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THE INTEGRAL ROLE OF ORGANIZATIONAL CHARACTERISTICS AND THEIR IMPACT ON LEAN IMPLEMENTATION SUCCESS

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DISSERTATION APPROVAL

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AN ABSTRACT OF THE DISSERTATION OF

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MAJOR PROFESSOR: Dr. Beth Freeburg

The increasingly competitive nature of the manufacturing industry has forced manufacturers to examine alternatives to traditional management philosophies. While there were several management systems such as Total Quality Management (TQM), Six Sigma, and Theory of Constraints utilized in the manufacturing sector, the lean management philosophy was the most utilized manufacturing management philosophy by far. Lean was based on the extraordinarily successful Toyota Production System (TPS) which was developed by the world class automotive manufacturer Toyota. Although lean's success had been proven it was not uncommon for companies that opt to implement lean concepts to meet with mixed results and sometimes even outright failure. This puzzling disconnect between the high level of interest in lean and the actual rate of successful lean implementations suggested there was a need for a closer examination of the problem.

The purpose of the study was to investigate the relationship between organizational characteristics and issues associated with lean implementation. The study identified the following organizational characteristics (a) *organizational leadership*, (b) *organizational culture*, and (c) *organizational change* and examined the role each played in lean implementation efforts. The study also looked at sixteen individual *intrinsic*

organizational characteristics to determine the extent to which each impacted lean implementation efforts.

The study utilized both qualitative and quantitative research tools. The qualitative component utilized both document analysis and interviews. The interviews were conducted with area business leaders who were members of the Department of Technology's Industrial Advisory Committee at Southern Illinois University Carbondale. The quantitative component utilized a separate on-line survey that was developed and administered to members of the Illinois Manufacturers' Association.

Results indicated highly capable leadership was the number one indicator of success for organizations that made the transition to lean. Other key factors included communication channels with an effective feedback system, the development of collaborative relationships between management and employees, being well versed in the practice of change management, and understanding how to effect change of cultural mores within an organization.

The implications of understanding how the organizational characteristics discussed in the study affected lean implementation empowered organizations to effect change more successfully. The goal of implementing lean successfully required much more than a step by step process of implementing the lean tools in a particular order. It required a broad understanding of the things which cannot be seen; things such as, what constitutes highly capable leadership, knowing how to change the mores of organizational culture, and understanding how to overcome the barriers to successful change management. Understanding these complex relationships provided the basis upon which to advance lean implementation theory where it had been only marginally successful.

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CHAPTER I

INTRODUCTION

Lean is a management philosophy based on operational efficiency and originally was utilized in the manufacturing sector. It has been recognized as the most widely-employed manufacturing management system currently utilized in the United States, according to a national survey in Industry Week, (Blanchard, 2006). Based on the Toyota production system (TPS) created by the Japanese, lean concepts were widely popularized in the 1990s through the research of Womack and Jones (1996). Detailed information of exactly how the system worked was initially limited, but continued interest spurred additional research and as a result many books about lean have been subsequently published. Lean has been successfully implemented in a broad range of company types such as Doyle Wilson Homebuilders, Porsche, Pratt & Whitney, and the Wiremold Company (Womack & Jones, 1996).

Lean concepts, while seemingly easy to understand, present many challenges to companies attempting implementation. There is much confusion about this issue and how to address it. Consequently, extensive research is required to find solutions to this challenging problem. So, in an effort to better understand the phenomenon of problematic lean implementation, this research examined organizational characteristics to discover their correlation to lean implementation issues. Once identified, the characteristics attributed to lean implementation complications could be systematically reduced/eliminated, and those shown to promote successful implementation efforts could

be reinforced. To more fully understand the complexities of this issue, it is necessary to present a brief overview of previous manufacturing philosophies.

Background of the Study

The model used for manufacturing consumer goods has been in a constant state of flux since its inception. Although there were divisions of labor for tasks such as hunting and gathering, the production of manufactured items was originally in a very primitive state. Items were generally manufactured entirely by one individual rather than by a host of highly trained specialists such as seen today. Some of the earliest production methods had little semblance to what was seen in the then current highly efficient, technologically advanced manufacturing facilities. The original focus of manufacturing was oriented more toward the individual rather than supplying products for the masses as in the current times. Systems of production or managerial philosophies such as used to guide modern-day production operations had not yet been conceptualized. Groover (2001) stated,

> The early fabrication of implements and weapons was accomplished more as crafts and trades than by manufacturing as we know it today. The ancient Romans had what might be called factories to produce weapons, scrolls, pottery, glassware, and other products of the time, but the procedures were largely based on handicraft. It was not until the *Industrial Revolution* (circa 1760 – 1830) that major changes began to affect the systems for making things. (p. 26)

While the craftsman style of manufacturing often required lengthy apprenticeship periods, sometimes several years, the advent of the Industrial Revolution brought about the innovative concept of management systems.

Out of this ground-breaking change came the formulation of a management model known as scientific management. The scientific management style, credited largely to Frederick Taylor, introduced management into manufacturing to improve efficiency which led to reduced costs (Groover, 2001). The premise of scientific management was to change manufacturing styles from the craftsman type methodology, where one person crafted the entire product, to one in which jobs were broken down into very simple steps that anyone could do, which eliminated lengthy and costly apprenticeship training. Taylor believed workers in the general workforce were not capable of meaningful intellectual contribution and advocated a *do as you were told* approach. This management style advanced manufacturing efficiencies exponentially and has been in use for many years. The scientific management system had not been exempt from evolutionary advances however, as the relatively recent development of the lean management style has exhibited even greater operational efficiencies.

Lean represented a significant departure in management theory from the Taylorian-based principles of scientific management developed nearly 100 years earlier. The primary focus of lean was to eliminate waste, which reduced costs and led to improved operational efficiency. Kochan and Lansbury (1997) stated that, while lean emphasized reducing cost, it did so by integrating worker input regarding conceptual responsibilities and the carrying out of production duties. According to Spencer and Carlan (2008), "Due to production's emphasis on physical strength and mental skills, it should be viewed as distinctly different and significantly contrary to Taylorism" (p. 274).

Taiichi Ohno, an engineer at Toyota is largely credited with the development of lean (Groover, 2001). The lean management philosophy is often considered synonymous

with the Japanese-based Toyota Production System (TPS) because the lean name was derived from the TPS characteristic of increased productivity with fewer resources, which led to a lean operation with relatively little waste. Although lean went by several similar sounding names, such as lean manufacturing, lean production, and lean enterprise, they all utilized similar ideologies and were referred to in this study as lean. The reason for the *enterprise* connotation came from the realization from many in industry that lean concepts are universal truths applicable to the entire organization. Alukal (2006) suggested, "In the office functions of a manufacturing firm or in a strictly service organization, many of the same tools and techniques are applicable but in a slightly modified form" (p. 32).

