SIX SIGMA SUCCESS: A VIEW THROUGH AUTHENTIC LEADERSHIP AND BEHAVIORAL INTEGRITY THEORETICAL LENSES

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ABSTRACT

Despite plethora of empirical evidence establishing a strong positive correlation between top leadership support and a successful Six Sigma implementation, there is a dearth of studies that investigate in depth how the top leadership actually influences the Six Sigma success through theoretical lenses. Drawing on Authentic leadership, and Behavioral Integrity theory, this study uses a cross-sectional survey methodology to explain why and how the top leadership characteristics influence the success of this quality improvement initiative. Preliminary results suggest that authentic leaders and leaders with behavioral integrity significantly and positively influence the outcome of a Six Sigma process.

Key words: Authentic leadership, Behavioral integrity, Six Sigma.

INTRODUCTION

Quality provides an opportunity to compete. In a dynamic and uncertain business environment such as today’s, attempts toward a continuous improvement in quality in processes and products can lead to a sustained competitive advantage (Sitkin et al, 1994). Developed at Motorola Corporation in the mid 1980s, Six Sigma is fundamentally a quality improvement methodology that aims to achieve zero defects in a process. It is done by measuring the quality of a process that meets or exceeds the demand of the customer with perfection up to 3.4 defects per million opportunities. Anecdotal evidence supports well the effectiveness of Six Sigma. The leading beneficets of using Six Sigma include the originator of this methodology itself Motorola, General Electric, Samsung Electronics, American Express, and also the National Science Foundation (Gutiérrez et al 2009).

Six Sigma has been described as a business improvement strategy for greater customer satisfaction (Antony & Fergusson, 2004), better organizational performance (Park, 2003), and also as a culture change effort and a drive towards competitiveness and profitability (Gilbert, 2003). Viewing the commonly used definitions found in the literature for Six Sigma as inadequate for scientific investigation and considering the rules for constructing conceptual definitions developed by Wacker (2004), Schroeder et al (2008, p. 540) proposed the following definition for Six Sigma that captures its theoretical aspects from the extant literature:
“Six Sigma is an organized, parallel-meso structure to reduce variation in organizational processes by using improvement specialists, a structured method, and performance metrics with the aim of achieving strategic objectives.”

Six Sigma pursues a rigorous, disciplined, fact-based methodology that defines, measures, analyzes, improves, and controls (DMAIC) processes with an aim for drastic reduction in process and product variability. This DMAIC procedure has its roots in Deming’s well known Plan-Do-Check-Act (PDCA) cycle with specialized tools and techniques assigned for use in different stages (Linderman et al, 2003). These well-defined procedures, tools and techniques provide not only a concrete methodological framework for execution or implementation of a Six Sigma program, but also a chance to promote team learning and knowledge acquisition (Zu et al, 2008).

Overall, quality management as a field of practice has developed, grown, and extended outside of its initial industrial domain to gain global acceptance in many other sectors including service. Among the critical success factors for Six Sigma, leadership support has topped the list and reports suggest that the organizations that cannot manage continuous support of the top management do have trouble in getting the envisaged benefit from the Six Sigma program. Many quality improvement awards have been instituted over time with an aim not only to promote certain organizational practices, but also to emphasize process improvements and excellence. All these quality awards highlight the importance of leadership in the pursuit of quality improvement (Vokurka et al, 2000).

There appears to be a thorough evidence of strong top management support and an implicit assumption of top leadership being the driving force behind a successful Six Sigma process, but not enough literature exists in this stream of research that analyzes the specific behaviors and mechanisms through which leaders impact Six Sigma process and its outcome. Drawing upon the emerging Authentic leadership (AL) and Behavioral integrity (BI) theory (Avolio & Gardner, 2005; Simons, 1999), we attempt to address this gap in the existing Operations management literature while addressing this broad research question: “What is the impact of top leadership on Six Sigma outcome?” Specifically, we analyze how authentic leaders and leaders with behavioral integrity influence important elements of the Six Sigma process that ultimately affect its outcome. We develop a theoretical model and empirically test that model to find out specific traits and behaviors of leaders impacting the Six Sigma process. Both AL and BI are new to the field of operations management and the field of Six Sigma research. We contribute to the body of Six Sigma literature and leadership by linking these two well researched fields with fresh application of AL and BI.

