pounds, and was stoned on cocaine. The FBI immediately launched an investigation into Lords' agency and the individuals who had hired her. All of her films were soon banned by the government, and anyone found to have them would be charged with possession and/or distribution of child pornography. Lords testifies that even today, her films circulate among child pornographers and pedophiles looking to whet their appetites for viewing children engaged in sexually explicit acts (Whitworth).

Appendix B

Text from the PROTECT Act (2003)

"'Child pornography' means any visual depiction, including any photograph, film, video, picture, or computer or computer-generated image or picture, whether made or produced by electronic, mechanical, or other means, of sexually explicit conduct, where –

(A) the production of such visual depiction involves the use of a minor engaging in sexually explicit conduct;
(B) such visual depiction is a digital image, computer image, or computer-generated image that is, or is indistinguishable from, that of a minor engaging in sexually explicit conduct; or
(C) such visual depiction has been created, adapted, or modified to appear that an identifiable minor is engaging in sexually explicit conduct (Child Pornography: Constitutional Principles and Federal Statutes).

The PROTECT Act defines "sexually explicit conduct," for purposes of (B) as:

(i) graphic sexual intercourse, including genital-genital, oral-genital, anal-genital, or oral-anal, whether between persons of the same or opposite sex, or lascivious simulated sexual intercourse where the genitals, breast or pubic area of any person is exhibited;
(ii) graphic or lascivious simulated; (I) bestiality; (II) masturbation; or (III) sadistic or masochistic abuse; or
(iii) graphic or simulated lascivious exhibition of the genitals or pubic area of any person" (18 U.S.C. §§ 2251-2260).

Appendix C

Electronic Communications Privacy Act

The Electronic Communications Privacy Act (ECPA), 18 U.S.C. § 2701, provides the customers and subscribers of certain communications service providers (such as ISPs) with privacy protections. The ECPA protects records held by providers about customers and subscribers (such as billing records) as well as files stored by the providers for customers and subscribers (such as e-mail or uploaded files). Depending on the type of provider, ECPA may dictate what type of legal process is necessary to compel a provider to disclose specific types of customer/subscriber information to law enforcement agents. The National Center for Forensic Science states, "as the level of government process escalates from subpoena to 2703(d) order to search warrant, the information available under the less exacting standard is included at the higher level (e.g., a search warrant grants access to basic subscriber information, transactional information, and content of the stored communication" (National Center for Forensic Science, 2003, p. 9).

Endnotes

1. Name has been changed to protect the innocent.

2. A minor is legally defined as an individual under the age of 18.

3. Obscenity that is not protected under the First Amendment is defined in *Miller v. California* as a work that, "(a) whether the 'average person, applying contemporary community standards' would find that the work, taken as a whole, appeals to the prurient interest [in sex]; (b) whether the work depicts or describes, in a patently offensive way, sexual conduct specifically defined by the applicable state law; and (c) whether the work, taken as a whole, lacks serious literary, artistic, political, or scientific value" (413 U.S. 15 (1973)).

4. Refer to Appendix A: The Traci Lords Story, which details the first large-scale pornography and child sexual exploitation case in the United States.

5. Refer to Appendix B for text from the PROTECT Act.

6. The Child Protection and Sexual Predator Punishment Act of 1998 states that an Internet Service Provider that is aware of a violation of U.S. Title 18, "shall, as soon as reasonably possible, make a report of such facts or circumstances to a law enforcement agency or agencies designated by the Attorney General" (H. Res. 3494, 1998).

7. The Wiretap Act, also known as the Omnibus Crime Control and Safe Streets Act of 1998, states that interceptions of private communications are illegal and are inadmissible in court unless they are supported with a court order (18 U.S.C. § 2501). These communications include but are not limited to, wiretapping a phone, placing a listening device or "bug" in a room to pick up conversations, and installing "sniffer" software that captures a suspect's instant messages. Investigators who determine it necessary to intercept communications for the purposes of collecting evidence must prove to a judge the reason for the interception. Without first obtaining a search warrant, evidence obtained through surveillance will not be admissible in court and may constitute a crime on the part of the investigator (National Center for Forensic Science, 2003).

8. For example, "10.134.23.2" is a typical IP address.

9. Refer to Appendix C, which contains information about The Electronic Communications Privacy Act, enacted to provide customers and subscribers of ISPs with privacy protections.

10. Eighteen is the legal age in the United States for a person to appear in a pornographic photograph or film.

Small Businesses: The Impact on 21st Century America

Paul Atkinson

Abstract

During an age of General Motors, Wal-Mart, and Microsoft, small businesses represent a large part of the working population and a significant portion of capital earned. Moreover, small businesses owned and operated by women will continue to grow for the foreseeable future. This article examines the future of small business in this country and explores the role of women in small business.

In 2002, the most current year provided by the Unites States Small Business Administration, 22.9 million small businesses existed in the United States alone. Small businesses have been extremely important to our success as a nation. The following statistics reflect its importance: Small businesses, according to the United States Small Business Administration:

- Provide approximately 75 percent of the net new jobs added to the economy
- Represent 99.7 percent of all employers
- Employ 50.1 percent of the private work force
- Provide 40.9 percent of private sales in the country
- Account for 39.1 percent of jobs in high technology sectors in 2001
- Account for 52 percent of private sector output in 1999
- Represent 97 percent of all U.S. exporters. (http://www.sba.gov/aboutsba/sbastats.html)

Support from the United States Small Business Administration

It is important to first recognize the role that the United States Small Business Administration has played over the past 5 decades. Small business has been able to make an impact on the 21st century in America due to support from the United States Small Business Administration (SBA). The SBA's mission is to "Maintain and strengthen the nation's economy by aiding, counseling, assisting, and protecting the interests of small businesses and by helping families and businesses recover from national disasters" (http://www.sba.gov/aboutsba/index.html). It came into existence as a result of the pressures formed from the Great Depression and World War II. In the past 51 years, the SBA has provided nearly 20 million loans, loan guarantees, contracts, counseling sessions and other forms of assistance to small businesses and has "become the government's most cost-effective instrument for economic development" (http://www.sba.gov/aboutsba/history.html). The SBA has grown alongside of small business in general and their current portfolio is made up of approximately 219,000 loans that accumulate to over $45 billion in loans. The Small Business Administration has played a big role in the last decade which has provided a platform for small business to

make such an impact in the 21st century. In the last ten years, the SBA "has helped almost 435,000 small businesses get more than $94.6 billion in loans, more than in the entire history of the agency before 1991. No other lender in this country – perhaps no other lender in the world – has been responsible for as much small business financing as the SBA has during that time" (http://www.sba.gov/aboutsba/history.html). The support from the SBA has provided the financial assistance that many entrepreneurs have desperately needed in order to make an impact in business in the 21st century. Without the Small Business Administration's funding, it would be impossible for many entrepreneurs to even have a chance at fulfilling their dreams and without their counseling, many businesses would have failed long before achieving those dreams. The continued support from the SBA will allow for small business to continue to make a significant impact throughout the 21st century.

The 21st Century

It is no surprise that as time has passed, the dynamics of small business have changed. According to Kirk Tyson, "the 20th century experienced more change than the 19 centuries that preceded it," and the 21st century looks to be no different. During the 20th century, businesses moved from the industrial age to the information age and have now stumbled upon the intelligence age (Tyson 193).

Small business has had an impact on 21st century America in two major ways. First of all, the continued immergence of technological advancements has propelled small businesses forward into a sea of available information mixed with swifter methods for conducting business transactions of all forms which has led to financial success. The implementation of such processes and equipment has caused business to be conducted at a rapid pace. Secondly, small business has created an avenue for women to assert themselves and has provided opportunities for success in a once, man-dominated realm called "business."

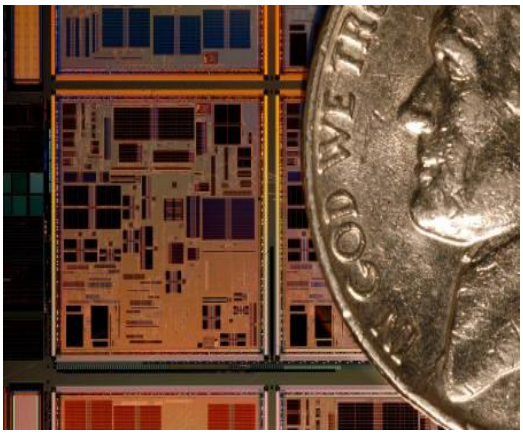
Technological Advancements Promote Continual Change

If there is one word that has played a crucial role in achieving success in the 21st century, it would be flexibility. An article entitled "A Brave New World" acknowledges the importance of flexibility and notes it as one of the three hallmarks to success in the 21st century: "Flexibility, innovation, and access to up-to-date information will be the hallmark of the successful entrepreneur in the 21st century." Small business has implemented the use of technology to perform activities that businessmen centuries before never even imagined such as online business transactions, inventory control systems, and computerized assembly lines.

In the 21st century alone, technology has advanced in exponential proportions. The technological requirements for a small business long ago would have been few: a phone, an old computer, and a fax machine if you were really on the cutting edge of technology. Those types of instruments are not even considered the bare minimum today

according to Judy McCarter of *National Public Accountant*. According to McCarter, today's essentials, at minimum, include: "Fast computers, laptops, laser printers, and cell phones are essentials, as is an Internet connection, preferably a high-speed connection." Janet Runge is correct when she says in *The Journal of Computer Information Systems*, "In today's business, information technologies (IT) have become necessities rather than luxuries. Systems that record and analyze business transactions are now lifelines of many corporations."

Flexibility, innovation, and access to up-to-date information are synonymous with one thing in the 21st century: the internet. New technology has allowed small businesses to bring new products and services to the consumer table in a more timely and efficient matter. In today's fast pace of small business, communication plays a huge role in making an impact. The continued implementation and use of the internet and PDA's in small business has allowed small business to make a consist impact on America. Many would agree with Judy McCarter when she says, "Frequent Internet access and email are my business' lifeblood." According to Darrell Zahorshky, a Small Business columnist from About.com, the internet is identified as one of the "hottest small business trends in 2003." The internet has been a resource that has proven unsuccessful for many who want to make a "quick million," but small businesses that effectively use the internet can be quite prosperous. According to Zahorshky, internet usage continues to grow. "Pollster, Ipsos-Reid's, Internet usage survey shows 72% of Americans have gone online at least once during 30 days in the past year." Zahorshky says that with more internet usage comes more online spending. "According to the Internet measurement firm, comScore Networks, consumer sales online reached $2.2 billion, an all-time weekly record in the week ending December 13th, 2002."



The internet has helped small business produce sales, but it has also impacted the 21st century by allowing information to be transferred and processed at incredible rates. It has been said that the internet is "the information highway." Steve Solazo, vice president of small and growing businesses for IBM's software division, would agree. He says, "The internet can really help small companies improve their competitive posture. If they can move more quickly to make information available to their suppliers and buyers, they can get an advantage over their competitors." Though it is not considered a small business, such practice has allowed Wal-Mart to successfully promote a motto that says, "No one sells for less." The same practices implemented by Wal-mart for inventory control are being used in small businesses across the country and are enhancing their profitability.

A Woman's World

There was once a sexist joke that said, "Don't ask a woman to do a man's job." In the 21st century, women have not only taken over small business, the once male-dominated field, but are doing a much better job in many cases. If there were ever a time for a woman to start her own small business, the time would be now. A country that once thought it inconceivable to have the woman working outside the home has become a springboard of opportunity for women pursuing business careers. The impact of women in business has escalated even as we have stepped into the new century.

Women owning more small businesses was not an unforeseeable trend. It started in the early 90's and has escalated with the turn of the century. An article in *Women in Business* that dates back to 1992 said, "Women are starting businesses at twice the rate of men and they are expected to own half of all American businesses by the year 2000, according to Patricia Saiki, administrator of the U.S. Small Business Administration." According to the Small Business Administration, their most recent publishings in 2001 reported that women made up nearly 51% of the total U.S. population. Not only that, but they represented 46% of the labor force and 37% of the self-employed. Around the turn of the century, women began flocking to small business. According to *The USA Today Magazine*, the *Wall Street Journal* reported, "Women are choosing to leave high-paying corporate jobs in record numbers--often taking significant pay cuts when they do--in order to enjoy the greater autonomy and flexibility of the entrepreneurial life." Again, flexibility in small business is important, but the personal flexibility that small business offers to a business owner personally is important as well. *The USA Today* went on to report, "Because of this shift, women-owned small businesses have become one of the fastest growing segments of the American economy, according to Kotch & Poliak, a New York-based producer of industrial expositions." This growth in women-owned small businesses has led to women owning nearly 6 million small businesses in 1999, a number that had risen by 43% since 1987. Today, the SBA's Online Women's Business Center reports that 9.1 million women-owned businesses exist which employ 27.5 million people and contribute $3.6 trillion to the economy (http://www.onlinewbc.gov/about_us.html).