Although lean concepts in various forms have been around for many years, the way in which they were now being so successfully employed by Toyota was somewhat of an enigma. Many companies had noted Toyota's success with lean and had tried to duplicate it. However, what seemed like a relatively straightforward adoption of the lean philosophy at times was met with mixed success. Consequently, there was need for an investigation into organizational characteristics in order to determine to what extent they influenced lean implementation. Söderquist and Motwani (1999) posited,

> For both managers and scholars, this kind of research has identified a new area of the highest strategic importance and academic interest. However, there is very little literature, in terms of case studies or examples that focuses on the daily struggle in companies of transforming these strategies into working practice. (p. 1108)

Still, there was widespread recognition that the principles of lean were sound and there was a continuing movement within the manufacturing industry toward the adoption

of lean in some form. Since there were many different types of manufacturing organizations, it was important to identify the causes that led some lean implementations to be successful when others were not. In order to do this, a fundamental question needed to be answered. What salient organizational characteristics affect lean implementation? In order to answer this question, an initial pilot study was conducted that consisted of doing interviews with experts in the field of lean. The data from the pilot study indicated there were four key categories that had an obvious impact on lean implementation. The subsequent discussion provides a cursory look at these categories.

Key Organizational Characteristics

The phrase *organizational characteristics* represents a broad expression that had been identified by the pilot study and divided into four distinct yet interrelated categories. For the purpose of this study, these categories included *organizational leadership*, *organizational culture*, *organizational change*, and *intrinsic organizational factors*. In order to distinguish the extent to which these categories affected lean implementation, each was examined individually. The following is a brief introduction to organizational leadership, organizational culture, and organizational change concepts as well as examples of intrinsic organizational factors that influence lean implementation. A deeper examination of these categories and how they form a conceptual framework to support the research conjecture is presented in Chapter Two. Understanding how each affected lean implementation provided the basis upon which to advance lean implementation theory where it is now only marginally successful. Organizational leadership was the first category to be examined from the four organizational characteristics.

Organizational Leadership

The first of the four categories listed under the broad umbrella of organizational characteristics was organizational leadership. The general purpose of leadership is to provide an overall vision for the organization while investigating new ideas, making quick decisions, encouraging cooperation, and avoiding being overcautious (Ekvall & Arvonen, 1991). These functions were then developed through the use of effective planning and decision making into a clear sense of direction for the organization. A proven track record of effective planning and decision making promotes trust between the leader and the rest of the employees. This trust fosters faith in the leader that he/she has the best interest of everyone involved and makes it easier for the organization as a whole to cope with drastic change. Leaders and managers are responsible for change strategy, implementation, and monitoring; thus, they function as change agents (Kanter, Stein, & Jick, 1992). Consequently, with the hastened pace of organizational change, effective leadership is more important than ever (Gilley, McMillan, & Gilley, 2009). Organizational leadership requires the ability to marshal a complex array of both internal and external factors into a positive and cohesive force for the organization. In order to better understand how this is accomplished when implementing lean, leadership characteristics had to be examined. Gaining insight into leadership characteristics such as the style of leadership, extent of lean training, knowledge of change management theory and so forth, was essential to identifying fundamental precepts of successful organizational leadership within the context of lean. Organizational culture is another key component that must be understood for the implementation of lean to occur. The subsequent discussion of this topic brings

into focus the challenges organizations have when dealing with cultural change when attempting to implement lean.

Organizational Culture

The second category of organizational characteristics, as described in this research, was organizational culture. It has been noted that organizational culture is analogous to an individual's personality, an unseen but unifying theme that provides purpose and sense of direction. (Kilmann, Saxton, & Serpa, 1985) According to Shafritz, Ott, and Jang (2010), culture was seen as an "intangible phenomenon, such as values, beliefs, assumptions, perceptions, behavioral norms, artifacts, and patterns of behavior" (p. 338). A general overview of organizational culture depicted mannerisms within a particular group. Therefore, this discussion focused on culture within a group setting. Whether a situation involves few individuals in a small social setting or a large group, there is always this hidden force, culture, that serves to naturally bond the individuals together. Organizational culture, especially in the context of a Japanese-oriented management system being adopted by non Japanese-oriented businesses, is particularly important due to the powerful impact of Japanese/American cultural differences. Understanding these differences and an in-depth examination of the role culture plays in the adoption and integration of a new management philosophy is essential for addressing the sensitive issues of cultural integration. Some anticipated effects on the outcome included reduced employee alienation and resistance, thus resulting in increased lean implementation success. This research looked at the role of culture not only from an organizatational perspective, but in the particular context of how it affected lean implementation. Organizational change is

another of the critical components that affect lean implementation. The following explanation sheds light on the complexity of this issue.

Organizational Change

The third category of organizational characteristics noted here was organizational change. Organizational change theory is a complex labyrinth of ideas formulated about how and why organizations change as they do. There was no one gold standard for how to implement organizational change correctly in all situations. Consequently, organizational change is often problematic. According to Kramer, Dougherty, and Pierce (2004), the probability of any change project realizing planned financial and strategic objectives has been found to be 25-50%. In order to identify and master effective lean implementation techniques and eliminate marginal ones, it is essential to figure out what makes organizational change function on a more elemental level.

The concepts of organizational leadership, organizational culture, and organizational change will be examined more in-depth in Chapter Two as part of the conceptual framework regarding organizational characteristics. It should be noted that in the context of this study, organizational leadership, organizational culture, and organizational change were considered categories of a *general* nature. They affect all organizations in a somewhat common or universal manner. The next category, intrinsic organizational factors, has a different focus but is no less important to understanding the lean implementation process.

Intrinsic Organizational Factors

The fourth category within the overarching theme of organizational characteristics, as identified for this study, was intrinsic organizational factors. *Intrinsic organizational factors* are unique attributes that are specific to each individual organization. The factors, as used in this study include such things as the age of the organization, organizational adaptability, leadership effectiveness, teamwork oriented, management/employee training, management/employee relationship, number of management levels, number of employees, management/employee buy-in, union organization, nonunion organization, employee resistance to change, management/employee communication, understanding of organizational culture theory, environment of continuous improvement, and management's understanding of change management theory. Although the intrinsic organizational factors vary from one organization to the next, from a holistic perspective there are commonalities among organizations as a collective whole that present a framework from which to develop an assessment of organizational characteristics that, in general, affect lean implementation. Intrinsic organizational factors were examined to define an unifying theme that could make successful lean implementation techniques applicable on a more universal level to all organizations.

The four key categories within organizational characteritics, *organizational leadership, organizational culture, organizational change, and intrinsic organizational factors* are interrelated as can be seen from the categorical representation in the Venn diagram illustrated in Figure 1. Each category had multiple issues, and changes in any one of the four would affect the other three by changing the relationships to one another within the group. The overlapping section in the center that contains segments from all four key

categories represents an *area of agreement* or success in lean implementation. While it was impossible to show every factor that impacts lean implemetation, this visual model exemplifies the interdependent dynamics of those relationships.