The main contribution of this paper is the integration and extension of two emerging theories: AL and BI in the leadership literature to the field of operations management and quality management. In this paper, we provide an insight to how authentic leadership qualities and behavioral integrity of a leader can facilitate and promote the Six Sigma process in an organization. As the results indicate, to reap the best benefits of Six Sigma, both qualities in leaders are desired under different circumstances.
The rest of our paper is organized as follows. In the following section, we provide a broad overview of factors that help make Six Sigma achieve its desired benefits and also factors that hinder its successful implementation. A thorough review of literature on management theories relating to Six Sigma is also presented in this section. Next, we develop our conceptual research framework and state our hypotheses. The research design and methods for our study are presented in the following section. We provide a plan for this study and conclude by mentioning the limitations and directions for further research in the final section.

**LITERATURE REVIEW**

**Six Sigma and Top leadership**

Six Sigma, seen as a parallel development to earlier quality initiatives such as TQM and Quality Circles, draws its strength from its focus on continuous improvement and customer satisfaction, fact based decision making, employee engagement, and top management support (Green, 2006). Several key success factors responsible for Six Sigma implementation have been reported. Henderson & Evans (2000) found top management support and involvement, and organizational infrastructure to be among the key factors contributing to Six Sigma success. From their pilot survey conducted in several manufacturing and service organizations in the United Kindom, Antony & Banuelas (2002) identified top leadership commitment and involvement as the most important factor contributing to a successful Six Sigma implementation. In his best seller “The Six Sigma Revolution - How General Electric and Others Turned Process into Profits”, George Eckes (2000) emphasized the need of top leadership support to reap the full rewards from a Six Sigma implementation. Goldstein (2001) included active participation of top leadership in his list of success factors for a Six Sigma initiative.

Schön (2006) discussed commitment of top leadership, project selection and implementation strategy in linking Six Sigma to the overall business strategy. Snee & Hoerl (2002) observe the top management support to be one of the key differences between a successful and a not-so-successful Six Sigma implementation. An exhaustive list of such CSFs can be found in DeRuntz & Meier (2010). Interpersonal relationships, employee engagement, training, and recognition (Zu and Fredendall, 2009) and mentoring (Gobeille, 2009) have also been found to be contributing to successful Six Sigma cases. Pulakanam & Voges (2010) found executive leadership, and top management commitment to be among the top contributors to Six Sigma success and the absence of top management leadership as one of its major barriers.

Deming (1986) points out that it is possible to find out the sources of defects in a process, and it is also possible to eliminate those sources. He insists that the variation in a process is not random or by chance and it is essential that the source of variation is detected and a suitable potential strategy is developed for its reduction and, if possible, its elimination (Pyzdek, 2003). In this respect, Six Sigma fits the bill perfectly. It adopts a disciplined approach of defining, measuring, analyzing, improving, and controlling, processes with an aim to reduce variability in products. It also supports the philosophy of doing the thing right for the first time as recommended by several prominent quality gurus such as Deming.
Considering the conceptuality, concreteness, and effectiveness of the improvement procedure of Six Sigma, the top leadership in the organization has valid reasons to provide and extend support to its implementation. The top leadership also finds this approach a logical, fact based, and sustainable change management initiative to improve organizational performance. The process improvement focus of Six Sigma leads to a culture of innovation where employees try to come up with new strategic solutions to existing problems with appropriate process evaluation. Moreover, the top management sees it as a cultural change initiative too, where a quality culture in the organization contributes to improvement in the overall organization culture. Harry & Schroeder (1999) argue that quality reduces costs. With six sigma approach, the costs related to inspection, rework, warranties, and customer service can be drastically reduced which, on the other hand, can in fact increase the profitability of a company. This may be a reasonable logic for the top leadership in an organization to adopt and promote Six Sigma.

From this review, one thing is obvious: continuous support from the top leadership in the organization is an absolute requirement for a successful implementation of Six Sigma. Other factors such as lack of resources, poor communication among hierarchies, and inadequate training of employees that pose major threats to a successful implementation also could arise from insufficient focus on the part of executive leadership on Six Sigma.