Women's Small Business ownership has even received presidential support in the 21st century. President Clinton ordered in 2000 that the SBA provide further support for

Women Owned Small Businesses (WOSB's) in Executive Order 13157 which dealt with increasing opportunities for women-owned small businesses. A few of the SBA's responsibilities included:

" (a) working with each agency to develop and implement policies to achieve the participation goals for WOSBs for the executive branch and individual agencies; (b) advising agencies on how to implement strategies that will increase the participation of WOSBs in Federal procurement; (c) evaluating, on a semiannual basis, using the Federal Procurement Data System (FPDS), the achievement of prime and subcontract goals and actual prime and subcontract awards to WOSBs for each agency; (g) developing and implementing a single uniform Federal Government-wide website, which provides links to other websites within the Federal system concerning acquisition, small businesses, and women-owned businesses, and which provides current procurement information for WOSBs and other small businesses; (h) developing an interactive electronic commerce database that allows small businesses to register their businesses and capabilities as potential contractors for Federal agencies, and enables contracting officers to identify and locate potential contractors; and (i) working with existing women-owned business organizations, State and local governments, and others in order to promote the sharing of information and the development of more uniform State and local standards for WOSBs that reduce the burden on these firms in competing for procurement opportunities" (Clinton 2000) to name a few.

President George W. Bush has lent his support of women's small business ownership as well. On March 10, 2004, the "Women's Entrepreneurship in the 21st Century" held it fifth meeting in Cleveland Ohio. The gathered " to hear from leading women business owners and government officials on how to make a small business succeed and to learn how women truly are helping grow the American workforce." (http://www.women-21.gov/cleveland.asp) Support from the United States government has encouraged women's small business to continue impacting our country. "The President's presence demonstrated to all how important women small business owners are to the economy and the Administration."

Women-owned businesses have made an impact in the 21st century economically by operating as consumers of goods and services. The Center for Women's Business research reports, "Estimated annual spending in just four areas—information technology; telecommunications; human resource services; and shipping—accounts for over $100 billion annually."

Annual Expenditures by Women-Owned Businesses on Selected Products and Services, 2002/3 Estimates	
Information Technology	$38 Billion
Telecommunications	$25 Billion
Human Resource Services	$23 Billion
Shipping/Mailing	$17 Billion
TOTAL, SELECTED PRODUCTS AND SERVICES	**$103 Billion**

© Center for Women's Business Research, 2004 Source: Women-Owned Businesses in 2004: Trends in the U.S. and 50 States

Women-owned businesses have not only impacted this century by providing economic growth from sales of products and services, but they also help provide jobs with salaries and benefits. Because of the job opportunities women are providing, billions of dollars, as seen in the chart below, are being paid which initiates spending throughout the economy.

Salary and Benefit Expenditures by Women-Owned Businesses, 2004 Estimates	
Salaries	$492 Billion
Benefits:	
Health Insurance	$38 Billion
Retirement/Savings Plans	$14 Billion
Life Insurance	$ 1 Billion
Disability Insurance	$ 1 Billion
Total Benefits	$54 Billion
TOTAL, SALARY PLUS BENEFITS	**$546 Billion**

© Center for Women's Business Research, 2004 Source: Women-Owned Businesses in 2004: Trends in the U.S. and 50 States

Please see Appendix A for further current statistics.

Overcoming Obstacles in the 21st Century

Small businesses have already experienced great economic obstacles in the 21st century. One such obstacle was the turn of the economy after the terrorist attacks of September 11, 2001. The Central Intelligence Agency credits the resiliency of our economy to its market-orientation that is comprised mainly of "private individuals and business firms." Although the economy experienced some declining immediate effects, recovery took place in 2002 with the GDP growth rate rising to 2.45%. Currently the per capita GDP is a healthy $37,600. Because of its ability to withstand economical pressures, the CIA titles the Unites States "the largest and most technologically powerful economy in the world." Other obstacles include a sharp decline in the stock market in 2002 due in part to the exposure of illegal accounting practices in a few major corporations and the war that has blanketed most of the 21st century (The World Factbook 2003).

High taxes have also been an obstacle for small business owners. Our President recognizes the importance of small business to our country and plans to implement procedures that will cut out some of the obstacles; thus, allowing small business to continue to make an impact on the 21st century. Part of his plan involves tax cuts. By cutting taxes, Bush hopes to quicken the pace of job creation. Less taxes that have to be paid will free cash that will create incentives for small business owners to "invest in technology, machinery, and other equipment to help them expand and create jobs" (http://www.women-21.gov/cleveland.asp).

Conclusion

The future profitability outlook for small business looks favorable. Even in times of recession, small businesses have been consistent in turning profits and meeting needs. As more needs in our country are exposed throughout the 21st century, small business owners will have an incredible opportunity to meet needs in ways that larger businesses cannot. The small business realm will be faced with many obstacles: economic, political, personal. Perseverance and a dedication to success will continue to drive the small business realm forward.

It will be crucial for small businesses to change with the times. As technological improvements are made, it will be incredibly important for small business owners to invest in new technology. The 21st century, as said before, is an intelligence age. Technology continues to allow our intelligence to expand and even the equipment itself is getting smarter and more user friendly. For small businesses to continue to make an impact, it will be important for them to maintain swift avenues of communication so that business transactions can continue to take place rapidly.

Women will continue to prosper in small business as the century unfolds. Women have already made such a critical contribution and impact in this century. As more and more women pursue vocations that provide flexibility and as many more of them desire to be their own boss, new businesses will be created; successful small businesses.

Small business is a wonderful thing. The President recognizes the importance of. Women recognize the importance of it. As many larger companies outsource their labor and production to foreign countries, small businesses here in the United States will continue to make an impact. They will continue to offer hope towards the American dream.

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Appendix A

Statistics are from The Center for Women's Business Research
http://www.womensbusinessresearch.org/key.html

Top Facts About Women-Owned Businesses

Center for Women's Business Research is the source for all of the facts below.

- **10.6 million** firms are at least 50% owned by a woman or women
- Forty-eight percent (**48%**), nearly **half**, of all privately-held firms are at least 50% owned by a woman or women.
- Between 1997 and 2004, the estimated growth rate in the number of women-owned firms was nearly **twice** that of all firms (**17%** vs. **9%**), employment expanded at twice the rate of all firms (**24%** vs. **12%**), and estimated revenues kept pace with all firms (**39%** vs. **34%**).
- Women-owned businesses will spend an estimated **$546 billion** annually on salaries and benefits (**$492 billion** on salaries and **$54 billion** for employee benefits – heath, retirement, and insurance). Health benefits comprise the largest share of benefit expenditures, with 2004 spending estimated at **$38 billion**.
- Women-owned firms employ **19.1 million** people and generate **$2.5 trillion** in sales.
- Privately-held 50% or more women-owned firms are **just as likely** as all privately-held firms to have employees (**23%** of women-owned firms compared to **25%** of all firms).
- Annual expenditures by women-owned enterprises for just **four** areas – information technology (**$38 billion**), telecommunications (**$25 billion**), human resources services (**$23 billion**), and shipping (**$17 billion**) – are estimated to be **$103 billion**.
- Between 1997 and 2004, privately-held 50% or more women-owned firms **diversified** into all industries with the fastest growth in construction (30% growth), transportation, communications and public utilities (**28%** growth), and agricultural serves (**24%** growth).
- The number of women-owned firms with employees has expanded by an estimated **28%** between 1997 and 2004, three times the growth rate of all firms with employees.
- As of 2004, almost **two-thirds** (**63%**) of all women-owned businesses are privately-held majority (51%) or more women-owned for a total of **6.7 million** firms, employing **9.8 million** people and generating **$1.2 trillion** in sales.
- The top three **fastest growing states**, based on an average rank of 1997 to 2004 growth rates, in the number of privately-held, 50% or more women-owned firms, employment and sales are: 1) Utah; 2) Arizona; and 3) Nevada.

Data Mining

by

Rebecca Fay
Stafford Gill
Gabriela Guzman
Daniel Harvey
James Headrick

Abstract

Data mining is the practice of automatically searching large stores of data for patterns. Techniques for pattern recognition generally fall into one of two categories: classical techniques and next generation techniques. The purposes of this article are to: (1) describes several scenarios in which both techniques may be applied in contemporary organizations; (2) discuss the benefits of using data mining; and (3) consider legal and privacy issues germane to data mining.

Definition of Data Mining

We will begin by defining data mining. What is data mining? According to Asinah.NET Encyclopedia Website, data mining is "the practice of automatically searching large stores of data for patterns." Kurt Thearling, Director of Advanced Data Mining at Capital One defines data mining as "the automated extraction of hidden predictive information from databases…. [It] allows users to analyze large databases to solve business decision problems" (Thearling, Thearling.com).

Data mining derives its name from the similarities between searching for valuable business information in a large database — for example, finding linked products in gigabytes of store scanner data — and mining a mountain for a vein of valuable ore. Both processes require either sifting through an immense amount of material, or intelligently probing it to find exactly where the value resides. (Thearling, "Introduction")

According to the ISoft website; in an article titled "Technical presentation: Data Mining," data mining software was developed because business users wanted to:

> reappropriate their data, to easily test their models, and to build out new ones, guided by their strong knowledge of the business. One major improvement of data mining over classical navigation tools is that, further than just testing an already supposed trend, it can discover completely new patterns, and fully validate a model, with the business knowledge of the user. The model can be automatically built, but each step of its construction can be controlled by the business user. This model then enables him to predict the behavior of other pieces of data, and to evaluate their chances to behave as predicted.

Sarabjot S. Anand and John G. Hughes, in an article titled "Data mining: Looking Beyond the Tip of the Iceberg," differentiate between database management systems and data mining. Database management allows members to access information explicitly present in the

data, such as a customer's name or date of birth. Data mining goes beyond database management by allowing users to access additional information implicitly contained within the data. It identifies relationships between elements of data as well as historical trends and patterns.

Data mining uses computational techniques from statistics, pattern recognition, and other fields of study to identify the patterns and predictive information hidden within data. Data mining uses several classical techniques to analyze data—statistics, neighborhoods and clustering. Data mining also uses techniques developed in the last twenty-five years, known as Next Generation techniques, such as trees, networks and rules. The six data mining techniques we will discuss (three classical, and three Next Generation) "are the ones that are used 99.9% of the time on existing business problems" (Berson, Smith, and Thearling, "Overview").

Classical Data Mining Techniques

Let us begin by looking at the classical techniques. Statistics provide a way to obtain a high-level overview of large amounts of data by identifying important summary values such as the maximum, minimum, mean, median, mode, and variance. This technique is also used by businesses to predict values using the mathematical concept of regression.

Clustering, the second classical technique, is used to group similar records together. A simple example of clustering can be seen when we sort our laundry. We sort air permanent press, dry cleaning, whites, and brightly colored clothes. (Berson, Smith, and Thearling, "Overview") One common use of clustering is identifying the unusual records, known as outliers, that do not fit into a cluster.

Neighborhoods, the final classical technique, is similar to clustering. In order to make a prediction about a certain record using this method, one looks for records with "similar predictor values in the historical database and uses the prediction value from the record that is 'nearest' to the unclassified record" (Berson, Smith, and Thearling, "Overview"). To provide an example, Alex Berson, Stephen Smith, and Kurt Thearling suggest you look at people in your neighborhood. "You may notice that, in general, you all have somewhat similar incomes. Thus if your neighbor has an income greater than $100,000 chances are good that you too have a high income" ("Overview"). One common use of neighborhoods is text retrieval by an Internet search engine. When users find the type of document they are looking for, they can tell the search engine to "Find more documents like this one" which means to find other documents in the same neighborhood.

Next Generation Data Mining Techniques

The techniques developed in the last twenty-five years are referred to as Next Generation techniques. Artificial neural networks, perhaps the most prominent Next Generation technique, are "computer programs implementing sophisticated pattern detection and machine learning algorithms on a computer to build predictive models from large historical databases" (Berson, Smith, and Thearling, "Overview"). This data mining technique was a product of the Artificial Intelligence movement in computer science that attempted to create computers capable of "thinking" by building them with a structure that copied the true neural networks of the human brain. Neural networks are a popular technique in data mining due to their "highly accurate predictive models that can be applied across a large number of different types of problems" (Berson, Smith, and Thearling, "Overview"). They are not without disadvantages,

however; the complex nature of neural networks can make them difficult to develop and use effectively.