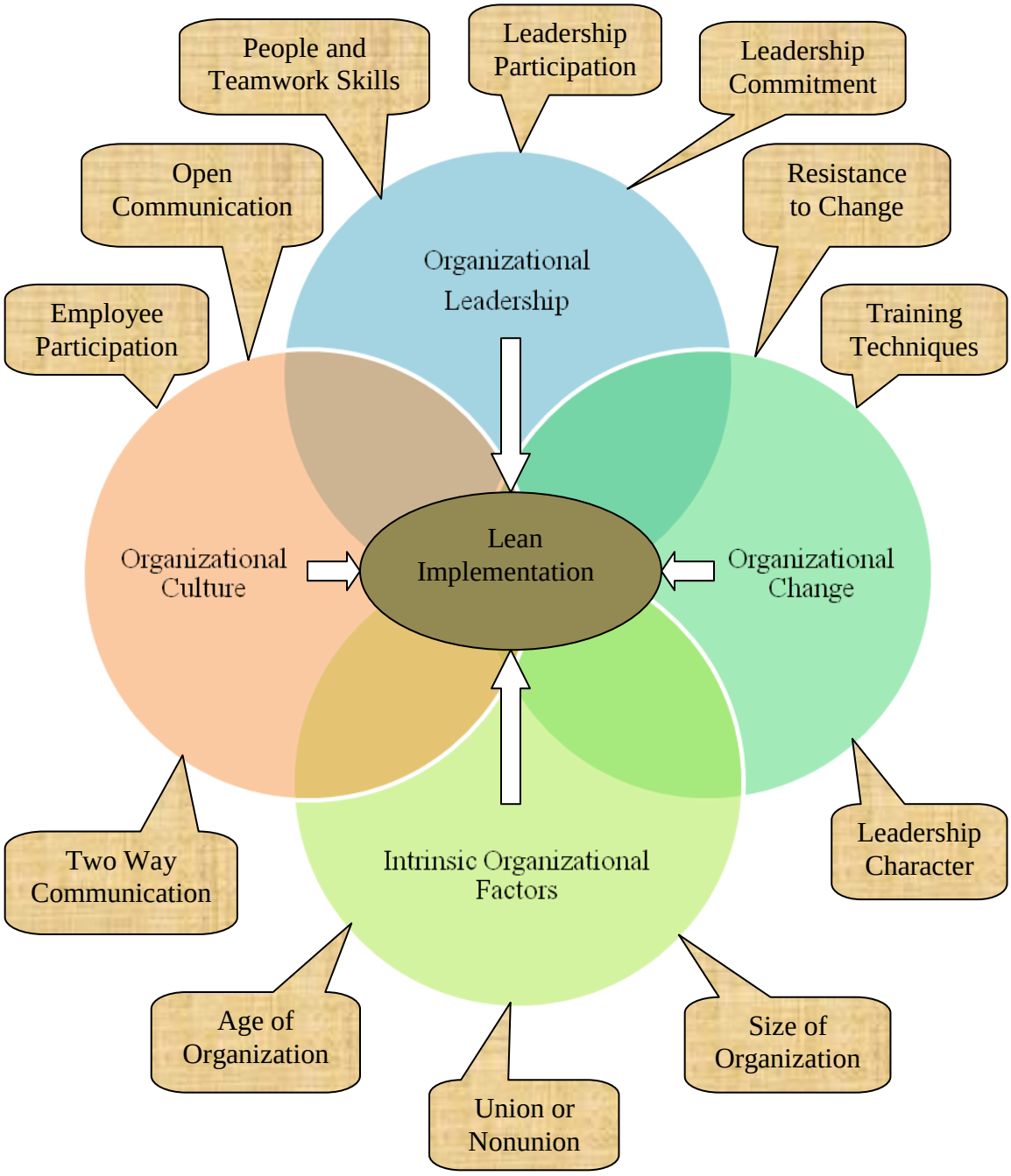

Figure 1. Relationship of four key organizational characteristics affecting lean implementation.

Statement of the Problem

A management system for manufacturing operations has been developed that is improving operational efficiency for many organizations. The system, known as lean, is rapidly growing in popularity and has been proven effective in the U.S. and abroad. However, there is a disconnect between some U.S. companies that want to utilize lean and those that are able to successfully implement it. Unless problems associated with implementation are understood and addressed, issues that contribute to problematic lean implementation in these companies are likely to continue.

Purpose of the Study

The purpose of the study was to investigate the relationship between organizational characteristics and issues associated with lean implementation. In particular, the study identified organizational characteristics which, for the purposes of this study, include (a) *organizational leadership*, (b) *organizational culture*, and (c) *organizational change* to determine how each influences lean implementation efforts, and (d) also determine the extent to which *intrinsic organizational factors* impact lean implementation efforts.

Research Questions

This study examined organizational characteristics in an effort to identify salient factors affecting lean implementation. Four research questions guided the study:

Research Question 1: What role does organizational leadership play in lean implementation?

Research Question 2: What role does organizational culture play in lean implementation?

Research Question 3: What role does organizational change play in lean implementation?

Research Question 4: To what extent do intrinsic organizational factors affect lean implementation?

Significance of the Study

Global competitiveness is causing the loss of a nearly unprecedented number of U.S. manufacturing jobs (Bivens, 2006). Technological advantages that once provided U.S. manufacturers job security are now easily purchased by international competitors resulting in a reduced level of global competitiveness for the U.S. manufacturing sector. International competitors have vast numbers of workers willing to work for a fraction of the wages earned by American workers. This is not a recent occurrence, but rather a long-term trend that is continuing to threaten the U.S. economy on both national and state-wide levels.

The manufacturing management philosophy, lean, has been proven effective and is available to U.S. companies seeking ways to remain competitive in the global marketplace. Based on the outstanding success of organizations that incorporate lean principles such as Toyota, Porche, Boeing, Lockheed Martin, Alcoa and many others, lean is arguably a logical step forward in the struggle to stem the loss of high-paying U.S. manufacturing jobs. Although some companies are utilizing lean techniques successfully, a number of manufacturers are still stumbling through the implementation process with

mixed results. The intent of this study was to provide a more clear picture of the organizational characteristics conducive to successful lean implementation so that Illinois-based companies can take advantage of these techniques in their efforts to become more competitive.

It is vital to know not only which characteristics affect lean implementation, but also which ones are most influential in the lean implementation success. This information will provide a sense of direction in determining how and where to allocate resources that most effectively support lean implementation initiatives.

Limitations of the Study

The chief limitations to the study involved the time and expense required. A lengthy research study, within the time constraints of the Ph.D. program, was impractical. Equally problematic would be funding a large scale study. Working with available resources was a necessity to finish in a timely manner. Another limitation was the extremely low response rate to the on-line survey. With such a low response rate, survey validity was marginalized.

The results of the study were intended to be generalizable to all Illinois manufacturers. However, due to the marginal validity of the Illinois Manufacturers' Association survey, the results were primarily generalizable to only the manufacturing organizations involved in the interviews.

Delimitations of the Study

The research study, although not all inclusive, was based on the responses of two groups. The first group was the Industrial Advisory Committee which works in conjunction with faculty from the College of Engineering's Department of Technology at Southern Illinois University Carbondale. The second group was a consortium of manufacturers known as the Illinois Manufacturers' Association.