**Six Sigma and Leadership theories**

There has been a considerable argument about the very existence and valid reasoning for acceptance of Six Sigma. Zhang et al (2009) present three reasons in support of their argument that Six Sigma is not a management fad. One, usually management fads do not last long, where as Six Sigma has been popular for over a quarter of a century. Two, Management fads cannot deliver what they promise, which is not true in case of Six Sigma, as evident from its past records. And last, the acceptance of Six Sigma appears to follow a different pattern from that of management fads. Critics of Six Sigma (e.g. Linderman et al, 2003, p. 195) argue that “it lacks a theoretical underpinning and a basis for research other than best practice studies.” Schroeder et al (2008) observed that despite its acceptance way back in 1980s, attempts towards building a theoretical foundation of Six Sigma is a recent development. Zhang et al (2009) question how a mechanistic approach, such as the one Six Sigma adopts, can work well in today’s dynamic business environment. They note that the mechanistic approach works efficiently for highly repetitive and predictable tasks, but is not appropriate for an adaptive organization. They insist that an in depth theoretical understanding of these issues is very important.

Leadership theory refers to leaders at any level in the organization and leadership research focuses on the relationship between the leaders and followers (Vera & Crossan, 2004). While research on trait and style approaches focus on leaders (e.g. Bryman, 1986), researchers focus on followers for studying implicit theories of leadership (e.g. Lord & Maher, 1991). Other approaches include focusing on the nature of interactions among leaders, followers, and contexts (Graen & Scandura, 1987; Meindl, 1993). All these leadership research approaches have micro focus meaning they study leaders and followers on individual basis. In this study, we adopt this micro paradigm of leadership research and focus on the characteristics of the leaders and their relationship with their immediate followers.
The success of Six Sigma has been attributed a lot to the top management. Transformational and visionary leadership theories have been expressed to contribute to a more realistic view of top management (Cannella & Monroe, 1997). Schroeder et al. (2008) suggest that leadership involvement in using improvement specialists and strategic selection of projects with the combination of a structured methodology, can lead to improved performance. The full range leadership theory that includes three dimensions of leadership: transformational, transactional, and laissez-faire, has been a dominant theory of leadership in the last two decades (Lowe & Gradner, 2000).

Transformational and transactional leadership styles are presented to be at two extremes of a continuum (Burns, 1978), however a leader can be either/neither transformational, transactional, or both. Transactional leaders motivate followers mainly through contingent-reward exchanges and active management by exception (Avolio et al., 1999). Staying within an existing system, transactional leaders seek to strengthen an organization’s culture, strategy, and structure. On the other hand, transformational leaders tend to be charismatic, inspirational, intellectually stimulating, and individually considerate (Avolio et al., 1999). They inspire their followers by their vision, enthusiasm, and drive for innovation (Bass & Avolio, 1990). While transformational leaders display the roles of facilitator, mentor, innovator, and broker (Quinn, 1988), transactional leaders reflect the roles of coordinator, monitor, producer, and director (Egri & Hermon, 2000). As the organizations grow, they tend to rely on well-established procedures and norms to influence employee behaviors and this is when transactional leadership become more important. In contrast, poor performance of an organization calls for a strategy renewal and fosters transformational leadership (Vera & Crossan, 2004). Laissez-faire leadership represents a lack of leadership.

Vera & Crossan (2004) argue that certain processes in an organization can thrive under different leadership styles at certain times. They mention that in times of change, transformational leadership may be best suited to a task, while in times of stability, transactional leadership may work better. Leaders may possess both kinds of styles and even transformational leadership can build on transactional leadership (Avolio et al., 1999). In a dynamic and complex business scenario, leaders in organization need to adapt different leadership styles to succeed. However, the ability to adapt to change and adopt various leadership styles differ across individuals as their values, orientations, and preferences vary. As Vera & Crossan (2004) observe, highly transformational leaders promote open cultures, organic structures, adaptable systems, and flexible procedures to facilitate implementation of change. On the other extreme, highly transactional leaders encourage closed cultures, mechanistic structures, rigid systems, and procedures to facilitate reinforcement of existing structure and processes in an organization. Therefore, they suggest that an ideal leader must recognize his/her limitations and how well that leader can balance transactional and transformational behaviors. In the context of Six Sigma, which has been sometimes hailed as a break-through improvement approach and at times criticized as a mechanistic approach relying on predictable and repetitive tasks, it appears that both transactional and transformational forms of leadership may be suitable to manage this process.