The second Next Generation technique we will discuss is called a decision tree because it is a predictive model that can be visually represented as a tree. Anand and Hughes state:

> The leaf nodes represent the class labels while other nodes represent the attributes associated with the objects being classified. The branches of the tree represent each possible value of the attribute node from which they originate…. Once the decision tree has been built, start at the root node of the tree and follow the branches associated with that attribute value until we reach a leaf node representing the class of the object.

"From a business perspective decision trees can be viewed as creating a segmentation of the original dataset (each segment would be one of the leaves of the tree)" (Berson, Smith, and Thearling, "Overview"). Companies can segment sales based on customer type, product type and geographic regions. Because of the ability to "easily generate rules, decision trees are the favored technique for building understandable models. Because of this clarity they also allow for more complex profit and R[eturn] O[n] I[nvestment] models to be added easily in on top of the predictive model" (Berson, Smith, and Thearling, "Overview").

The final Next Generation technique, rule induction, is perhaps "the form of data mining that most closely resembles…'mining' for gold through a vast database…. Rule induction on a data base can be a massive undertaking where all possible patterns are systematically pulled out of the data and then an accuracy and significance are added to them that tells the user how strong the pattern is and how likely it is to occur again" (Berson, Smith, and Thearling, "Overview"). The benefits of the rule induction technique are that the process is highly automated and deals with data at a detail level. "The bane of rule induction systems is also its strength—that it retrieves all interesting patterns in the database" (Berson, Smith, and Thearling, "Overview"). The strength is founded on the thoroughness of the analysis, while the bane lies in the fact that the system can easily induce more rules than a user can evaluate.

Each of the six techniques we have presented has been used effectively in data mining applications. How should a manager decide which technique to implement? Thearling believes that question is a difficult one to answer:

> There are definite differences in the types of problems that are most conducive to each technique but the reality of real world data and the dynamic way in which markets, customers and hence the data that represents them is formed means that the data is constantly changing. These dynamics mean that it no longer makes sense to build the 'perfect' model on the historical data since whatever was known in the past cannot adequately predict the future because the future is so unlike what has gone before. (Berson, Smith, and Thearling, "Overview")

Examples of Data Mining Uses

Now that we have reviewed the basic techniques of data mining, let us look at a couple practical examples from "Mining Data", written by Miriam Wasserman and published in the Federal Reserve Bank of Boston Regional Review:

> **SCENE 1:** It's late November 1999. The Celtics are struggling with their second lineup. In a typical game, the team can be up by 14 points; and when the second

> unit comes in, the lead is lost. It is time for Frank Vogel to come into play. Vogel, the Celtics' video coordinator, is in charge of running the game statistics through Advanced Scout, a data analysis package developed by IBM. Vogel's research confirms the coaches' observations: The second unit's defense is holding up, but the offense is failing. More important, the statistics tell him that in situations where one of the star players, Paul Pierce or Antoine Walker, is moved to the second unit, there is no drop-off in the performance of the first unit, and the production of the second unit increases. His recommendations help the coaches formulate their new strategy.
>
> **SCENE 2:** A patient has been having ulcer problems. He goes to the doctor and then buys the prescription she recommends at the local pharmacy. End of story? No. The record of the transaction—the drug bought, the location of the purchase, the value paid, and the name of the prescriber (none of which includes any of the patient's identifying information)—goes to IMS America, one of the largest pharmaceutical market research companies in the world. The transaction is added to a database of over 1.5 billion prescriptions generated that year from over 33,000 retail pharmacies (and medical mail order) which matches the prescriptions to over 600,000 physicians. With these data, the company can track which physicians have changed their prescribing behavior, and pharmaceutical companies can fine-tune their ulcer-drug marketing campaign: which physicians should be visited by medical reps and which should just receive an informational package.

These two scenes are quite different from each other, but they have at least one thing in common. In both examples, data mining was used to identify patterns in data that could be "harnessed and used for more effective business making decisions" (Anand and Hughes). In the first scene, data mining software analyzed the prescribing habits of doctors to identify physicians most likely to switch brands. This information could be harnessed to tailor a marketing campaign to the most receptive physicians. In the second scene, the data mining analysis was used to determine the most effective starting lineup for the Celtics. Wasserman notes:

> Although data mining by itself is not going to get the Celtics to the playoffs, Vogel can, for instance, run queries to find whether Antoine Walker is more effective with Dana Barros or with Kenny Anderson, by matching all of Walker's game minutes with each of the point guards…. "It definitely has found some trends we hadn't recognized," says Jay Wessel, director of technology for the Celtics.

In these two examples, data mining techniques were used to analyze the practices of doctors and the performance of NBA players, but data mining analysis is increasingly being applied to the daily activity of housewives and blue-collar workers. As we go about our modern lives, we leave a trail of data behind. According to Quentin Hardy, in the article "Data of Reckoning," from the 10 May 2004 edition of Forbes.com, it is estimated that, during 2002, the world produced 5 exabytes of information. (An exabyte is 1,000 trillion bytes of data, or roughly a trillion novels.) This information was created through supermarket purchases, bank transactions, credit card purchases, phone calls, and retail catalog orders. Each click of the mouse and swipe of the credit card can be recorded, stored, and analyzed. "These data reveal information about who we are: our habits, our preferences, and what we are interested in. And, this information means money. That is, if companies can figure out what to do with it" (Wasserman).

Applications of Data Mining

Now that we have introduced the concept of data mining and looked at some basic examples, we will address specific applications in the business world. While companies are exploring numerous ways to utilize data mining, we will focus on two applications prominently covered by the current literature—increasing profits and detecting fraud.

Increasing Profits

With the quantity of data being produced, it is only logical to believe that there are hidden trends to be found in the patterns of data creation which can provide great benefits to businesses. In addition, the realities of the current business environment indicate that, through business diversification, our markets are shrinking. When these shreds of logic are coupled, it can be seen that, in order for companies to generate ever-increasing profits, they must cater to the ever-changing needs and desires of their customers. Data mining affords companies the ability to gather data regarding trends of sales of their products, as well as consumer needs and desires. Bloor Interactive, in a November. 1999 article titled "Business Intelligence through Data Mining,",reports that "according to independent research, data mining returns on investment are typically in the seven to tenfold range." It continues by saying "a report in Byte Magazine claimed that some companies have reaped returns on their investment of as much as 1000 times their initial outlay on data mining projects, though these will be the exception rather than the rule" (3).

Data mining cuts directly to the heart of customer retention. This is described in an article co-written by Thearling, previously identified as the Director of Advanced Data Mining at Capital One:

> A customer's continuing business is no longer guaranteed. As a result, companies have found that they need to understand their customers better, and to quickly respond to their wants and needs. In addition, the time frame in which these responses need to be made has been shrinking. It is no longer possible to wait until the signs of customer dissatisfaction are obvious before action can be taken. (Berson, Smith, and Thearling, "Customer Relationships")

For this reason, data mining has become an essential tool for companies in their attempts to gain and retain customers in the larger drive for increased profits. However, the mining of data is only the first of two steps, which are integral to the increase of profits. The second step requires that companies decide how they will use the data to reach the target audience—the customer.

Berson, Smith, and Thearling define customer relationship management (CRM) as "a process that manages the interactions between a company and its customers" ("Customer relationships"). As eluded to above, CRM goes beyond the simple mining of data, and it must determine how to use that data to reach a target audience. The process of reaching out to the audience is called a campaign, and campaign management software is utilized to organize and target that campaign. Typically, these campaigns are designed to help companies develop and execute long-term change. However, as McKinsey Marketing Solutions authors Margo Georgiadis, et al. state, through CRM:

> more and more companies are discovering that focused use of customer and process insights—and tighter tracking processes—enables them to: 1) quickly

> field more cost-effective customer acquisition programs, 2) better target those customers who yield maximum spend/wallet share, 3) more precisely manage customer attrition or decreasing customer activity, 4) effectively channel sales force energies, and 5) allocate service budgets with greater efficiency. (1)

Suppose that a local grocery chain had the ability, through the use of data mining, to determine that, throughout the summer months, when men bought brats and hot dogs, they typically bought charcoal as well. The store has now made an important interpretation of data received via mining. Now suppose that the grocery store determined that this scenario is most prevalent on Thursdays and Fridays. The inference can be made that men are making these purchases in order to grill brats and hot dogs over the upcoming weekend. The store can now take action to ensure that these products are in close proximity on the days leading up to the weekend.

Suppose that a bank had the ability, through the use of data mining, to determine that there was a direct, positive correlation between a customer's checking account balance and the amount of securities investments made by that customer through the bank. The bank now has actionable data with which it can target specific customers who may be willing to invest in programs offered by the bank. In the 15 May 1998 issue of CIO.com, author Peter Fabris says "Many financial institutions use data mining to study the needs and habits of customer groups in the interest of [CRM]." He continues by saying that "The objective is to increase the amount of business with each customer. Banks regularly take aim at that goal with targeted promotional mailings and in the normal course of customer interactions; however, data mining helps them market more precisely, saving money on mailings and increasing the effectiveness of cross-selling efforts." (3-4)

Finally, suppose that insurance companies had the ability, through the use of data mining, to determine characteristics that are common to various accidents. This knowledge would allow the companies to better target activities that tend to erode profits through the claims process. In an article titled "Data Mining in the Insurance Industry: Solving Business Problems using SAS 'Enterprise Miner' Software," the SAS e-Intelligence company says:

> data mining can help insurance firms in business practices such as: establishing rates, acquiring new customers, retaining customers, developing new product lines, creating geographic exposure reports, detecting fraudulent claims, performing sophisticated campaign management, estimating outstanding claim provisions, assisting regulators understand the firm's rates and models, and coordinating actuarial and marketing departments. (3)

As is evident by the information provided above, data mining has a direct correlation to company profits. Through the use of data mining, companies have the opportunity to learn more about their customers, as well as about their own product. This knowledge, when applied appropriately allows companies to manage their relationships with customers, for the purpose of maximizing profit and customer satisfaction. While maximizing profits may be on the forefront of many managers' minds, businesses have also found considerable applications for data mining in the area of fraud detection.

Fraud Detection

In the previous section, SAS e-Intelligence cited the use of data mining in the insurance industry to detect fraudulent claims. Many companies today, in a variety of industries, are using

data mining to detect and fight fraud. Some of the most noted industries pioneering and utilizing this technology include financial services and telecommunications, as well as the government sector.

Prior to the implementation of data mining, manual monitoring was the process in which fraud was detected, often requiring the help of a whistle blower. Not only was this a slow process, but it was also very costly and ineffective. Now, with highly specialized data mining tools, many companies are able to detect fraudulent activity. Data mining applications help identify suspicious patterns and trends over some period of time. By focusing on these patterns, experts are able to identify fraud-indicative trends as they emerge.

Lisa Sokol, Technical Director at Veridian Information Solutions, explains that much work goes into the data mining process before the information is fed into the system. Some of these undertakings may include "customer discussions, data extraction and cleaning, transformation of the database, and auditing (basic statistics and visualization of the information) of the data" (1). In a report by the Health Care Financing Administration, experts contend that these methods make it much easier to identify and quantify the number of fraudulent schemes. Through traditional statistical models, a set of suspicious activities stands out.

Although data mining identifies potential "misinformation," it is not always accurate. In fact, in an article titled "High-Tech Software Sleuthing," Mark Taylor mentions that such data mining analysis and results must be investigated. Technology alone cannot detect fraud, just as manpower alone cannot contest all the scams that occur. A lawyer commented that such analysis cannot be presented as evidence that fraudulent activity has occurred. He contended that the suspicious activity identified by data mining must be supported by witnesses and by other evidence of fact. In some instances, there have been valid explanations presented for unusual patterns that were deemed "suspicious" when data mining methodology was used. However, despite the faults of the system, many private companies and government agencies agree that they would never have been able to decipher such a massive amount of data without the technology involved.

To make this possible, many public and private companies specialize in building application tools and models that use data mining to detect particular patterns indicative of fraud. One such data-mining tool is Darwin. This application, in conjunction with others, develops criteria for grouping certain activities together. This consequently leads the data into trends and patterns. Together with SSA software, another fraud-combating application, this helps to maximize the quality of the research and can be "routinely updated as further analyses identify new trends and groups" (Williams). With SSA's capabilities, data mining tools instruct intelligent systems how to perform fraud investigation by accurately searching for and screening customer information. Unlike other methods, SSA founders claim that this version "does not require the data to be cleaned or formatted, and supports virtually all countries and character sets" (SSA).