Definition of Terms

Implementation Process. An organized plan of putting something into effect or action. In the context of this study, it referd to the systematic replacement of a traditional management system with a lean management system within an existing manufacturing operation.

Intrinsic Organizational Factors. Factors inherent in an organization such as age, number of employees, or number of management levels.

Lean. A manufacturing management philosophy based on the Toyota Production System. The premise of the philosophy is to achieve operational effectiveness by finding ways to eliminate waste throughout the organization.

Management Philosophy. The administrative viewpoint and plan of action to achieve an objective as it pertains to controlling the affairs of a business. In the context of this study, it refers to traditional vs lean management philosophies used in a manufacturing operation.

Organizational Culture. An "intangible phenomenon, such as values, beliefs, assumptions, perceptions, behavioral norms, artifacts, and patterns of behavior" (Shafritz, Ott, & Jang, 2010, p. 338) shared by the members of an organization.

Organizational Change. A situation where the organizational structure of a company experiences substantial change in the way it operates.

TPS. The Toyota Production System, or TPS, as it is known is a manufacturing management philosophy developed in large part by an engineer at Toyota named Taiichi Ohno. Ohno's insightful perspectives about waste elimination led to counterintuitive ideas that overturned long held beliefs about operational efficiencies in manufacturing.

CHAPTER II

REVIEW OF LITERATURE

Status of Lean Research

The Toyota Production System (TPS) has been a work in progress at Toyota since the 1950s. Only since Ohno published a book on the TPS methods, first written in Japanese in 1978 and later in English in 1988, did it come into the mainstream public awareness. Since that time, there has been a great deal of interest by researchers in the TPS ideas which came to be known as lean because of the concept of waste elimination. Although the name lean has undergone several revisions in reference to manufacturing, it has recently gained widespread attention as a management philosophy in other areas due to its universal concepts. Lean concepts are applicable not only to manufacturing, but also in service sectors such as office work, healthcare, and accounting. There are currently many levels of lean certification courses offered that prepare lean practitioners for a variety of fields.

The purpose of the study was to gain a more clear understanding of issues affecting lean implementation in order to help Illinois manufacturers become more competitive. This was done by investigating the relationship between organizational characteristics and issues associated with lean implementation. In particular, this study identified organizational characteristics which for the purposes of this study include (a) *organizational leadership* (b) *organizational culture* and (c) *organizational change* to determine how each influences lean implementation efforts; and (d) also determine the

extent to which *intrinsic organizational characteristics* impact lean implementation efforts. The subsequent narrative is a review of literature currently available on the topic.

Historical Evolution of Lean

The development of the Toyota production system (TPS) began in the 1950s. The focus of TPS is to eliminate waste in every way possible. Although successfully employed at Toyota, TPS remained in relative obscurity for over three decades. The publication of books by Ohno, Womack, Jones, Roos and Carpenter in the 1980s and 1990s shed light on this manufacturing philosophy that later came to be known as lean. Lean is often considered synonymous with TPS; and the term lean is in fact a nickname based on characteristics of TPS. However, lean concepts have been the result of an evolving progression of manufacturing methodologies; beginning with the earliest craft type of manufacturing and leading up to today's sophisticated systems of manufacture. Lean concepts were in existence long before Toyota began developing TPS. To better understand the lean transition and how it impacts current lean implementation efforts, significant evolutionary milestones were examined chronologically.

Handicraft Production

Manufacturing has always been a necessary component of man's survival, whether to provide clothing for protection from the elements, or weapons for self-defense and hunting. The earliest manufactured items were hand-made and each item produced had distinctly unique characteristics. Ndahi (2006) noted, "Handicraft production can be traced back to the beginning of civilization when goods were produced to satisfy basic human

needs" (p. 14). Early workforce structures relied on craftsmen to gain skills necessary to create products entirely by one person.

Industrial Revolution

As early manufacturing methods advanced, there came a period during the late 1800s and early 1900s known as the Industrial Revolution. The significance of this era was due to the way in which manufacturing methods changed and their subsequent impact on society. The Industrial Revolution marked a turning point in history where the use of animals and manual labor were largely supplanted by mechanized equipment. Led by steam and water-powered machinery, and begun primarily in textile mills, productivity increases were dramatic (Meier & Rauch, 1995). As technology continued to advance and with the introduction of electricity and electric motors, productivity continued to increase at remarkable rates. The era of rapid technological advances is sometimes called the Second Industrial Revolution. There was a profound effect on society brought about by socioeconomic and cultural changes due to the changes in transportation, agriculture, mining, and manufacturing.

Interchangeability of Parts

According to Black (1991), "although England was on the forefront of the Industrial Revolution, an important new idea involving the interchangeability of parts for manufactured items was being pioneered in the United States. Eli Whitney (1765-1825) is largely credited for developing this concept, although many others were cognizant of its importance" (p. 27). Groover (2001) stated,

> Whitney perfected his interchangeability of parts as a result of working drawings, tolerances, and most importantly, the development and use of machine tools. The secret behind his achievement was the collection of special machines, fixtures, and gages that he had developed in his factory. Interchangeable parts manufacture required many years of development and refinement before becoming a practical reality, but it revolutionized methods of manufacturing. (p. 27)

Busch, Harlow, and Thompson (1998) noted that even though the interchangeable concept was recognized as a revolutionary step forward, the early standard was not based on a system of measurement as we know it, but instead on a model that was handmade representing the specification of how the component was to be made. It is believed that Ford used a method like this for manufacturing the Model T. The next significant initiative in manufacturing management, scientific management, was introduced during the Industrial Revolution era as well.

Scientific Management

Around the turn of the nineteenth century there was a new movement called *scientific management*, "led by Frederic W. Taylor (1856 – 1915), Frank Gilbreath (1868 -1924) and his wife Lilian (1878 – 1972), and others" (Groover, 2001, p. 27). Scientific management was developed to control the activities of a growing number of workers in production jobs. Components of scientific management were designed to examine production activities for waste, inefficiencies, and effectiveness through processes known as time study, work standards, motion study, standards in industry, piece rate system, process chart, data collection, bookkeeping, and expenditure accounting in factory

operations (Groover, 2001; Ndahi, 2006). One aspect of the scientific method was to break every job down into individual components so that anyone could perform a simple operation, which resulted in less specialization. At this point, specific operational standards were set and each operation was subjected to a time study. A new level of efficiency was discovered and productivity rose. Ndahi (2006) explained the significance of these advancements by saying,

> These developments have expanded the activities of manufacturing beyond the idea of machines and tools to the inclusive concept of organization and management. This new concept gave rise to the assembly line (or mass production) by Henry Ford in the early 1900s. Further developments continued with Edward Deming's total quality management (TQM), which links the quality of a product to the company's management technique. (p. 14)

Shewhart's seminal concepts of statistical control for manufacturing processes were also considered significant contributions (Manuele, 2007). Ford was able to build reasonably priced vehicles by taking advantage of task specialization, mass production, and staying with a very specific item (Ndahi, 2006). Current scientific management concepts include a mix of many of the earlier ideologies as well as an ever evolving mix of global philosophies such as lean and Six Sigma, a statistically based method to reduce variation within a manufacturing process.