Bass (1985, 1998) concluded that both transformational and transactional leadership behaviors can be learned through training programs, and Vera & Crossan (2004) pointed to a missing factor
in transformational and transactional leadership. A new form of leadership theory: Authentic leadership has been proposed (Avolio et al, 2004; Gardner et al, 2005) which is more generic and it can incorporate other forms of positive leadership such as, transformational and charismatic leadership. Authenticity involves being true to oneself, not others. However, authentic leadership involves the leader’s relations with others because all leadership is relational at its core (Avolio & Gardner, 2005). The central premise of authentic leadership theory is that through increased self-awareness, self-regulation, and positive modeling, authentic leaders foster the development of authenticity in followers. The followers’ authenticity contributes to their well-being and the attainment of sustainable and veritable performance (Gardner et al, 2005).

While authentic leadership may or may not be charismatic, the transformational leaders are charismatic (George, 2003). Transformational leaders are described as being optimistic, hopeful, and of high moral character (Bass, 1998), all of which could be manifestations of authentic leadership. A leader needs to be authentic to be transformational; an authentic leader may not have to be transformational. For a comprehensive difference between authentic leadership and other forms of leadership, see Avolio & Gardner (2005).

**Authentic leadership (AL)**

Authenticity of a person can be described as the individual’s personal characteristics such as experiences, needs, thoughts, beliefs, and emotions (Harter, 2002). Luthans & Avolio (2003) describe more clearly authenticity as being self-aware and behaving as one’s true self. A comprehensive list of different definitions of authentic leaders and authentic leadership can be found in Gardner et al (2011). These definitions include the reflected concepts of self-awareness, positive self-regulation, positive self-development, and/or a positive moral perspective of an authentic leader.

For this work, we adopt the definition of authentic leadership given by Walumbwa et al (2008, p. 94): “as a pattern of leader behavior that draws upon and promotes both positive psychological capacities and a positive ethical climate, to foster greater self-awareness, an internalized moral perspective, balanced processing of information, and relational transparency on the part of leaders working with followers, fostering positive self-development.”

*Self-awareness* refers to the degree a person possesses accurate self-knowledge of his/her individual characteristics, ideals, intentions, thoughts, and behaviors (Cambell et al, 1996). Ilies et al (2005) describe self-awareness as one’s understanding of his/her natural conflicting self aspects and impact of these contradictions on his/her feelings, actions, and behaviors. Walumbwa et al (2010) describes *self-awareness* as the degree to which the leaders know and recognize their true self and authentic leaders observe and analyze their own mental state through introspection during the process of self-awareness. Also as Avolio & Gardner (2005) point out, during this process, authentic leaders discover and acknowledge their fundamental values, thoughts, true character, and goals. To summarize, self-awareness is a process by which the authentic leaders recognize their true, distinct capabilities, understanding and experience and it is by this self reflection these leaders attain clarity of their fundamental values and thought processes (Avolio & Gardner, 2005; Gardner et al, 2005).
**Balanced processing** involves an impartial analysis of all related information while accounting for other’s opinion and feedback before any decision making (Walumbwa et al, 2010). Authentic leaders consider issues with even attention to all kinds of criticisms about themselves and also their style of leadership (Gardner et al, 2005). As they go through an internal and external self-reflective process of gaining self-awareness, authentic leaders try not to misrepresent, overstate or disregard the relevant information required for their decision making (Kernis, 2003).

Clarity of relations between the leaders and their followers or **relational transparency** is about the presentation of a leader’s true self. Authentic leaders with relational transparency exhibit openness and self-disclosure (Walumbwa et al, 2008). In other words, relational transparency encompasses an open sharing of information and expression of true feelings and emotions to others. Also relational transparency enhances trust through the relationship between a leader and her followers and reduces expressions of inappropriate feelings (Kernis, 2003). By revealing their true self in terms of goals, motives, ideals, and emotions to their followers, authentic leaders promotes trust and intimacy that fosters greater teamwork, cooperation, and learning process.

Avolio & Gardner (2005) point out that authentic leaders orient their ideals with their motives and actions through the process of self regulation. This process is internally motivated and involves making these expressions transparent to followers and being consistent with their words and actions. Self-regulation involves maintaining equivalence between one’s self standards and expected outcomes (Gardner et al, 2005). Through this process of self-regulation or an **internalized moral perspective**, authentic leaders manage conflicts and tensions between their principles and tasks.