Though many would agree that fraud is not as common as most of us might believe, it definitely is very costly. The Medicare system has been defrauded out of millions of taxpayer dollars because of fraudulent billing. And in recent efforts, the Department of Education is purportedly trying to detect fraud, waste, and abuse using data mining techniques. NASA's interest in analyzing research information through this method has raised some eyebrows. More and more government agencies today are using data mining methods to deter fraud. In a USA Today report, Eric J. Sinrod states "the GAO reports that the federal government is using data mining for improving service, detecting fraud, analyzing scientific information, managing

human resources, and detecting criminal and terrorist activities…" The system, while not perfect, has saved the government and private corporations worldwide plenty of time and money. While upfront costs and investments are required, many agree that this pays off if you utilize your resources effectively. Yet many have denounced these measures as being unconstitutional because they invade one's privacy. And if this is true, then how can companies protect themselves from suspicious activity if not through data mining?

Legal and privacy issues

After reviewing the current applications of data mining, it is easy to understand why many businesses and government agencies are interested in the technology. In this section we'll take a close look at some of the legal and privacy implications of data mining. What happens with all of that data and how does it affect an individual's privacy? Do individuals' give consent for their personal browsing habits to be collected? Are they notified when the information has been used or sold? Has an individual's privacy been invaded when his or her data is collected and, if so, are there legal ramifications? These are some of the controversial questions we will address in this section.

Webster's New World Dictionary defines "privacy" as, "not open to or controlled by the public" (475). Data mining technology is sometimes utilized to collect personal information and habits with the specific intent of providing that information to private enterprises and other third parties. Where does the individual right to privacy come into play? The Legal Information Institute explains:

> The right of privacy has evolved to protect the ability of individuals to determine what sort of information about themselves is collected, and how that information is used. Most commercial websites utilize "cookies," as well as forms, to collect information from visitors such as name, address, email, demographic info, social security number, IP address, and financial information. In many cases, this information is then provided to third parties for marketing purposes. Other entities, such as the federal government and financial institutions, also collect personal information. The threats of fraud and identity theft created by this flow of personal information have been an impetus for right of privacy legislation requiring disclosure of information collection practices, opt-out opportunities, as well as internal protections of collected information. However, such requirements have yet to reach all segments of the marketplace.

The Technology Studies in Education website states that:

> Although our US Constitution does not outline a specific right to privacy, some privacy rights have been defined via Court decisions. No one could disagree that the protection of our privacy is an important issue. US Lawmakers are frantically trying to propose legislation to deal with the new privacy issues that technological innovations have created. It takes time to pass such proposals. These laws must be carefully crafted to insure that our privacy is truly guarded. If not appropriately worded, and deeply and thoughtfully considered, the laws themselves could end up encroaching on privacy rights!"

Is there, or should there be, a clear privacy line drawn in the sand? Personal information and browsing habits are already being collected and distributed to third parties. Some organizations use this information to increase sales, target their market audience, and appeal to

the individual desires of each consumer. "One of the key issues raised by data-mining technology is not a business or technological one, but a social one. It is the issue of individual privacy. Data mining makes it possible to analyze routine business transactions and glean a significant amount of information about an individual's buying habits and preferences" (Brewer). Other organizations use individuals' personal data as a means for profit and actually sell that personal information. Many of the free "gimmicks" found in the marketplace are not free at all, but a means used to sell personal information.

For an article published in Realtor Association Executive, Michael Thiel wrote:

> Association executives come face-to-face with this issue every time they need to find out more about what members are thinking, what they need, and what they're doing with association products and services. On one hand, association executives need to know everything they can about their members to better market the association to those members and possibly others. On the other hand, members, who are the association's principal customers, may want control over the use of that very same information.
>
> In the law, this issue is referred to simply as privacy. In litigation that reached the U.S. Supreme Court just a few months ago (*Reno v. Condon*), the Court held that the federal government could restrict the right of states to sell to marketing firms personal information provided by citizens. In that case, a state was selling to marketers information gathered from people applying for driver's licenses.

Vladimir Estivill-Castro, Ljilana Brankovic and David Dowe recount one case where a state chose to sell information about its citizens. "In 1989, the Californian Department of Motor Vehicles earned over $16 million USD by selling the driver-license data of 19.5 million Californian residents. A certain Mr. Brado used this facility to obtain the home address of actress Rebecca Schaeffer, and killed her in her apartment. The sale of driver-license data ended after this tragedy." In this case the Department of Motor Vehicles (DMV) was taking personal information from the applicants and selling it to interested parties. The applicants had no idea that their information had been sold. The personal information of one individual was actually used to take her life. This raises several issues. First, what gives the DMV the right to sell a citizen's personal information to anyone? Second, should an individual be entitled to a percentage, if not most, of the profits generated by the sale of his or her personal information? Recording artists get a cut of any monies collected in association with their names. Why should the general public be any different?

To what extent is the sale of personal information occurring? According to Estivill-Castro, Brankovic and Dowe:

> At least 400 million credit records, 700 million annual drug records, 100 million medical records and 600 million personal records are sold yearly in the US by 200 superbureaux. Among the records sold are bank balances, rental histories, retail purchases, criminal records, unlisted phone numbers and recent phone calls. When combined, this information provides data images of individuals that are sold to direct marketers, private individuals, investigators, and government agencies.

What of the general public? What is being done to protect their information?

In response to consumer demand, the federal government is flirting with the idea of regulating companies that use the Internet to collect consumer data for the purpose of building

profiles for advertising and marketing. But to deter federal intervention in Internet data mining, those companies invested in the practice are advocating self-regulation. Marketers are realizing the need for an acceptable industry-wide policy that lets computer users know what information is being collected about them and for what purposes it will be used... In one recent case, a large online advertising agency was accused of using cookies—electronic files automatically attached to site visitors' hard drives to identify them on subsequent visits. The agency used cookies to find out which banner ads at various sites were selected by consumers. Depending on the settings of the consumers' browsers, the consumers may not even know the cookie has been added to their hard drive. The advertising agency planned to integrate the new consumer data with a marketing database and make it available to advertisers so that they could better target their advertising to consumers on the Internet. But a California woman filed a lawsuit (*Judnick v. DoubleClick*) alleging that the cross-referencing of the data, collected by the cookies, with the marketing database was being done without the consent of the consumers involved. And in early February, a complaint against the ad agency's practice was filed with the Federal Trade Commission. Although the act empowering the FTC to regulate trade doesn't mention privacy, it does address deceptive trade practices. The FTC has relied on this act's general language to bring actions against Internet companies whose marketing practices have been deemed deceptive. Other cases based on the deception provision in the FTC act include one against the Geocities site, which involved alleged deceptive use of information that was collected as part of the registration process for the site. Another case involved the ReverseAuction site and claims that it used the personal information of registrants at the eBay site to send spam (unsolicited e-mail) to those individuals, in violation of the eBay user agreement. The common thread running through these cases is that personal information was being collected and used without the consumers' knowledge or consent. The FTC is increasingly being called on to cite businesses that misuse consumers' personal information. (Thiel)

In his article "In this data-mining society, privacy advocates suffer […]," Brian Bergstein writes:

> At the very least, the Internet has made it far easier for anyone to obtain not only someone else's birthdates and Social Security numbers but also liens, lawsuits, divorces and other personal and potentially embarrassing—but technically public—information. "I consider the issue of public records on the Internet to be one of the most challenging public policy issues of our time," said Beth Givens, director of the Privacy Rights Clearinghouse. Activists have been sounding alarms for years about the decline of privacy in the digital age, with the public sometimes responding. Witness attempts by lawmakers in 2003 to stomp out telemarketing and spam, albeit with limited success. Or how spooked citizens recently recirculated e-mails warning that Google can within seconds deliver the names and addresses that coincide with listed phone numbers. Privacy advocates say far more worrisome intrusions are due as improving technology gives government, advertisers and insurance companies new ways to harvest precise information. "We are really on the cusp of creating a surveillance society where every action, every utterance—some might say every thought—can be traced," said Barry Steinhardt, director of the American Civil Liberties Union's technology and liberty program. The next year will bring more debate over radio-frequency identification, or RFID, which lets stores and suppliers track inventory. Critics fear that it could secretly monitor consumers' behavior or whereabouts; retailers say those worries are overblown partly because RFID tags will be disabled at checkout counters.

This brings up some interesting information. Not only is personal information being exploited, but also personal computers are being invaded by cookies. One computer user wondered why he frequently received strange e-mails and banners when he got on the Internet. That is, until a coworker informed him about certain "spy-ware" and data mining techniques. Now he uses free software that searches his computer hard-drive and deletes those cookies and data mining programs. It is effective at removing them, but should he have to do that? What will tomorrow bring?

There must be some good from data mining—other than the potential to increase corporate profits. How can the technology benefit society as a whole without destroying privacy?

> Personal data is placed on large on-line networked databases, such as the Physician Computer Network in the US, with the intention to build and expand knowledge. Data is necessary for informed decision-making in the public and private sector. How could planning decisions be taken, if census data was not collected? How could epidemics be understood if medical records were not analysed? Individuals benefit from data collection efforts via the process of building knowledge that guides society. The protection of privacy cannot be achieved simply by restricting data collection or restricting the use of computer and networking technology. (Estivill-Castro, Brankovic and Dowe)

Data mining can be a beneficial source of information to better society. How do we reap the benefits of data mining while also maintaining individual privacy? The legislature must take action that protects both data mining and privacy. There needs to be a partnership between data miners and individuals. Individuals should be told when their personal information is being collected, for what purposes it is being collected, and to whom it will be distributed. In certain cases, the data miner should be required to get the consent of the individual before the personal information is collected. Computers are private physical property. When individuals sign into agreements with Internet Service Providers in order to access the Worldwide Web, those agreements should protect them from unsolicited, and unauthorized access to their personal property with the intent to download unauthorized software or programs. Society and its leaders must work to amplify the benefits, and reduce the vulnerabilities, of data mining. The legislature needs to solidify the meaning and right to privacy by establishing strong laws that protect both the data miner and the individual.

Conclusion

With a typical return on investment of seven to tenfold, and a potential return of 1000 times the original capital outlay, it is easy to understand why so many companies and governmental agencies are interested in investing in data mining software. Yet the concept of data mining is still highly controversial, as discussed in the final section of our paper. We concluded that the legislature needs to define the concept of privacy as it relates to electronic data and electronic access of personal property; but until clear law is established, what is a manager to do?

As is the case with many challenging situations, the fact that a practice is legal does not mean it is ethical. The question of whether or not to use data mining is not a simple black and white issue, but one with shades of gray. Most of us probably agree that a company should have the ability to analyze data it has received directly from the customer. So perhaps that application of data mining falls within the white side of the spectrum. On the other hand, many people are disturbed by the fact that cookies can pull private information from our personal computers without our knowledge. We might classify that in the black end of the spectrum. What of all the nuances and shades of gray in between? That is a decision that each manager will need to make based on assessment of which applications of data mining are applicable, appropriate, and ethical for his/her specific situation.

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Is Six Sigma Still the Best Approach to Total Quality Management?

by

Raymond Bell
Monty A. Carpenter
Jason Carter
Deborah Dyer

Abstract

The term Six Sigma is merely a description of various levels of success in driving non-conformances out of a process. Six Sigma measures a product realization process from design to transaction to achieve nearly 100 percent conformance to the envisioned goal. Six Sigma has a long history of being the key to quality in many large organizations, but requires commitment from top management and a culture change throughout the organization in order to be successful. This paper compares and contrasts opposing perspectives concerning the position that Six Sigma is still the best approach to Total Quality Management.

With Six Sigma dominating the total quality management ("TQM") arena for many years, it is time to consider that it may no longer be the best tool for the job. Six Sigma as a business initiative has been defined in several ways. Its proponents describe it as much more than simply a quality improvement plan, but a way of doing business. Its critics define it as simply a catch phrase that offers little insight that other TQM programs of the past haven't already revealed. Either way, Six Sigma is a measurement standard in business that has garnered tremendous attention in the last 20 years due to its successes and failures and its implementation in many high profile corporations throughout the United States. It is the purpose of this paper to provide an overview of the subject of Six Sigma, and to explore the question of whether Six Sigma is still the best approach to TQM.