Mass Production

Henry Ford used the scientific management model but added an important new concept, which later became known as *mass production*. In 1913, Ford designed the

Model T Assembly Line so that all the processes were in the same sequence as the build. "Prior to this, all manufacturing processes (stamping, welding, etc.) were grouped together creating batch manufacturing" (Epply & Nagengast, 2006, p. 1). According to Brett and Queen (2005),

> Ford likened his Lean Flow process, which has also been called Lean Manufacturing, Continuous Flow, and more recently, Just-In-Time Manufacturing, to a river that flowed continuously: Anything that disrupted the flow was a waste that must be eliminated. Using this methodology, Ford Motor Company could start and finish a Model T in just over 30 hours. (p. 61)

Assembly lines in modern manufacturing facilities utilize similar, but greatly updated ideologies which have become known as lean manufacturing. Green (2002), pointed out that this is not a new management practice or concept. Henry Ford actually practiced lean manufacturing in his company. Levinson (2002) noted that two of Henry Ford's books; *My Life and Work* (1922) and *Moving Forward* (1930) described lean manufacturing techniques. "These references are a strong indication that lean manufacturing actually began in the United States decades ago" (Green, 2002, p. 64).

Toyota Production System

Groover (2001) noted, after Ford, the next major evolutionary step in lean development was credited largely to Taiichi Ohno (1912 – 1990). Ohno, an engineer at Toyota, was largely responsible for the creation of the Toyota production system (TPS). Although seemingly counterintuitive in some contexts and largely ignored by the manufacturing community at the time, Ohno's ideas were eventually validated with the

phenomenal success of Toyota. Barnes, Lightfoot, Williams and Greenough (2006) agreed that "the value of the lean paradigm to the success of manufacturing is now without question" (p. 1539). However, it appears that while lean is based on TPS ideas, and U.S. manufacturers are receptive to the lean concepts, they are not willing to commit fully to TPS philosophies.

Lean Defined

With the significance of lean becoming increasingly apparent it is more important than ever to gain a greater understanding of the integral nature of this philosophy and how it complements traditional management systems. Therefore, the following is an examination of Ohno's influence on the development of lean, the origin of the lean name, a discussion of key components, and how the unique confluence of lean's components are focused.

Taiichi Ohno – The Inspiration for Lean

Ohno, the Toyota engineer known for work on the Toyota production system (TPS), was guarded about publishing work on the subject. Nothing was allowed to be recorded regarding these efforts for fear of causing the process of continuous improvement to become crystallized (Ohno, 1988). However, after a career spanning three decades and coinciding with retirement in 1978, Ohno published a book detailing the inception, development, and philosophy behind TPS. Although originally published in Japanese in 1978, the book was later translated and published in an English version in 1988. This book is considered not only a seminal piece of work for Ohno, but an essential

resource for those interested in learning about the foundational concepts of lean as well. The following details how the term *lean* came about.

Origin of Lean Name

The origin of the name *lean* came about as the result of a nickname for the Toyota Production System. Groover (2001) explained the term *lean production* was coined around 1989 with the popularity of the book, *The Machine that Changed the World*, authored by Womack, Jones, Roos and Carpenter (1990). The authors noted how Toyota was doing more and more with less and less and observed the lack of waste and overall leanness of the operation. Hence, the term lean production became a popular way to explain the operational efficiency of Toyota's manufacturing facilities. Consequently, this is why lean and TPS are often used synonymously.

According to Yingling, Detty, and Sottile (2000), Americans came to realize, through Womack and Jones' writings, that elements of the Japanese manufacturing system such as cost, delivery, flexibility, and quality were part of a comprehensive management philosophy. They stated,

> Moreover, Womack and Jones demonstrated that, in the automotive industry, lean manufacturing offered more than a 2.5:1 cost advantage over mass production approaches traditionally practiced. Only the earlier transition from craft manufacturing to mass production led by Henry Ford and others in the early 20th century has offered more dramatic cost advantages (estimated at a 9:1 ratio). (p. 215)

Lean Focus

To understand lean as a management philosophy, it must be noted that the historical evolution of production systems provided examples of lean management styles predating the development of the Toyota Production System (TPS). As will be shown in subsequent discussions of TPS, components of lean were already in existence well before Ohno started crafting Toyota's production system. What makes lean/TPS different from traditional management systems is its unique focus. Ohno's principle goal was the elimination of muda (Ohno, 1988), or what is known as waste. Although others, especially Ford, were keenly aware of waste in the system and did much to eliminate it, no one made it the primary focus of their management philosophy. For Ohno, the central theme of TPS was waste elimination, and a relentless pursuit of this goal ultimately became the foundational concept upon which the TPS was developed. Recognizing there were many ways to accomplish a job, Ohno knew the way that had the least amount of waste was the most operationally efficient. This conceptualization resulted in a production system in which all elements of the system were benefactors of waste elimination.

Womack and Jones (1996) provided a simple definition for waste as "any human activity which absorbs resources but creates no value" (p. 15). Ohno (1988) stated, "True efficiency improvement comes when we produce zero waste and bring the percentage of work to 100%. The preliminary step toward application of the Toyota production system is to identify wastes completely" (p. 19). Ohno identified seven forms of waste: (a) waste of overproduction, (b) waste of time on hand (waiting), (c) waste of transportation, (d)

waste of processing itself, (e) waste of stock on hand (inventory), (f) waste of movement, and (g) waste of making defective products.

Ohno (1988) explained, "The basis of the Toyota production system is the absolute elimination of waste. The two pillars needed to support the system are *just-in-time* and *autonomation*, or autonomation with a human touch" (p. 4). An examination of the literature contrasted the traditional versus lean management ideologies and explained key lean concepts such as just-in-time, kanban, push versus pull, and autonomation.

Traditional Management Methods Versus Lean

Although traditional and lean management methods have a host of similar characteristics, for the purposes of this study, it is their distinctive differences that are of relevance. To gain a better understanding of exactly what lean is it is necessary to provide at least a cursory definition of long-established manufacturing methods whereby these differences may be highlighted. Subsequent discussions will focus on lean components where the contrasting viewpoints may be noted in detail.

Traditional manufacturing models use a system that relies on large quantities of stock on hand to prevent stockouts on the production line. This strategy ensures workers will always be productive and helps to keep manufacturing efficiencies high. Large finished inventories are also maintained *just-in-case* there is a sudden surge in market demand to prevent stockouts in retail outlets, according to Womack and Jones (1996). This type of model is problematic because of the large amount of capital investment required to keep the operation going. There is also a flawed assumption that high

production efficiencies are always a good thing. Brown, Collins, and McCombs (2006) noted,

> Traditional batch manufacturing focuses on one main theme or production philosophy - run as large a batch as is economically feasible in order to avoid changing over equipment. Many times, however, this philosophy is contrary to what the customer actually wants, needs, or is willing to hold in inventory. (p. 3)

There is a distinct difference between production efficiencies and operational efficiencies. High production efficiencies are based on the *economies of scale* concept of *the more items produced the cheaper the cost per unit*. Operational efficiencies are based on overall efficiency of the manufacturing operation as a whole. While high volume output *could* lead to high operational efficiency, there is a notable exception to the rule. When orders consist of merchandise that has a large degree of variation possible, such as the many available options on new automobiles from which it is possible to produce a near infinite number of combinations (Ohno, 1988), manufacturing concepts utilizing high production efficiencies based on economies of scale begin to lose their legitimacy.