Having described all the components of AL, it is worth mentioning that no leader achieves all of these components all the time and hence AL exists on a continuum.

**Behavioral integrity**

Behavioral integrity (BI) has been defined by Simons (2002, p. 19) as “the perceived pattern of alignment between an actor’s words and deeds”. He and his colleagues describe BI as a trait that entails an observed pattern recognized in a manager and differentiated from common conceptualizations of trust. In fact, BI includes several other components such as courtesy and respect, besides most of the affective components of trust (Simons et al, 2007). BI is a perceived objective pattern of alignment between a manager’s word and action. The perception of an employee of her manager’s BI has been shown to significantly influence her work attitudes and behaviors (Simons, 2002). Simply put, if an employee observes that her manager has a tendency or pattern of not being truthful or forthright, she is most likely to trust the manager less. So BI of a manager impacts important characteristics in an employee, such as employee motivation towards promoting and implementing change, employee retention, and employee performance. These attitudinal and behavioral factors subsequently impact the outcome of an objective or goal of an organization. For an example, in a Six Sigma process, these factors are very critical to its success.
THEORY DEVELOPMENT AND RESEARCH MODEL

Authentic leadership, Behavioral integrity, and Six Sigma

Avolio & Gardner (2005) describe AL as a form of leadership where the leader is *true to oneself*. In contrast, BI involves *being true to one’s word when dealing with others* (Simons, 2002). While processes such as self-awareness, balanced processing, relational transparency, and internalized moral perspective have been used to describe authentic leadership (Walumbwa et al, 2008), BI has been expressed as the degree to which the leaders do what they say (Simons, 2002). AL is also described as a *root construct* or a key ingredient of other positive forms of leadership (Avolio & Gardner, 2005). In a broad sense, both authentic leadership and BI have been associated with positive organizational behavior and induce similar levels of follower performance through similar theoretical mechanisms. However, as Leroy, Palanski, & Simons (2012) point out, they are not the same because authentic functioning is mostly inward-focused and BI is largely outward-focused.

Deming (1986) called on managers to institute leadership and explicitly stated in the recommendation of his famous fourteen points that “constancy of purpose” is one of the most significant criteria for the success of a quality improvement initiative. In case of Six Sigma, constancy means a continuous effort towards achieving Six Sigma quality by maintaining the employee engagement. Waldman et al (1998) mention that in the absence of a devoted and persistent leadership effort towards quality improvement, employee motivation may decline over time and the employees may adopt a reactive approach to the quality initiative instead of a proactive one. In the case of Six Sigma, persistent support from the top leadership is essential and the top leadership that commits to this quality improvement program should continue to extend the support until the goal is achieved. This is entirely in line with Deming’s recommendation for constancy of purpose.

Considering the definition provided by Yukl (1989), Waldman (1993) finds a typical connection between leadership and implementation of a quality change initiative. He (p. 66) writes “leadership includes influence processes involving the determination of a group’s or organization’s objectives, motivating task oriented behavior to accomplish these objectives, and influencing group maintenance and culture.” Although he found a clear requirement of such processes for TQM practices, these may be very relevant for Six Sigma themes as well. Waldman asserts that top management that leads from the front with inspirational leadership behavior recognizes the team effort and that of an individual They are highly likely to motivate their followers toward an overall quality goal or in case of Six Sigma program, the six sigma quality. This is again about creating a quality culture across the organization where every employee starts and continues to believe in the top leadership commitment and perseverence towards a quality goal. This finding is in agreement with BI theory that posits leaders are considered more credible when they do what they say and this credibility forms the base for employee loyalty and commitment that is critical to employee motivation and performance (Simons, 1999). We hypothesize that a leader with strong BI will persistently support the Six Sigma cause, which will lead to Six Sigma success. Also, a leader with strong BI will have high credibility with his or her followers and induce high employee engagement that will lead to Six Sigma success. This argument leads to the following two hypotheses.
H1: Leader BI is positively related to Six Sigma Performance.

H2: Leader BI is positively related to employee engagement.