The term Six Sigma is merely a description of various levels of success in driving non-conformances out of a process. Six Sigma measures a product realization process from design to transaction to achieve nearly 100% conformance to the envisioned goal. Upon reaching the sixth sigma of conformance specification, a supplier is performing at or better than the goal of less than 3.4 errors per 1 million opportunities in the identified Six Sigma process. This is a very difficult standard to meet and the cost of reaching this standard of internal quality can be quite expensive. On the other hand, the benefits in reduced waste and internal scrap, and customer satisfaction can be exponential in value when put in perspective of continuous improvement and customer loyalty (Stamatis).

The roots of Six Sigma as a measurement standard can be found in the concept of the normal curve, introduced by Carl Frederick Gauss (1777 – 1855), a simple tool to categorize the distribution of item deviation (non-conformances) from the mean

(envisioned goal). A sigma is the term for a Greek symbol used to identify each level of deviation from the mean. During the 1920's, statistician Walter Shewhart identified that a three sigma deviation from the mean is the point at which a process needs to be corrected (iSixSigma).

In 1981, Motorola Corp. executives decided to vastly raise their company's level of quality commitment by launching an initiative that would improve quality levels 10 times over the following five years. In 1987, "Six Sigma Quality" was born and the goal of 3.4 PPM became company policy. Much of the credit for defining the Six Sigma methodology is given to a Motorola engineer named Bill Smith. Motorola found success with Six Sigma and in 1988 won a prestigious Malcolm Baldrige National Quality Award. In 1988, Motorola opened the Six Sigma Research Institute with the funding of many other Fortune 500 companies interested in raising the bar on quality. Since then, the list of companies who have subscribed to the Six Sigma model reads like a Who's Who of Wall Street. Numerous consulting firms and universities have jumped on the Six Sigma bandwagon, offering training services, tools and business software to incorporate Six Sigma into the grain of a company's operating plan. Motorola went so far as to copyright the term Six Sigma to forever benefit from its initial vision of high level quality production (iSixSigma).

Without question, quality management is the key, and possibly the most critical element to the growth of a company. Quality within an operation can be defined in many areas from production to finance, but in the manufacturing sector, where Six Sigma has largely found its niche, quality measuring systems are applied to ways to recognize and eliminate waste. Over the years several quality management and improvement initiatives have been brought forth to streamline production processes. Among these are Lean Manufacturing, Kaizen, ISO & QS – 9000, Process Mapping, Value Stream Mapping, Shannin, Taguchi, FMEA and Root Cause Analysis. Each of these tools are aimed at pinpointing an opportunity for improvement in a process by identifying the waste, how often it occurs and facilitating testing to improve upon or eliminate it all together. All of these processes of TQM, like Six Sigma, require some financial investment in training of people and application of capital resources once opportunities for improvement are identified. Additionally, and probably most critical for the success of Six Sigma, they require some level of management commitment within an organization to work. With many other TQM systems, the level of management investment can be as high as the level of the project requires. These TQM projects can be small and led by an individual, or a small group, to attack one area of concern within a very large picture. Six Sigma on the other hand is really a way of doing business that requires a commitment from top management down within a company. It requires a cultural change among its officers and employees to make it work. Once a company re-engineers its mindset for top performance it reaches greater quality in the long run (Bajaria).

As stated before, the tools for improving quality within an organization have been around for years, but the advantage that Six Sigma offers is a financial yardstick by which to measure the cost of poor quality. The effects of the costs of poor quality, as well as the rewards of quality improvement, can be compared over time with Six Sigma.

Once initiated, Six Sigma has provided a generic and easy to understand structure for a company to achieve and maintain levels of sigma.

As described above, Six Sigma has a long history of being the key to quality in many large organizations, but requires commitment from top management and a culture change throughout the organization in order to be successful. The next section of the paper summarizes several articles supporting the position that Six Sigma is still the best approach to TQM.

Review of Articles in Support of Six Sigma

In reviewing literature in support of Six Sigma, the passion and commitment of the authors for the Six Sigma process is obvious. Some articles focused on one or two specific aspects of the Six Sigma process to convince the reader of the author's position, while other articles focused on an overview of the culture of Six Sigma. The following paragraphs blend the articles researched in support of Six Sigma, and will illustrate the difference in approach by each author.

The Six Sigma strategy for Total Quality Management (TQM) will not cure all organizational deficiencies but the methodology of Six Sigma has proven to be effective by major corporations. Companies such as Motorola, AlliedSignal and General Electric (GE) have made Six Sigma the culture of the company. One example is GE's 1996 annual report estimated that of $300 million invested in Six Sigma between $400-$500 million was credited as savings due to the Six Sigma process (Erwin).

Six Sigma is viewed as a common sense approach to a problem. "Sigma," the eighteenth letter of the Greek alphabet is described as a statistical expression of variation in a product (Erwin). During the 1970's, international competition for quality was taken seriously, primarily by Japan, who caused many manufacturers to begin looking at the manufacturing process in order to achieve a better quality product.

In the 1980s, Motorola took on this challenge and is credited as the founder of the Six Sigma process (Pyzdek). The Motorola quality management model became known as Define-Measure-Analyze-Improve-Control ("DMAIC") (Pyzdek). When Motorola began defining strategic goals, the process hinged upon upper management commitment. The commitment must be a true desire to implement the process in order to achieve its goal. If upper management is not serious, more than likely employees view the new process as a paper tiger and regress to their previous ways of operating (Franco). Motorola in this case was and still is committed to this process. When Motorola received the 1988 Malcolm Baldrige National Quality Award, the public was then introduced to a new process and continues to be a major player in TQM. Once management has established its goals they then must be measured.

The measuring of reliable metrics includes data collection by surveys, reports, inspections, talking to employees, which again includes the cooperation of managers at

every level. Some managers and employees may feel threatened, because mistakes will not be tolerated and if doing so may jeopardize his or her job because of below quality standards (Erwin). Motorola understood this and introduced Six Sigma as a common language by providing all employees a clear understanding of why measuring product performance is essential to achieve the company goals. The short-term of 3-6 months per project in identifying defects for reduction is one of Six Sigma's strongest characteristics (Snee). This includes the quality of the product provided to the customer and identifying the type of error or defect as superficial or problematic such as total failure of the product. The more complicated process consequently has more potential for errors, repairs, rework, scrap cost and ultimately dissatisfied customer (Erwin).

Once the measurement data has been compiled, root causes are identified for future courses of action by management. The data analysis and identifying the root causes continues to be a primary source of Six Sigma success. The number of units per potential defect can than be benchmarked using the concept of defects per unit (DPU). The DPU equation is (DPU= # Of Defects Found / # Units Produced) (Brenkert and Miller). Six Sigma uses one million units as a sigma measurement. The defects per million opportunities (dpmo) is dpmo = (DPU x 1,000,000 / opportunities for error = x number of defects that would occur). A conversion table provided by Motorola indicates the six different levels of sigma and the defects per million.

- 6 sigma = 3.4 defects per million
- 5 sigma = 230 defects per million
- 4 sigma = 6,210 defects per million
- 3 sigma = 66,8000 defects per million
- 2 sigma = 308,000 defects per million
- 1 sigma = 690,000 defects per million

Total quality achievement may not be possible but a consistent approach of addressing and identifying errors and improving the process while keeping in mind customer satisfaction can claim Six Sigma is indeed the best approach to TQM. The founder of Six Sigma Motorola considers itself to be a "5.7-sigma company" (Erwin). Once management has analyzed the data a course of action can now be taken to improve the sigma level.

Controlling the course of action that will be used to improve the process can be achieved by restating standard operating procedures, policies, and training/retraining in order to initiate the new process. Controlling and tracking cost savings is critical in assessing the value of the improvement made to the process. The success of Six Sigma also lies in the requirement to build a recognition program. Management must recognize the efforts of the employees in moving to the next level of sigma, through incentives such as compensation and awards (Gupta).

What ultimately drives the Six Sigma process to success is the infrastructure and commitment by the employees themselves. The establishment of Green Belts as project leaders who can lead Six Sigma teams is provided through five days of orientation and

training in the Six Sigma process. The Black Belt is a position for those in the organization who play a role in changing and developing the organization. The Black Belt also receives 160 hours of training and also assists in Green Belt projects. The Master Black Belt is the highest level and requires knowledge of mathematical and statistical methods. The Master Black Belt must have the ability to provide technical leadership and teaching skills (Pyzdek).

The infrastructure of committed and trained personnel who have the ability to identify errors affecting customer satisfaction is another reason for Six Sigma success. With the commitment of upper management and a process that never stagnates many managers continue to hypothesize that a six-sigma level is unattainable. The probability of never achieving a Six Sigma level may indeed be true, but Six Sigma continues to be the best approach to TQM because of its structure and application to the entire organization's culture.

The review of the next set of authors in support of Six Sigma reveals that their conclusions are based primarily on Six Sigma's use of a structured process. This structure is tempered with certain choices in the process left to management.

The author Pande summarizes the definition of a Six Sigma organization as "An organization that is actively working to build the themes and practices of Six Sigma into its daily management activities, and is showing significant improvements in process performance and customer satisfaction." (Pande) This next article provides an in depth look at Motorola's quality management model which has become one of the driving forces for a Six Sigma success is the methodology of Define-Measure-Analyze-Improve-Control ("DMAIC") being used as the improvement model when applied to the combination of process improvement / process design/redesign. Process improvement seeks to fix a problem while leaving the basic structure of the work process intact. Process design/redesign objective is not to fix the process but to replace the process or a piece of the process with a new one. Process improvement and process design/redesign are complimentary strategies. These strategies are built around the improvement tools of Six Sigma and are used to constantly raise the company's levels of performance, competitiveness, and profitability (Eckes). How does the DMAIC model fit into this strategy? The advantages of using the DMAIC model is the emphasis it places on two critical components of Six Sigma. When the DMAIC model is applied to process improvement and process design/redesign, a Six Sigma improvement team has a legitimate choice whether to "fix" or "redesign" a trouble process. Each step in the cyclical process of the DMAIC model is required to ensure the best possible results. The use of the DMAIC model allows a company to concentrate on the variables of each process with a remedy to be successful (Pyzdek).

In reviewing the Pyzdek article written in December 2000, his explanation of the DMAIC process was comprehensible and seemed easy to understand. Also, the book by Pande, Neuman & Cavanaugh stated that the DMAIC process is a core component in implementing the Six Sigma methodology.

Comparison of Articles in Support of Six Sigma

The narrative above illustrates that there are common threads to the claimed success of the Six Sigma process. The authors Pyzdek and Snee both emphasize the benefits of the structure of the Six Sigma process, stressing that models such as Motorola's DMAIC are crucial to the success of a quality initiative. Erwin also stresses the importance of the process itself, stating that a "consistent approach" is the key to Six Sigma claiming to be the best approach to TQM.

Other authors seemed to focus more on the people element as the key to Six Sigma being the best approach to TQM. Gupta and Franco discussed the recognition of employee process through the sigma levels as a key to success, and agreed that the top-down management buy-in was necessary. While all authors included the human resource element as important, Gupta and Franco seemed to rely on this aspect more in their support of the Six Sigma process. While Pyzdek mentioned process, he also claimed that the Six Sigma difference could be summed up in the one word, "management" (Pyzdek). He stressed that proper management of the process was often more important than the process itself, as even the best systems had slow or no progress with personnel issues present.

The articles reviewed that advocate Six Sigma as a complete quality management tool do little to convince the reader that Six Sigma is nothing more than old methodologies made new again. Erwin and Snee both point out the importance of Six Sigma as a tool for identifying and quantifying a problem and its related supporting data.

As can be seen, the reasons for supporting Six Sigma are as varied as the authors, but a common thread of the people element does come through in the review of the literature selected. The next section will explore several articles supporting the case that Six Sigma is not the best method to achieve TQM.

Review of Articles Not Supporting Six Sigma

In reviewing literature not in support of Six Sigma, the reasons given were many, and any common threads will be discussed at the end of this section. It is interesting to note that some of the authors seemed to have almost a resentful tone towards Six Sigma. Let's explore and see what's behind the attitude. The following paragraphs blend the articles researched not in support of Six Sigma, and will illustrate the differences and similarities in approach by each author.