Ohno's *just-in-time* approach shifts the focus from production efficiency to operational efficiency, which reduces the cost per unit through waste reduction rather than production efficiencies brought about by high volume requirements. The just-in-time approach eliminates large raw and finished goods inventories, leading to improved operational efficiencies (Ohno, 1988). The large raw and finished goods inventories are often referred to in traditional manufacturing as just-in-case buffers. These just-in-case buffers, or reserves of raw and finished goods, serve as a means of preventing stockouts within the manufacturing facility as well as to the retailers. The premise of just-in-time is

that large raw and finished goods inventories are kept in stock just-in-case there is unexpected equipment failure in the manufacturing process that throws the production schedule off, or a sudden spike in consumer demand. Either of these events could potentially cause product shortages for the consumer and ultimately loss of consumer confidence in the company. The just-in-case versus just-in-time ideologies are in direct conflict with one another in the traditional versus lean management systems. With key differences in the two manufacturing styles outlined, the discussion now moves to lean components, beginning with what just-in-time is and how it works.

Just-In-Time

The first pillar of lean was what Ohno called just-in-time. This was a term used to describe the flow of the right parts required for the assembly of a product, arriving at the right time and in the right quantity (Ohno, 1988). The idea behind developing the just-in-time system, which is in direct contrast to just-in-case, was to prevent the buildup of large levels of inventory waiting to be used in the production operation, also known as work in process (WIP), as well as large finished goods inventories stored in warehouses. The just-in-time system uses advanced systemic techniques such as kanban and a pull model to accomplish on-time deliveries to consumers instead of inventory buffers used by the just-in-case approach. As noted previously in Ohno's list, excessive stock on hand (*inventory*) is considered a form of waste.

Kanban

Ohno took a radically new approach to solving these issues through the *just-in-time* concept from Toyoda Kiichirō, longtime mentor and one-time president of Toyota (Ohno, 1988). Based on this idea, a system was developed that utilized information cards that were sent between work stations to signal the need for more parts. This system is known as kanban (sign board). The cards contained information detailing things such as the part number, order number, and amount needed along with other data required to move the required materials throughout the production process in a timely manner as needed. What made this system fundamentally different from traditional systems is how orders were generated.

Push Versus Pull

Orders are typically generated from historic, marketing, and economic data used in forecasting by managers in the main office. Merchandise is produced, and large inventories are stored in warehouses, in hopes of consumers being ready to buy as was forecast. This is known as the *push* model because of the nature of pushing the product from the front office to the consumer. Ohno's reverse thinking pioneered an approach utilizing a different strategy. Ohno considered finished goods inventories a form of waste. So, to eliminate these inventories he developed what is known as a *pull* model (Womack & Jones, 1996). In the pull model, orders are generated by customer requests for a particular product. Items are produced only when there are customers ready to buy the product, thereby eliminating the storing of finished goods in hopes of finding buyers. The kanban system is used as follows. When orders are placed, kanban cards are sent

upstream in the process flow to initiate production of the exact number of units required to fill the order. This method ensures no overproduction, which eliminates or greatly reduces work in process (WIP) and finished goods inventories, thereby increasing operational efficiencies through the elimination of waste from the system. The other pillar, as Ohno called it, is autonomation.

Autonomation

In production settings, manufacturers are frequently looking for ways in which machines can be automated, leaving the operator available to run multiple pieces of equipment simultaneously. The advantage of this seems readily apparent as labor costs are greatly reduced. Ohno (1988) observed that many previous studies indicated that manufacturing costs did not necessarily go down. Although fewer operators were needed for the same amount of machines, the situation was problematic. Automated machines can and frequently do produce many parts that are out of design specifications due to lack of operator attendance. Tooling gets dull and breaks as well as a host of other issues that occur resulting in the machine continuing to run without regard to quality requirements. Consequently, the savings in labor costs are transferred to product rework or scrap replacement costs.

The idea for autonomation came from Sakichi, inventor of the first auto-activated loom and founder of the Toyota Motor Company (Ohno, 1988). The significance of the auto-activated loom was the machine's capability to detect a problem with the threads being spun and to automatically stop the loom in order to prevent bad product. Ohno capitalized on this concept by finding ways to introduce autonomation into other

manufacturing processes in his quest to eliminate waste in the manufacturing process. Complementing the two main tiers of the system is a host of *tools* designed to purge the system of waste.

Lean Tools

Although there are numerous interpretations as to exactly how many tools are in the lean arsenal, the seven significant categories outlined here provide methods with which to systematically eliminate or greatly reduce waste within the system. The following overview describes, in part, a variety of techniques contained within these tools to accomplish the goal of waste elimination. It is important to know, that before any lean concepts can be applied it is imperative to have full management support. Although this is not a tool, it is a necessary first step in the process of organizational change. The tools used in the lean process are listed in a general order of implementation although some are often completed simultaneously.

Value Stream Mapping

A process called value stream mapping is utilized to eliminate waste from a manufacturing process by examining all steps required to manufacture a product and removing those steps that add no value to the product. Once a particular product is selected a plan of action is put in place identifying all steps required to produce the product. This includes every step from the time an order is placed until the finished product is sold at a retail outlet. The premise is to determine exactly how the product is currently being produced through a mapping process that illustrates each step of the

process in picture form. The picture can be illustrated through pencil drawings, photos, or sophisticated computer models. This process is called the *current state* of the value stream. The results are analyzed to find steps where no value is being added to the product. The no-value added steps are considered waste. Once the no-value added areas have been found, a new or *future state* value stream is created. The future state value stream eliminates, to the extent possible, these areas of waste. The final step is to develop and institute a plan in accordance with the future state value stream. According to Rubrich and Watson (2004),

> Ford is credited with introducing process mapping as early as the 1920s to graphically display all of the things happening in a series of operations. The Japanese and Toyota in particular, are credited with refining and perfecting Value Stream Mapping, which they also refer to as *material and information flow maps*. (p. 158)

5S

In any place of work there is a need for an organized environment that facilitates productivity. "The 5S's are the keys to workplace organization, housekeeping, and visual management" (Rubrich & Watson, 2004, p. 59). There are five words that start with the letter *S*, and each represents a component of the 5S tool. These individual elements include the following:

Sort – Arrange items needed for immediate production in such a manner so as to have instant access to them. Unused items such as fixtures and tooling are placed in

proper storage areas until needed for a particular job. Items which are obsolete, unidentifiable, or broken beyond repair are discarded.