Mayer et al (1995, p. 712) define trust as “the willingness of a party to be vulnerable to the actions of another party based on the expectation that the other will perform a particular action important to the trustor, irrespective of the ability to monitor or control the other party.” They point out a perception of another person’s integrity as one of the key antecedents to trust. Simons (2002) argues that for an establishment of trust between two parties, a perception of BI may form an essential condition as a speaker’s words creates some sense of reliability in the listener that the actions of the speaker will confirm to her words. BI is closely related with trust in leaders and organizational commitment and both these factors impact customer satisfaction and company bottom-line (Simons & McLean Parks, 2000). In their research model, Simons (2002) describes trust to be a mediating variable between BI and several factors such as employee willingness to promote and implement change, employee retention, and employee performance. All these factors are very relevant to our research because the Six Sigma process very much depends on employee commitment to the quality change initiative, and also getting and staying involved throughout the process of change. The performance of individual employee in the process is linked with the overall success of this process. We posit that trust mediates the relationship between the BI of a leader and employee engagement.

Employee engagement can be broadly expressed as commitment, work ethic, and loyalty of an employee. It can be a combination of various perceptions such as satisfaction, pride, sense of personal responsibility, and willingness to be part of an organization. These perceptions have an impact on employee behavior. It is also a sense of purpose and focused energy of an individual directed toward the overall organizational goals and objectives. Leadership factors impact employee engagement. Although an authentic leader need not be transformational, AL has ethical and transformational leadership components (Avolio & Gardner, 2005). By being visionary, an authentic leader inspires and motivates followers (Wildermuth & Pauken, 2008). Also recognizing individual differences and complementary talents in employees, an authentic leader helps them build on their strengths that lead to greater employee engagement. A significant relationship has been shown between authentic leadership and employee engagement (Avolio et al, 2004). Drawing on diverse relevant literatures, Macey & Schneider (2008) provide a thorough explanation of employee engagement and offer a series of propositions about psychological state engagement, behavioral engagement, and trait engagement. Since a highly engaged employee can affect positively the customer service and a disengaged employee can negatively impact the service or product quality, we posit that employee engagement positively affects Six Sigma performance. Also an authentic leader at the top will inspire greater engagement of employee in the job that will lead to an enhanced Six Sigma performance. This leads to the development of our next three hypotheses.

H3: The positive relationship between Leader BI and employee engagement is mediated by trust in the leader.

H3a: Employees’ trust in their top leadership positively influences their engagement in job.
H4: *Employee engagement positively impacts Six Sigma performance.*

The relationship emerging from a strong word-deed alignment can generate great deal of enthusiasm and commitment within a team that truly engages members in problem solving and driving customer service (Simons, 2008). These are two important characteristics of a Six Sigma process. We can relate AL qualities to this phenomenon that in case of an authentic leader who sticks to her commitment by a strong follow through process, the followers will have a greater confidence in her. We posit this enhanced confidence of followers will most likely result in greater employee engagement that can lead to a successful Six Sigma implementation. This leads to our next two hypotheses.

H5: *An authentic leader at the top positively influences the Six Sigma success.*

H6: *The effect of authentic leadership in Six Sigma success is mediated by employee engagement.*

Both AL and BI literature report that leader authenticity and integrity is one of the major factors influencing employee engagement and employee performance (Leroy et al, 2011). In their study of a service industry, Leroy et al (2011) report that authentic leadership is associated with the follower’s affective organizational commitment. This relationship is mediated by the leader’s BI. They find that AL and BI are closely associated with follower’s work role performance which is fully mediated through follower’s organizational commitment. Also authentic leadership was found to be an antecedent to perceptions of BI in their study. In the same vein, we argue that AL influences the employee engagement in a Six Sigma process and this relationship is mediated by trust of the employee on the leader. Furthermore, because both AL and BI are emerging fields and not enough literature is available reporting the relationship between AL and BI, in line with findings of Leroy et al (2011) we want to test the notion that authentic leadership qualities of a leader influences his/her BI in the context of this study. This argument leads to our next two hypotheses.