The articles and journals surveyed give us snapshots of who's using Six Sigma and focuses on the pitfalls or why some companies fail utilizing this methodology. The first article reviewed emphasizes that failure of a Six Sigma initiative is often due to the mind-set of management and lack of dedicated resources. There is the saying "to give it your all," just as we are to surrender all to our Savior. A company must dedicate resources for

infrastructure and change management at all levels to succeed at Six Sigma. Resources defined here are used in general terms but as I elaborate it will lead me into my second point as to why Six Sigma fails. The implementation and deployment of Six Sigma is costly and is generally achievable for those companies with over 500 employees or annual sales of over $50 to $100 million. Though Six Sigma is scaleable, adequate resources may not be available in smaller companies (Dusharme).

Regarding dedicated resources, the biggest mistake an organization could make is to send out a couple of people from the quality assurance department to an open-enrollment course, and then come back and try to convince upper-management why they should roll out this new initiative. Companies often overlook acquiring and maintaining top management support, which means Six Sigma is being led by middle management and below (Dusharme).

Other issues come into play such as management is not schooled properly in what constitutes a Six Sigma project or Six Sigma projects are not tied in with corporate goals. In summary, the executive team must be sold on the benefits, structures, processes, and overall goals, and deploy the necessary resources to implement Six Sigma successfully (Dusharme).

Based on the next set of articles and journals surveyed, two additional key components were identified that will result in failure utilizing "The Six Sigma Methodology." These two components are time and communication. These two factors are essential in the success of Six Sigma. Companies that adopt Six Sigma are unsuccessful when they fail to attain results quickly and the initiative is eliminated or put on the shelf. It should not be looked at it as a quick fix. Six Sigma brings about continued long-term change. Benefits may take three to five years depending on the effectiveness of the implementation (Hassan).

Deficiencies in Six Sigma visibility and the inability to share results companywide are another reason why Six Sigma will not succeed, according to Hassan. Expensive disasters are caused by disparate computer systems and databases, inadequate investments in the information technology infrastructure to manage the program and communicate to employees, or rudimentary tools to track Six Sigma projects which can result in ineffective reporting. Proper data collection and management tools provide corner stones of any Six Sigma program. Consequently, projects fail when soft skills such as analytical and problem-solving, ethics, communications, information-gathering and people skills are ignored (Ames). The goal is to incorporate those employees who have these abilities. Eventually all employees will need to be involved and participate in the program. They will need to support projects as team members. It will be difficult to gain support if the general employee population feels left out. In the evaluation of the articles, it is evident that management needs to carefully and properly plan what they want to accomplish if they want to implement this methodology.

In summary, Six Sigma is not a "get rich quick" methodology. It takes years of dedicated work to implement successfully (Waxer). It should be viewed as a retirement

savings plan. It is a slow methodology, but it will make you rich if you plan and execute consistently, allocating the needed time and human resources.

The following article review offers an opposing view of the perceived "revolutionary" status of Six Sigma as a TQM tool. The author points out that there are, and long have been, several very effective tools in manufacturing for defining and improving upon quality issues. The author Stamatis states that Six Sigma was developed years ago primarily to develop a control standard for weak quality efforts rampant throughout the manufacturing world. Over time, especially the past thirty years, many wonderful evaluative tools and methodologies have been developed to improve quality, however they are only effective when used consistently to take their lessons learned and improve planning for the next process. Manufacturing has proven to itself for decades that there is no quick fix for quality. There are new methods of accounting for the lack of quality improvement introduced from time to time and Six Sigma is just such a method. The author maintains that Six Sigma is quite simply a flashy rendition of the same old quality methods of the past that has been invented and hyped by "experts" as a method of continual quality accountability that will increase funds to a company's bottom line (Stamatis). Six Sigma also offers to take funds from a company's bottom line due to the extensive training of people required to take another approach to doing the things which they already know how to do. Also, Six Sigma threatens the bottom line by often demanding large amounts of capital to fix a problem now, rather than plan the problem out of the new product design of the future.

The automotive industry has for years been innovative in quality management devices to control what they like to refer to as "non-conformances". Six Sigma deals with identifying problems before they occur, problem solving for current issues and aiming for a goal of 3.4 defects per million opportunities. Failure mode and effect analysis ("FMEA") have been useful for years in identifying potential problems before a product is launched and applying the "lessons learned strategy" (Stamatis). It is a critical part of the automotive Advanced Product Quality Planning or APQP process. The APQP process is designed to allow suppliers to review a customer's product expectations in the design phase and examine the product in a trial phase to ensure that both customer and supplier agree upon acceptable quality standards for future production. The lessons learned and documented in the previous product line FMEA are vital in determining new product quality standards in APQP. Furthermore, the eight discipline ("8D") approach to problem solving has also been around the automotive industry for years and is part of the backbone of non-conformance control (Stamatis). The 8D process allows the supplier to determine, through root cause analysis, how non-conforming product deviation occurred, and define ways to offset future non-conformances of the same type. Lessons learned within the 8D process must be added to the product FMEA to maintain continuous quality improvement. Finally, the author has concluded, the goal of reaching the sixth sigma, or 3.4 defective parts per million defect, is simply a colorful statistical way of aiming for near zero defects. The automotive industry has long recognized that this is an impossible expectation and has adjusted their standards to reflect this fact (Stamatis).

The author made a valid point in the previous article, that Six Sigma is not new thinking or innovative technology. The principles of improving quality through constant process review and documentation of quality improvement efforts are old concepts. These concepts, however old, are still effective and have only been re-labeled through a clever marketing ploy in the selling of the "Six Sigma philosophy" (Stamatis).

Upon further investigation in reading articles offering a counterpoint of view to Six Sigma, discussion has been generated about the true validity of ever reaching the sixth sigma milestone. In the curve of normal distribution of deviation from mean, the sixth sigma of deviation constitutes a level of 3.4 PPM. Is this reality?

There has been evidence that nothing of real value lies outside the third sigma level of improvement within a quality management system. The Gauss model of distribution within a normal curve illustrates that calculations outside of +/- 3 sigma have no relevance. If actuality approximates acceptable product distribution, then the deviation level of +/- 3 sigma shows acceptable product is distributed 99.73% of the time. This is an actual PPM of 1350, but in reality a PPM of zero (Bajaria). In many manufacturing processes, reaching beyond 3 sigma is unattainable due to process variation. This suggests that a better way to report quality progress is not by sigma improvement, but rather by where you were before quality improvement interaction, and where you are after. Once again, the author suggests that the matter of continuous quality improvement cannot simply be addressed as a shift in deviation from a goal of zero defects. Bajaria explains that in real numbers a 3 sigma defect rating is so close to zero PPM that anything greater is simply unreasonable. He is suggesting that the true measure of quality performance is how a customer moves on from past non-conformances and utilizes these lessons learned to make future gains in working towards a minimal product defect rate.

The reality, and only goal that matters, is of a total quality management system that has tangible results affecting the bottom line. Real quality improvement achievements, not statistics are what matter most. Goals should be attainable and realistic and other articles have demonstrated that many manufacturing sectors are acutely aware that zero PPM is fantasy. In conclusion, the idea of quality management should be to solve problems rather than be hung up on reporting what sigma level your company has reached just in time to move on to a new process or product line.

In comparing the previous two articles offering opposing views to Six Sigma as a positively effective step to take in improving TQM, one striking similarity is the fact that each author urges the reader to focus on what is real. The first article reminds us that the principles of Six Sigma are grounded in tried and true quality improvement tools that have been around for years and, when properly utilized, need no sigma yardstick to tell a company that they are effective. Secondly, we are reminded that the idea of attaining a sixth sigma of consistency is near perfection. This also is unrealistic to think that a measurement system will foster this achievement. This level of perfection is simply too costly and lofty a goal to reasonably attain. There appears to be no real variation in either

article of the fact that when operating in the realm of quality management, that companies must keep in mind what is reality, when choosing their methods and goals.

Comparison of Articles Not in Support of Six Sigma

The paragraphs above list a variety of factors cited by the authors as key reasons for Six Sigma not being the best approach to TQM. In fact, the reasons listed by the authors not in support of Six Sigma seem to lack a common thread, as compared to the reasons listed by the authors supporting Six Sigma.

The reasons cited not supporting Six Sigma include lack of resources, lack of top management support, lack of communication, impatience, not using lessons learned from past mistakes, and simply having unrealistic expectations. The authors Stamatis and Bajaria focused in part on the point that reaching Six Sigma levels was just not achievable in their opinions, considering errors inherent in any process, and that Six Sigma was simply a restatement of earlier TQM processes.

In reviewing articles opposing Six Sigma, the main issue of failure discovered was the mind-set of management. If management takes the proper approach, Six Sigma could and should work. On the other hand, with smaller companies it may be a little more challenging to implement. Smaller companies may have limited resources such as personnel and smaller budgets. Six Sigma is achievable if a small company works one a piece at a time instead of trying to conquer the whole.

The author Hassan focused on the fact that management often expected results too quickly and gave up on the Six Sigma process prematurely. This issue would seem to be driven by failures in one of several other areas mentioned earlier, such as proper expectation and buy-in by management in a top-down fashion. Hassan also mentioned that the lack of communication is a key issue in the lack of success with Six Sigma. This would be related to a lack of allocation of adequate resources, ranging from human resources to technology resources to enable full communication. Dusharme focuses on the factors of lack of dedication of adequate resources and lack of top management support.

As we see from these summary paragraphs, the reasons for not supporting Six Sigma are numerous, and do not appear to have a common thread. The next section will draw conclusions on the various articles reviewed.

Conclusions

The articles reviewed that advocate Six Sigma as a complete quality management tool do little to convince the reader that Six Sigma is nothing more than old methodologies made new again. Erwin and Snee both point out the importance of Six Sigma as a tool for identifying and quantifying a problem and its related supporting data. Snee claims a benefit of Six Sigma is the short term 3-6 months for identifying product defects for reduction. Three to six months is a long time when one considers that money and time investments necessary for a group of people to take 3-6 months to identify a problem before they begin to resolve it. The compilation of data supporting a problem through charts and graphs, as Erwin references is indeed useful.

The continuous quality improvement tools of the automotive industry are time tested and easily adaptable to other sectors of manufacturing as well. Stamatis sings the praises of APQP and 8D as effective ways to foresee quality issues in new product lines and quickly do root cause analysis for current quality issues. Both of these tools also foster an open supplier to customer communication relationship which is essential for quick problem solving. If a company expects to wait 3-6 months to identify problems with Six Sigma, then Six Sigma is not cost effective at all. Your customers will let you know of quality problems as they happen and good internal auditing of the TQM system within a company will offset many problems before they get to the customer.

Six Sigma has also been identified as a cultural shift within an organization that must be led from the uppermost levels of management to ensure compliance and effectiveness. While it is true that quality control must be a corporate mindset for company survival, quality leadership at the top level cannot be the driving force in TQM. It is in fact the middle managers who must have the initiative, and bear the burden of investigating and resolving quality issues. Furthermore, it is middle management and supervisors who must maintain the quality is first culture in their plants for quality to succeed. It is too costly to wait on corporate management to lead the charge, when one considers that by the time they become involved the damage may already be catastrophic.

The articles reviewed that generally were not in support of Six Sigma as the best approach to TQM were the most convincing and made the most business sense. Quality management should be a company mindset on all levels, not only led by those in upper management with Black Belts. The value of lessons learned within an organization are supreme in any area and are simple to maintain and utilize without an additional measurable such as Six Sigma.

Dusharme's article was most impressive in making the point that large companies have a higher probability of success with Six Sigma, due to adequate resources. While authors such as Snee, Erwin and Franco provide very good information on the systems of Six Sigma, it is Stamatis that takes the full picture of Six Sigma and convinces the reader that Six Sigma is a good, but not the best, approach to TQM.

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OUTSOURCING AS A GLOBAL BUSINESS STRATEGY

Brian Satterlee, DBA, EDD
Nate Stevens
Charles Tokam
Chris Wheeler
Scott Wilkerson

Abstract

This paper investigates common motives behind decisions to outsource business functions overseas. More specifically, this paper reviews available literature and attempts to determine if the decision to utilize global sourcing is the wisest choice in the long term or typically only a vehicle for a quick profit boost.

The approach used to form conclusions begins with an identification of the primary business drivers that factor into global sourcing decisions. Using those business drivers as a foundation, common miscalculations that occur during decision-making are identified and analyzed. Building on that data, a comprehensive review of the appropriate factors to consider is detailed and supported. Finally, the results of topic research and analysis are summarized and conclusions stated.

Overview of Global Sourcing

"Global sourcing can help U.S. companies reduce their costs by 10 percent to 35 percent" (Minahan, 2003). This business strategy can lift companies and make them more profitable due to a lower cost of labor, material, and production. By cutting production cost and increasing profit, organizations may become more competitive in the global market.