Straighten – Create an orderly system in which to store items such as fixtures and tooling that is labeled for easy identification and access to the workstation. Eliminate clutter by having a designated place for everything to go and keeping it in its place.

Sweep – Keep work areas and equipment clean. Isles, storage areas, and machines should be maintained in such a manner that there are no dirty, greasy, or oily areas that are conducive to accidents or covering up equipment malfunctions.

Schedule – Cleaning and maintenance responsibilities should be set up on a regular schedule in order to preserve the sense of order that has been accomplished from performing the previous steps.

Sustain - The aforementioned steps must be repeated in a consistent manner until they are institutionalized. When they are carried out as part of the normal daily routine, the 5S's become an integral part of waste elimination activities.

Although not a member of the original 5S group, *Safety* is often considered an important addition. Workplace injuries are considered a form of waste because they do not contribute anything to the value of the finished product, cause decreased operating efficiencies, and are preventable.

Setup Reduction

In a traditional manufacturing scenario, large batches of product are produced because of the economies of scale concept, which serves in part to distribute the cost of non-value added setup time over a large production run (Carreira, 2005), thereby

minimizing the economic impact regarding cost per unit. Since lean utilizes much smaller lot sizes to accommodate the high variation in product options, there are many more setups to perform and as a result the costs associated with them grows proportionally. To overcome this obstacle, it becomes necessary to find ways in which to counteract or neutralize the additional non-value added time spent and the negative economic consequences associated with these additional setups.

Lean methodologies seek ways in which to negate the cost linked to setups by greatly reducing the amount of time required to do a setup. Rubrich and Watson (2004) pointed out that Shingo, a consultant from Japan, "developed a revolutionary setup concept – separating external setup elements from internal elements" (p. 315). Even though Shingo was working on setup reduction concepts for presses, the ideas were applicable to a wide range of setup activities. By reducing setup time many setups can be performed at a greatly reduced cost (Shingo, 1985). The reduced setup time which results in reduced costs is an example of waste reduction, again supporting the main premise of lean.

Error Proofing

Poke-yoke or error proofing (Rubrich & Watson, 2004) is the development of a system that makes the processing part of an operation mistake proof. Controls are typically engineered into the process to provide constraints which allow only correctly processed units to proceed to the next operation. A simple example of how this concept works is demonstrated when attempting to hook up the cables to a new computer. There are wires for the tower, monitor, and printer, as well as a host of electrical ports in which

to plug them. The system is designed so that even a novice cannot do it incorrectly. Each individual cable and electrical port is configured so that only the appropriate plug can be inserted. Designs like this eliminate waste by reducing downtime, frustration, and reports of trouble to the manufacturer. Techniques such as this are commonly used to error proof manufacturing applications, thereby reducing scrap, rework, downtime, and other forms of waste.

Visual Communication

Communication of information is a vital part of any business; and one of the most effective ways to disseminate information is through visual means. This method serves as a form of transparency within a lean organization. Lean utilizes the team concept where everyone is considered an integral component of the operation and should know how their job impacts company goals. This fosters an air of teamwork and cohesiveness among workers and management. Visual communication comes in many forms, such as (a) safety charts, (b) quality graphs, (c) delivery performance schedules, (d) productivity performance outlines, (e) production boards, and (f) workplace organization diagrams. Rubrich and Watson (2004) stated, "The purpose for having visual controls is to provide effective communication about how the team is performing to its goals" (p. 200).

Total Productive Maintenance

Total productive maintenance (TPM) looks at maintenance as yet another place to reduce waste. Traditional maintenance methods repair equipment as needed. When a piece of equipment fails, a work order is sent to the maintenance department for it to be

repaired as soon as possible. The maintenance department is typically responsible for all duties regarding equipment upkeep.

The TPM approach places responsibility not only on the maintenance personnel and management, but on the operators as well (Feld, 2000). Operators are charged with checking/maintaining oil and coolant levels, greasing equipment, and monitoring/reporting equipment problems such as leaks, unusual noises and other routine tasks. Early problem detection devices such as bearing vibration sensors also alert maintenance of erratic machine operation before quality is impaired or the problem becomes catastrophic through extensive equipment damage. One important facet of TPM is the way in which it reduces unscheduled downtime. Machine uptime is vitally important when production lines are running. Downtime during regular production stops the parts flow to downstream activities, thereby idling workers. Therefore, it is extremely costly for machine malfunctions to occur during this time. The use of TPM allows for the scheduling of machine maintenance during nonproduction time when the equipment is normally shut down. Another way TPM contributes to improved equipment reliability is by tracking historical data regarding longevity of bearings, seals, and other consumable components used on the equipment (Carreira, 2005). This helps by knowing the expected lifespan of critical parts and replacing them on a scheduled sequence of normal downtime so as to prevent unanticipated equipment failure during regular production operations. The idea is that early problem identification saves the company money by eliminating unscheduled downtime, another form of waste.

Continuous Improvement

Kaizen is the Japanese word for "change for the good" (Rubrich & Watson, 2004, p. 383). The kaizen philosophy is at the heart of continuous improvement. Kaizen, also known as continuous improvement, is intended to come in small increments on a daily basis throughout the organization. When incorporated, everyone from management to production workers contribute to continuous improvement practices, which improves business processes and eliminates waste (Imai, 1986). Traditional methods seek more immediate large scale gains and often overlook the clout of techniques such as incremental change and employee empowerment. Traditional methods also tend to focus on the individual rather than the group as with lean methods. Consequently, cultural differences often affect how continuous improvement methods are implemented and inhibit the full effectiveness of the continuous improvement philosophy. According to Hoyle (2006),

> The automotive sector has taken the advice of Joseph Juran, who many years ago remarked, 'Putting out fires is not improvement of the process. Neither is discovery and removal of a special cause detected by a point out of control. This only put the process back to where it should have been in the first place.' (p. 46)

Lean's use of an overall continuous improvement philosophy fosters organizational change by encompassing a systemic approach. As Rubrich and Watson (2004) pointed out, "The Japanese make their suggestion systems an integral part of their management systems. Toyota receives 1.5 million suggestions per year and implements 95% of them" (p. 392). Another key indicator of the difference between traditional and lean management styles is the average suggestion rate of employees. "Japanese

companies average 32 suggestions per year per employee, American companies 0.17 per year" (Rubrich & Watson, 2004, p. 392).

Review of Conceptual Framework Literature

A review of the literature reveals the underlying theory that was used to develop a conceptual framework from which an argument may be posited. In this study, organizational culture is discussed as it pertains to organizational reform, implementation barriers, and transformation efforts. Organizational change was reviewed in the context of organizational change-readiness and resistance to change.

Organizational Leadership

Understanding the complex nature of organizational leadership requires an in-depth knowledge of fundamental leadership concepts. Some of these concepts include challenges a leader must navigate such as dealing with the dynamic character of an organization, how to find new leadership talent, understanding different leadership styles, and successfully integrating change management concepts. The following sections examine organizational leadership within this framework.