H7: *Effect of AL on employee engagement is mediated by trust between the leader and the follower/employee.*

H8: *AL is positively associated with BI of a leader.*
Research model

METHODOLOGY

We plan to use a cross-sectional survey design to include samples from companies that have implemented Six Sigma in the last five years. To make our sample homogenous, we do not differentiate between the sizes and turnover of the firms and number of Six Sigma projects each firm has successfully completed. We will consider a simple, single stage sample where the sampling units are same as the sample elements: an individual employee in a firm. Our sampling frame will be websites and addresses such as American Society of Quality (ASQ) where they publish the list of case studies of firms that implement quality improvement programs such as Six Sigma. We will have a second sampling frame that is the list of employees in these firms. This is the actual list or reasonable facsimile of sampling units from which the sample will be selected. The existing list of employees on the list defines our survey population. We plan to sample from a mix of companies including health care providers, service providers, and firms in manufacturing. Since we are interested in exploring the possible relationship between the leadership characteristics and Six Sigma success, the appropriate unit of analysis would be an individual employee or person. In this case, the unit of analysis and the unit of observation are the same. Samples of individual leaders and followers will be studied and the impact of their respective characteristics on the outcome of the Six Sigma process will be computed and compared. For determining the Six Sigma performance or success, our unit of analysis will be a particular firm. We will control for the factors for transformational and transactional leadership.
Operationalization of variables

Authentic leadership (AL), the first independent variable in our model, will be measured by the four dimensions as suggested by Walumbwa et al. (2008): self-awareness, balanced processing, relational transparency, and internalized moral perspective. To measure these four dimensions of AL, we plan to use the 16-item AL Questionnaire (ALQ) developed and validated by Walumbwa et al. (2008). They not only have obtained evidence of validity for this research instrument but also have distinguished it from other research instruments that measure other positive forms of leadership. The frequency of AL behaviors displayed by a leader will be rated by the followers on a 5-point likert scale (0 for never and 4 for almost always). The items such as “My Leader seeks feedback to improve interactions with others” and “My Leader solicits views that challenge his or her deeply held positions” intend to measure self awareness and balanced processing respectively, whereas items such as “My Leader says exactly what he or she means” will measure the relational transparency and “My Leader demonstrates beliefs that are consistent with actions” will try to measure the internalized moral perspective of the AL construct. The questions addressed by different scales in this instrument are listed in Table 1.

Table 1. Authentic leadership measurement scales and questions addressed

<table>
<thead>
<tr>
<th>Scales</th>
<th>Questions addressed</th>
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<tbody>
<tr>
<td>Self Awareness</td>
<td>To what extent does the leader recognize his/her strengths, limitations, how he/she is viewed by others and how the leader influences others?</td>
</tr>
<tr>
<td>Relational Transparency</td>
<td>To what extent does the leader reinforce a level of openness with others that provides them with an opportunity to be forthcoming with their ideas, challenges and opinions?</td>
</tr>
<tr>
<td>Ethical/Moral</td>
<td>To what extent does the leader set a high standard for moral and ethical conduct?</td>
</tr>
<tr>
<td>Balanced Processing</td>
<td>To what extent does the leader solicit sufficient opinions and viewpoints prior to making important decisions?</td>
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Behavioral integrity and Trust

Behavioral integrity (BI) will be measured using an 8-item Likert scale (1-strongly disagree to 5-strongly agree) suggested by Simons (2007). Sample items are “My manager does what he/she says he/she will do” and “My manager conducts himself/herself by the same values he/she talks about”. We use the instrument developed by Simons (2007) to measure trust on a 3-item scale. Sample items include “I would be willing to let my manager have complete control over my
future in this company”. The details of the two questionnaires can be found in the appendices. Table 2 lists the conceptual definitions of BI and Trust and the interrelations between them.

**Table 2. BI and Trust: Definitions and Interrelationships (Simon, 2002)**

<table>
<thead>
<tr>
<th>Behavioral Integrity</th>
<th>Recognized trait of a person that describes a perceived pattern of alignment <em>between</em> another person’s words and deeds. BI is a present-time trait <em>whose ascription</em> draws on history.</th>
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<tr>
<td>Trust</td>
<td>The willingness of a person to be vulnerable to the actions of another person based on the expectation that the other will perform a particular action important to the trustor, irrespective of the ability to monitor or control that other person. BI looks back to the past, whereas trust looks forward toward future decisions. BI is expected to be one of key antecedents to trust.</td>
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**Employee engagement**

We use Q12 benchmark questionnaire developed by Gallup Institute to measure employee engagement in this study. The instrument was the result of hundreds of focus groups and interviews conducted by Gallup Institute. This survey has 12 questions to be rated on a five point scale. The break-up of the questions is like this. Two questions assess the Basic Needs of the employee; Leadership support is assessed by four questions; four questions assess Teamwork; and finally Growth is assessed by two questions. The ratings from the questionnaire are combined into an index to segment employees into three categories: actively engaged, engaged, and not-engaged.