In many organizations, the term "global" infers the development of a longer term, planned, continuing relationship with international suppliers. Since the 1990's, international global outsourcing of intermediate products from suppliers has been propagated as a key means to improve the financial performance. It is argued that becoming leaner and internationally focused is beneficial for the buyer as well as for the supplier.

Definition

"Global sourcing is the use of worldwide suppliers, regardless of where they are located geographically, who are best able to provide the needed output" (Hodgetts & Luthans, 2003, p. 64). "Global sourcing is best defined as the process of identifying, evaluating, negotiating and configuring supply across multiple geographies in order to reduce costs, maximize performance, and mitigate risks" (Minahan, 2003).

The process for global sourcing involves (1) research to determine qualified factories with the plant and experience to build to Western quality standards, (2) supervising the client's prescribed Quality Control protocol at the factory, and (3) effecting timely completion and direct delivery of production. The outcome of global sourcing is to achieve a significant lowering of the cost of goods sold, thereby expanding gross profit margins. Global sourcing is considered a "cornerstone of total cost management (TCM), a technological and process framework for the optimal alignment, management and control of the Total Cost of Ownership (TCO) of supply relationships" (Minahan, 2003).

Primary Business Drivers

Global outsourcing (or offshoring, as it is sometimes called) "is not a new phenomenon – European and American companies have been using offshore services for years, some for decades" (LaFerla, 2004, p. 1). Recognized as the earliest segment impacted by outsourcing, manufacturing jobs are quickly being followed by other industries and job functions such as customer service, telemarketing, and document management. "Affected professions now include medical transcription, tax preparation, and financial services" (Drezner, 2004). Analysts and research firms are touting statistics and estimates of extreme proportions regarding the usage of global outsourcing by not only large corporations but also small businesses. These firms are predicting an increase of offshore usage of 30 to 40 percent, an overseas transfer of 3.3 million white-collar jobs by 2015, 1 out of every 10 information technology sector jobs outsourced overseas by the end of 2004, and the outsourcing of 2 million financial sector jobs by 2009 (Drezner, 2004).

What are the compelling reasons behind this seemingly unpatriotic and disloyal organizational shift toward global business? The answer lies in the ongoing advances and improvements in the communication and technology sectors along with the increased global availability and usage of the Internet. These have enabled businesses to secure and utilize global resources "from anywhere in the world to ensure that they have the right skills, at the right price, at the right time, with managed risk" (Chellam, 2004). The primary business drivers include, but are not limited to: (1) cost reduction; (2) improved productivity; (3) a renewed internal focus on core competencies; (4) increased flexibility; and (5) and the increased availability of a low-cost, highly-skilled labor pool.

Cost Reduction

Financial pressures have dramatically increased for businesses over the years. Downturns in the economy, coupled with increased investor expectations, have encouraged many organizations to reconsider both short and long term business strategies. The current objective appears to capitalize on the potential financial gains made possible by sourcing the required resources globally from the most profitable source and / or by outsourcing non-core business functions to lower-cost, developing countries.

Repeatedly, cost is listed as the number one factor driving companies to source globally. Eighty-two percent of supplier managers surveyed rated access to low cost materials or parts as the greatest motivation to source from offshore suppliers. Most respondents indicated an average cost reduction of 27 percent - with some as high as 70 percent. "Access to low cost labor or talent and lower inventory carrying cost were the next highest rated reasons to choose offshoring" ("The Global Sourcing Benchmark", n.d.). In another survey, ninety-two percent of 500 senior finance and human resources leaders indicated cost reduction as their primary driver while ninety-five percent use it as a means of gauging success ("Global Sourcing Trends and Outcomes", n.d.).

It should be noted that offshoring does not necessarily imply an immediate transfer of jobs overseas. Survey results of 127 U.S. information technology executives, conducted by Compuware and IDC, reveal respondents were more likely to use "nearshore" rather than offshore when the cost benefit is 65 percent or lower than the cost of a U.S. provider. IDC, a research and analysis firm, predicts that organizations that align their global sourcing strategy with their overall business objectives will likely be more successful than those that rush offshore in the sole pursuit of cost reduction ("Compuware Study Reveals Nearshore IT Sourcing to Canada a Viable Alternative to Offshore", 2004).

Productivity Improvement

Productivity is defined as "having the quality or power of producing, especially in abundance; yielding results, benefits, or profits" (Merriam, 1998). In the business realm, the term is synonymous with the efficient and effective use of the production and / or delivery of the products or services by an organization. The improvement afforded by outsourcing in this capacity is the ability to obtain necessary supplies within the entire global village from the most profitable and productive source. It also allows business the ability to realign discretionary non-core business functions to alternate sites affording the same benefits.

Zadorozny (n.d.) remarked that, based on the cost reductions discussed previously, firms have the resultant savings at their disposal to hire more low-cost

employees which potentially translates into decreased production cycle time and increased speed to market – both of which are essential to business success. As labor accounts for about two-thirds of the cost of making and selling products, greater labor productivity in today's global economy is tantamount to corporate survival (Cooper, 2004).

The ability to identify and access the critically skilled labor pool on a global basis also enhances innovation. "The savings realized through the cost reductions and productivity gains of global sourcing are available for investment into new and / or cheaper products and services, in new market expansion, and, possibly most importantly, in creating jobs and increasing real wages for the organizations' home-country workers" ("Global Insights Study Finds Global Sourcing of Software and IT Services Bolsters Domestic Employment and Wages Across the Entire US Economy", 2004). Cost reductions in products and services should translate into less expensive goods for consumers; innovative variety of goods typically correlates with more competitive choices; and market expansion typically translates into job creation. Therefore, the productivity gains of global sourcing present organizations with increased speed to market, increased product offerings, and increased market expansion, while at the same time affording consumers with new jobs, increased wages, cheaper products, and competitive variety.

Core Competencies

There are additional implications to consider when global sourcing is deployed as a business strategy. The decision to globally outsource various discretionary business functions to alternative work sites is somewhat similar to the decision regarding which business functions to maintain domestically. Zadorozny (n.d.) notes that "in consideration of production processes, an organization has the allowance to offshore only those projects that it feels comfortable entrusting to an outside provider." This action liberates the human resources at the home office to focus attention on organizational core competencies – those not entrusted to outsourcing. This may be deemed necessary to pursue further innovation, product depth, or market expansion, or may include those proprietary business functions that require maintenance of organizational privacy. An IDC business analysis concluded, "The activities that will migrate offshore are predominantly those that can be viewed as requiring low skill since process and repeatability are key underpinnings of the work. Innovation and deep business expertise will continue to be delivered predominantly onshore" (Drezner, 2004). Hence, organizations that outsource realize a major competitive advantage in the ability to concentrate domestic human resource talent on chosen core competencies.

Increased Flexibility

As has already been revealed, global outsourcing provides an organization with much more flexibility in its various business considerations. Supplies may be sourced

domestically or globally, dependent upon (1) availability; (2) quality; (3) cost; and (4) access. Human resources may be sourced domestically or globally on a part-time, full-time, or just-in-time basis. Labor pools may be sourced offshore or nearshore based on global location, location infrastructure, access, availability, cost, skill set, and quality. Domestic and offshore work teams may be utilized separately or in tandem to realize further efficiencies, collaborate on innovative endeavors, share expertise, or provide 24/7 staffing. Non-core business functions may be deemed available for outsourcing at the discretion of the organization. These flexibilities allow an organization to strategically address financial and competitive pressures, resourcefully adapt to competitive innovation, and wisely sustain a competitive advantage to ensure ongoing survival within the current global market.

Increased Availability of Highly-Skilled Workers

The pursuit of outsourcing non-core business functions to low-cost countries has a concurrently requires an available labor pool with the skills necessary to support the outsourced business function, in a quality manner and in accordance with organizational objectives. What began as the global repositioning of manufacturing and routinized non-core business functions, outsourcing increasingly includes many complex, white-collar jobs (Cooper, 2004). With that comes the added requirement of a higher-skilled, higher-caliber labor pool.

China and India are considered developing nations, each experiencing technological advances and large, available, educated, and highly skilled labor pools. India produces two million high-quality, English-speaking, university graduates each year. Comparable salaries for this work force are at a fraction of the cost for the same work in industrialized countries. For example, 60 percent of costs in a typical British call center are for staffing compared to only 30 percent in India. India also has the youngest demographic profile of any country with more than half of its large population under the age of 25 (LaFerla, 2004, p.2). The country currently has a total population of 1.06 billion, a labor force of 406 million, and a Gross Domestic Product (GDP) per capita of $2,900 (CIA - The World Factbook, 2004). India is clearly recognized as having a large, low-cost, available, skilled labor pool.

According to the CIA's World Factbook (2004), China has a total population at 1.29 billion, a labor force of 753.6 million, and a Gross Domestic Product (GDP) per capita of $5,000. By way of a GDP-per-capita comparison with developed countries, the U.S. reflects $37,800, Canada $29,700, Japan $28,000, and the U.K. $27,700 (CIA - The World Factbook, 2004). Based on this information, it is clear to see why organizations are "substituting cheap foreign labor for expensive U.S. labor" (Roberts, 2004).

In addition to the reality that other countries well positioned as recipients of outsourcing, the educational situation in the U.S. is revealed as a major contributing factor to the outsourcing phenomenon. According to Federal Reserve Chairman Alan Greenspan, U.S. colleges produce one-sixth the number of graduates with science and

engineering degrees when compared to Asian schools. The short-term prospects of this situation improving are not positive. Students are unable to determine the usefulness or benefit of degrees in those fields, since at times related jobs are not readily available domestically (Falcioni, 2004). Philadelphia Federal Reserve President Anthony Santomero echoed that sentiment by stating the U.S. is graduating too few skilled workers to address the outsourcing imbalance between the supply of knowledge workers and the growing demand for them (Hurdle, 2002). If the U.S. is to reposition itself from a global sourcing perspective, the higher educational sector must rise to the challenge. The educational knowledge, skill level, and global functionality of American graduates must improve, in order to compete against other countries that have gained this competitive advantage.

Business Miscalculations When Considering Outsourcing

The choice to outsource even a small portion of business should not be taken lightly. All decisions that change the way business functions should be reviewed carefully. The consequences of a wrong decision can be disastrous if that change involves utilizing outsourcing to perform a function vital to the business itself. Factors to be assessed, prior to making a decision, include: (1) economic and political, (2) workforce, (3) supply chain, (4) cost-reduction, (5) culture, (6) quality, and (7) image.

Economic and Political Environment

In deciding which outsourcing options are best, a careful examination of the economic and political environment of the host country should be considered. For example, a European country such as Germany may be a very attractive choice, but the European Union trading bloc (EU) may hold a different position due to the interdependency of the bloc members. "Multinational Corporations (MNCs) cannot avoid political risks even when doing business with individual countries because of what the EU may dictate" (Hodgetts, 2003, p. 36). Another example is Mexico, a country that has many attributes to make it an attractive outsourcing choice. However, the North American Free Trade Agreement (NAFTA) diminishes the benefit for non-NAFTA members. When looking at a potential host country, it is smart to consider others with a vested interest in that country.

The Chinese government's failure to curtail industrial piracy is another example of an unfavorable political environment. "Proctor & Gamble estimates that it loses $150 million in sales annually because of counterfeit brands" (Hodgetts, 2003, p. 282). In deciding to do business in China, losses such as these must be considered thoroughly.

Long-Term Tax Implications

Taxes directly affect bottom line profitability. Therefore, miscalculation of tax implications is directly proportional to how profitable an outsourcing experiment may be. As noted by Patel (2004), "some foreign banks and call centres that had planned to outsource jobs to India are reviewing their decision … [while] others who have already set up base in the country are reconsidering whether or not to shift more new jobs." This sudden second guessing is due to "the Central Board of Direct Tax's [India's equivalent of the United States' Internal Revenue Service] decision to cash in on the boom in business process outsourcing and call centre industry' (Patel, 2004). Another tax implication for consideration is in expatriate compensation. Expatriate employees may have to pay a U.S. tax bill and taxes in their host country. Usually, MNCs pay the extra tax burden" (Hodgetts, 2003, p. 462). Depending on the number and level of employees, this can be a substantial cost.

Long-Term Availability of Qualified Labor Pool

Another common miscalculation, when considering outsourcing, is the determination of whether or not there is a long-term availability of a qualified labor pool. Many U.S. MNCs have had success in outsourcing customer service aspects of their business. However, when attempting to outsource more complex tasks, the results have been less than satifying. "As U.S. companies move from exporting call centers to outsourcing more complex work like software development, they're finding overseas workers are often ill-equipped to deliver consistent, quality work" (Stone, 2004).

Additionally, employee turnover rate is especially high, resulting in a workforce that is ever changing but always low in experience. "Inside the largest outsourcing firms in Bangalore, up to 40 percent of workers leave each year, lured away by the promise of higher salaries and easier commutes at new jobs" (Stone, 2004). Hodgetts (2003) writes, concerning China: "It is difficult to find qualified people and when a multinational does invest money in training these individuals, it is common to find them leaving for jobs with other companies" (p. 34).

Accurate Measurement of Supply Chain Enhancements

Supply chain problems are often a byproduct of outsourcing. A third-part logistics (3PL) provider executes a particular function on behalf of another company. Problems may arise when one part of a process is outsourced and not well integrated into the supply chain. Although the outsourced function may be satisfactory, the process is no longer adequate and supply chain problems result. Logistics Transportation Distribution (LTD) Management President Thomas Craig (2003) noted that 3PL providers "have become too focused on "managing" tasks, not processes."

The emerging use of fourth-party logistics (4PL) addresses many of the 3PL failures and can reduce miscalculations. 4PL is defined as business process outsourcing. Craig (2003) concluded, "BPO (Business Process Outsourcing) logistics service providers enable firms to manage a critical part of their supply chain by providing visibility and integration across multiple enterprises." Savings may be accrued by outsourcing the whole supply chain, not just selected parts. Failing to adequately consider the complex nature of logistics outsourcing may have serious adverse effects.

Accurate Measure of Cost Reduction

"Although nearly one in three managers who've outsourced some work in the past year say it didn't produce a dime of savings, it obviously generated value in other ways since only 13% say they failed to get any benefits whatsoever from outsourcing" (Eckhouse, 2002).

The cost of raw materials is generally the same worldwide. The differences are in the overhead required to manufacture and market the product. Moving a labor-intensive process from $12.50/hour to $6.00/hour will produce substantial savings. However, the cost of changing suppliers, increased transportation costs, and the potential cost of lost quality, among others, must be considered. Eckhouse (2002) also notes: "most professionals surveyed call the savings they experienced small or moderate. Only about one in seven says outsourcing produced a substantial savings."

Miscalculations generally result from exaggerated cost reduction claims and failure to consider ancillary savings. In the former, data used to make outsourcing decisions is skewed, as a result of exaggerated cost reduction claims. In other words, the actual cost of outsourcing ends up being much more than was estimated. In the latter, business leaders tend to "neglect some of the ancillary savings they get from outsourcing" such as reduced staffing, training, and multiple vendor dependency. If a business fails to properly calculate these costs, the real benefits to outsourcing will appear reduced.

Stone (2004) also notes: "many American companies are discovering that sending work to low-wage countries is not as easy or as inexpensive as advertised. In hotspots like Bangalore, wages and real-estate prices are soaring to record levels – though still generally a fraction of U.S. costs – which cuts into potential savings." As the costs of living increases in these "hotspots" cost reduction will decrease.

Maintaining Corporate Culture and Personnel Management

When entering into a new environment, it is very important to continue the success that brought a business to the international level. However, what works in one country, may not work in another. The balance of maintaining a corporate culture that

appeals to both the MNC and the host country (subsidiary) can be tricky. An up-front analysis of the culture type of the country in question may help define its organizational culture and determine the best way to balance it against the corporation's own culture. Hodgetts (2003) alludes to this balance when he suggestes that "MNCs must work hard to understand the varying nature of the organizational cultures in their worldwide network and to both moderate and adapt their operations in a way that accommodates these individual units" (p. 175).

Maintaining Quality

The effects outsourcing has on product quality are often the most difficult to predict. Stone (2004) notes the case of a Minneapolis business man who " hired a large, reputable Indian outsourcing firm [to write code] a few months ago, then sat back and watched his troubles mount. Not only did the offshore team produce code that was full of bugs, they ran up big bills working overtime to fix their mistakes." This is not an isolated case, and it ultimately cost this business in both quality and profit.

Negative Image / Impact on Domestic Community

A final consideration is the cost of the negative publicity that results when jobs for the home country relocate overseas. In some industries, this cost may be significant while in others it may not affect image at all. Stone (2004) notes: "by outsourcing routine tech and customer-service jobs to educated, eager workers in countries like India and the Philippines, companies sharply cut costs – savings that outweighed the inevitable negative publicity." Often times, calculating the advantages of outsourcing can be much easier than determining the disadvantages caused by a negative image. "The real innovation seems to be in finding new ways to sell it to an uneasy public. The latest term making its way through corporate America: 'right-shoring'" (Stone, 2004).

In summary, the importance of analyzing outsourcing operations is clear. "A recent Dun & Bradstreet survey discovered that almost 25 percent of all outsourcing relationships fail within two years and half fail within five years. One of the major causes, the report says, is that many outsourcers fail to fully comprehend what they were hired to do" (Eckhouse, 2002). Often times the cause of the miscommunication is a MNC failing to do its homework.

Pre-Decision Critical Global Sourcing Factors

Several global sourcing factors must be carefully assessed, prior to implementing a global sourcing strategy. Global sourcing requires costs that many companies are ill equipped to analyze and identify. According to the Gartner Group, international logistics can consume up to 28 percent of the costs of goods. This two- to three-times increase in costs can potentially more than offset the price advantage of obtaining an overseas

supplier (Xporta Inc., 2004). The most significant global sourcing determinants are supply costs, legal costs, and cross-border management.

Supply Costs: Material, Transportation, Inventory

Supply costs include those expenditures associated with material, transportation, and inventory. Material considerations are price, setup, tooling, transaction, and other costs related to the actual product or service delivered. As previously indicated, the costs of raw materials are generally about the same any place in the world. Transportation relates to delivery, fuel surcharges, and other fees included in a freight rate. Inventory-carrying costs are composed of warehousing, handling, taxes, insurance, depreciation, shrinkage, obsolescence, and other expenditures associated with maintaining inventories, including the cost of money. Currency risk can often cause fear in the buyer. For this reason, it is best to lock in currency exposure with forward contracts and hedging (Laseter, Ramachandran & Leary, 2004, p. 5). Too many companies have lost money by speculating on currency rather than focusing on their core businesses. Logistic costs involve considering the optimal mode of transportation, inventory, and expediting fees. Additionally, global sourcing generally creates intermediaries, such as foreign distributors, brokers, freight forwarders, and customs clearing agents. These associated fees are normally small individually but can be significant when added together.

Legal Costs: Taxes, Tariffs, Duty

Legal fees include taxes, tariffs, and duty costs. Tariffs and custom duties are taxes placed on imported and exported goods and can be distinguished from other taxes in that their predominant purpose is to protect domestic industries from foreign competition. Duties are expressed as a percent of value, a fixed amount, or a combination of each. Other fees, often hidden, result from the multitude of documentation and regulatory compliance requirements (Lazowski, 2003). Tariff rates vary significantly among different countries and within the same country since there is variation between product classifications. Minor differences in classifications can lead to much greater costs due to the added costs imposed for protection of domestic critical industries. These variations often lead to complexity and confusion for companies considering global sourcing (Laseter, 2004, p. 5).

Supply managers must stay abreast of tariffs, trade regulations, and geopolitical landscapes that are constantly changing. Understanding and optimizing the total cost of offshore sources also requires supply managers to have a solid understanding of the Harmonized System (HS) Code and International Commerce Terms (Incoterms). An HS Code is a globally accepted six- to 10-digit number used to dictate the fees and restrictions associated with goods crossing a border (Minahan, 2004, p. 1). HS Codes are typically ten-digit numbers, with the first six standardized across all countries adhering to the World Customs Organization (WCO) nomenclature. The remaining four digits can vary by country, and typically define specific materials that may or may not be

commercially protected in the domestic market. In general, these codes are fixed and non-negotiable for a given material. However, depending on the finished state of the material and the end use of the product(s), classifications can change. The most advanced methodology for global sourcing requires a solid command over the dynamics of HS codes, and includes procedures and techniques for potentially minimizing duties and taxes by performing assembly or configuration processes in different countries in the global supply chain (Xporta Inc., 2004). Thirteen standard Incoterms define the roles and responsibilities of buyers and suppliers for cross-border shipping. Each Incoterm assigns a different set of responsibilities, costs, and liabilities to the buyer and the seller. In an ideal world, sourcing should provide bids for each Incoterm in every quote. The reality is that most companies seldom present bids for more than one Incoterm. By following strict procedures for gathering bids for the top 3-5 Incoterms, global sourcing managers often uncover another 1-2% gross margin improvement (Xporta Inc., 2004).

Cross-Cultural Management Issues

Management of supply and operational performance involves overseeing the cost of noncompliance or underperformance to ensure cost savings from shifting to an offshore source. The many variables and dynamics of global sourcing make the job of managing it comparable to that of financial managers. Companies must ascertain both short and long-term goals, using these to develop a diversified supply portfolio of cost, risk, and performance (Minahan, 2004, p. 1). Sourcing managers must be qualified to identify and evaluate new supply possibilities and adjust their companies' supply mix to derive optimal performance. In addition, sourcing managers need to constantly obtain current global supply market data and have the knowledge and tools to assess it. For example, a country's political situation can change dramatically and result in financial instability within the supply market (LaFerla, 2004, p.2).

Hewitt Associates, a global outsourcing firm based in Illinois, posits that finance executives consider the management of transition to overseas labor the hardest part of global outsourcing, followed by maintaining corporate culture and personnel management. Human Resources executives tend to focus more on legal and regulatory challenges, Hewitt said, along with cultural barriers, labor force quality and opposing views from home country employees (Study Notes Offshoring Downside, 2004).

Managers must also evaluate offshore countries to see if they are appropriate for their outsourcing requirements. Many countries are appropriate for providing smaller scale outsourcing and niche technical expertise, such as Canada, Russia, Ireland and the Philippines. However, these countries will never be able to become mainstream sourcing countries due to limited labor resources. Therefore, China and India are the only viable, long-term sourcing countries for primary non-niche outsourcing ("Global Sourcing Advantages", 2004). The proper methodology for evaluating a new country source is to model the total cost of operations (TCO) for all non-material costs and in effect compare material costs with local and other known sources. Following this method, companies

fully understand the non-material costs related to any transaction and are well-positioned to negotiate on a total-cost basis (Xporta Inc., 2004).

As discussed, many considerations and areas of study are required by companies prior to initiating a global sourcing strategy. Every sourcing decision requires a balance of trade-offs in cost, performance, and risk. Additionally, these factors are heightened when sourcing globally because of the variability of associated costs. Companies should analyze the topics discussed to minimize and identify the dynamics of the global sourcing arena.

Pros and Cons of Global Sourcing

Long-Term Business / Profit Strategy

Global sourcing is on the rise; the U.S. alone imported more than $1.3 trillion worth of goods and services in 2001. Most companies report a 10 percent to 35 percent cost savings by sourcing from low-cost-country suppliers. Companies should look at the long-term prospects of their operations and profitability. Globalization is here and must be included in any business strategy. The advance in information technology renders communications very easy today. Orders may be placed and received in a few seconds around the world and some companies have the capability to have their inventory searched online with updates made in just seconds.

Negative Impact on Domestic Country

The question to ask is, "How much work should we perform onshore, and how much should we perform offshore?" Operational risks to be considered include: geopolitical factors, such as changes in country leadership; tariff and policy changes; and instability caused by war and/or terrorism or natural disasters. In some industries and geographies, political and regulatory pressures may prevent a company from configuring a solution as aggressively as it would like. A recent example reported in the Nov. 21, 2003, edition of the Indianapolis Star involved an Indian company winning a U.S. state government contract only to have it taken away as public pressure mounted to provide the work to U.S. citizens.

Conclusion

Global sourcing is a viable business strategy that should be given serious consideration. However, as presented here, it should only be considered within the perspective of aligning it with the overall business strategy. To consider it only from a cost reduction perspective or as a pursuit of the latest business "fad" or trend, is not a prudent business decision. Only after careful consideration of all the factors and related impacts, both negative and positive, should it be included in the overall business strategy, objectives, and goals.

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Liberty Business Review: Final Thoughts

As you've completed this second issue of this online journal, we hope that you are encouraged in your own academic pursuits and challenged to contribute your own research to future issues of this publication. Our goal is to expand the pool of authors beyond Liberty University undergraduate students and faculty to students and faculty from institutions around the country.

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