**Six Sigma success**

Overall business performance of a firm is impacted by its quality performance (Garvin, 1984). Improvement in quality in manufacturing process results in enhanced productivity, lower non-conformance rate, reduction in waste, lower total cost of production, higher return in investment, and higher profitability (Kaynak, 2003). Also, an improved quality product is associated with greater customer satisfaction, higher sales and enhanced market share (Ahire & Dreyfus, 2000). Therefore, success of any quality improvement program can be measured by any of these factors in combination. We chose to measure Six Sigma success in terms of reduced non-conformance rate, customer satisfaction, and profitability. We use the instrument used by Zu et al (2008) for measuring Six Sigma success.
LIMITATIONS, FUTURE RESEARCH, AND CONCLUSIONS

This study has several limitations. One, the focus of the study is on finding the relationship of AL behavior and success of a Six Sigma process implementation. We try to measure AL behavior as our participants’ perceptions rather than the actual behavior. Also the measure of success of a Six Sigma process is perceptual and is not in actual numbers. Hence, it may be argued that this study may not reflect the actual AL behavior and its direct impact on Six Sigma success. Two, we sampled companies that have implemented Six Sigma in the last five years and significantly benefitted from this process. Our definition of significant benefit is not explicitly defined. Again we did not differentiate between the size of the sampled companies and a significant benefit for a small sized new firm may not be as significant for a large sized already established firm. So the findings of the study may have limitation in its generalizability. Three, the measurement of outcome of a Six Sigma process is somewhat limited in a sense that there are several other factors in estimating success of this process can also contribute to this outcome. Any further study in this direction can explore if behavior of an authentic leader at the top of the organization influences those factors that are responsible for a positive outcome of a Six Sigma process. Four, most of the data for our variables were collected from a single respondent of each sampled plant. Hence a problem of common method variance cannot be ruled out from the results. Although we tried to check for this problem with several statistical methods and we could not detect enough reasons for inferring common method variance to be a serious problem in this study, any attempts to collect objective data especially some numerical data to evaluate Six Sigma performance can present a greater accuracy of construct validity and discriminant validity. Five, the dependent variable in this case is a perceptual Six Sigma success. We tried to assess success of the process in terms of several factors such as profitability, reduction in defects, and customer satisfaction and its relationship with AL and BI. Although we found significant correlations between the independent and dependent variables, this should not be considered as a case of causality, as there may be other confounding factors affecting the dependent variables. It was difficult to isolate the effect of such confounding variables in the context of our study. This may again limit the internal validity of our findings. Last but not least, we used the AL Questionnaire (ALQ) developed and validated by Walumbwa et al (2008). Although this instrument is tested and used successfully by many past studies, this instrument has its own reliability, validity, and limitations in measuring what it tries to measure. Our study has all the limitations that this instrument may be having. Same can be said for all the other measuring scales used in this study.

The main contribution of this work is the integration and extension of two emerging theories: AL and BI in the leadership literature to the field of operations management. In this paper, we provide an insight to how authentic leadership qualities and behavioral integrity of a leader can facilitate and promote the Six Sigma process in an organization. To reap the best benefits of Six Sigma, both qualities in leaders are desired under different circumstances. To the best of our knowledge, this is the first paper linking AL theory and Six Sigma. Our study contributes to the quality management field that has been largely been considered to be lacking on strong theoretical foundations. The same can be said about BI theory; this research is among the first to investigate the relationship between BI of a leader and the success factors of a Six Sigma process. There could be several future directions for this research. Six Sigma being a relatively new concept, the performance reported in this study may not explicitly indicate its performance.
success. Future research may explore and investigate further with a larger sample size from more firms across more industries. Past research has studied if BI is an antecedent of AL, but in different contexts. It would be interesting to explore the same relationship in our context. Also it would be interesting to explore the conditions under which the AL and BI could have negative or less significant impact on Six Sigma outcome.

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REFERENCES


Swain

Six Sigma success: A view through leadership lenses