Leadership dynamics. The primary role of leadership is to provide visionary insight to facilitate organizational growth and prosperity. According to Gandossy and Verma (2009), "Eight-five percent of top companies very explicitly link developing leaders with the organization's business strategy" (p. 41). However, leadership at the organizational level is a multifaceted challenge. It combines numerous components such

as the current state of the economy, interest rates, customer demand, and many other factors that influence each other due to the interrelated nature of their relationships. Making this blend even more difficult to understand are the organizational dynamics in play. Organizational dynamics such as employee motivation, communication styles, and team-oriented environments among many others, are all elements associated with successful change management (Gilley, McMillan, & Gilley, 2009). Successful change management is also greatly affected by the relationship leaders have with the employees. According to Drucker (1999), and Howkins (2001), organizational leaders strongly influence the work environment through routine interpersonal interactions.

Determining how to effectively utilize these organizational attributes into a positive cohesive force can be problematic for any leader, but even more so when major organizational change is involved. The challenges facing an organization considering significant change must be addressed by the organization's leadership. Competent leadership is especially important when planning to undertake change of this type. Interestingly enough, however, only recently has leadership development been seen as essential to organizational survival; knowledgeable leaders were considered easily brought in from outside sources (Sessa & Campbell, 1997). A paradigm shift in the value of organizational leadership caused a fundamental change in the way in which many successful organizations viewed leadership. No longer are leaders considered a simple commodity to be accessed only as needed. As noted by Gandossy and Verma (2009), "Top companies realize that the biggest constraint to pursuing growth opportunities and surviving in today's fast-paced, dynamic world is talent" (p. 45). Consequently, a new

approach to leadership development has been since incorporated at many successful companies.

Leadership research. A noteworthy research study was initiated by Hewitt Associates called the Top Companies for Leaders in 2001 that sought to identify factors that allow financially successful organizations to consistently produce great leaders (Gandossy & Verma, 2009). The study repeated in 2003, 2005, and 2007 continued to examine leadership in the context of successful organizational transformation. The increasing frequency and difficulty with which organizational change is being required to maintain a successful operation prompted this question from Hewitt Associates. "Why do some companies flourish while others founder or fade away when faced with a transformation challenge?" (Gandossy & Verma, 2009, p. 41).

The findings indicated leadership was a key component in successful organizational transformation. However, what was significantly different from earlier attitudes about leadership was the source of new leaders for these top companies. The leaders were no longer being brought in from outside sources. Instead, these top companies began to transform their leadership model. It was recognized that the ability to position the company to manage change effectively was dependent on creating a comprehensive system to cultivate and advance current and future leadership talent of all ranks. Next-generation leaders are groomed to provide a consistent pipeline of talent that understands the company's goals and is ready for advancement into senior leadership roles. Gandossy and Verma (2009) stated,

> Eighty-five percent of top companies have a formal process for identifying high potentials or equivalents… They develop their critical talent through stretch assignments, action learning projects, exposure to senior leaders, and real developmental experiences. In fact, 80% of top companies grow their talent by having them change jobs often. Just over half of other companies do. (p. 43)

Competent leadership is a crucial component for more than just organizational success. Mastering successful organizational change through effective leadership is an essential capability required for an organization's continued existence.

Types of leadership. While discussing the topic of organizational leadership, it is important to note there are a number of different organizational leadership styles. Each has specific advantages that facilitate their use in a given situation. Although there are some commonalities among the different types of leadership, no one leadership style is applicable to all organizational goals. Choosing the correct leadership type to work in concert with change initiatives, thereby enhancing the effectiveness of change efforts, is vital to large scale organizational change success. According to Jenkins (2009),

> Different leadership styles to consider include visionary/inspirational leaders, commanding leaders, situational leaders, people-oriented leaders and task-oriented leaders. A visionary/inspirational leadership style should be used when a leader is trying to move people towards a shared dream. However, a coaching leadership style might be used to effectively connect what a person wants with organizational goals. A commanding leadership style gives clear direction and is useful in cases of emergency. The situational leadership model suggests that leaders change their

> style of leadership based on how ready their followers seem to be. When drastic organizational changes are involved, having leaders who are people-oriented as opposed to task-oriented will be better able to anticipate the needs of the employees as they motivate and enable them to change. (p. 1)

Other common leadership styles include transitional and transformational. The transitional style incorporates "small, gradual, even incremental changes in people, policies, procedures, technology, culture, or structures. These common changes are driven and orchestrated by management for units, departments, divisions, or the entire organization" (Gilley, McMillan, & Gilley, 2009, p. 1). The advantage of transitional leadership is the reduced level of employee resistance normally associated with abrupt organizational change.

Transformational change tends to be much more radical. The drastic nature of this type of change tends to go against long-held traditions, beliefs, culture, and other organizational paradigms (Kuhn, 1970). Although considered extreme, when successfully implemented, organizations often become more competitive in the market (Denning, 2005). Unfortunately, the literature illustrates the infrequency with which organizations successfully accomplish their goals of transformational change (Beer & Nohria, 2000; Cope, 2003; IBM, 2008).

Although there are numerous styles of leadership, the transformational style is most closely aligned with the subject of this study of organizational characteristics, which includes leadership, and their effect on lean implementation. As can be seen from the description of transformational leadership, a drastic change can be problematic due to its very nature. So, when other organizational characteristics such as adapting to a different

national culture (i.e., introducing the Japanese-oriented lean management philosophy into American businesses) as well as the broad range of other issues concerning organizational change are factored in, the challenges are even greater. This is part of the reason lean implementation tends to be problematic for some organizations. How leadership addresses some of these complex change management issues is discussed next.

Leadership/change management. One of the most challenging roles of a leader is to implement significant organizational change. However, before organizational change can be enacted, effective leadership, a necessary prerequisite in change management success, must first be in place. Exactly what constitutes leadership effectiveness varies according to what articles are reviewed, but the following represents a general consensus.

> The existing literature suggests that numerous variables affect a leader's effectiveness. In this study, the authors examine behaviors associated with leadership effectiveness in driving change. Results indicate that specific leader behaviors—the ability to motivate, communicate, and build teams—are predictors of successful implementation of organizational change. (Gilley, McMillan, & Gilley, 2009, p. 1)

However, according to Nadler (1998), "the reality of change in the organizational trenches defies rigid academic models as well as superficial management fads" (p. 3). Consequently, the complex nature of organizational change will require proven management models that are steeped in increasingly comprehensive change model theory. There is a positive linkage between leaders' change management skills and successful organizational change. Conversely, deficits in change management skills, inadequate

knowledge of change process techniques, and failure to transform organizational systems have been acknowledged as barriers to success (Bossidy & Charan, 2002; Gilley, 2005).

The role of top leadership as a critical element in change management is further anchored by Clement's (1994) belief that, "The leadership role cannot be delegated, for example, to a consultant. Top management must lead the change effort" (p. 1). Clement also noted,

> Management's leadership in the change effort seems to be the key determinant of whether that change will succeed. It is not new to say that leadership is critical. What is new is the type of leadership being recommended-one that does more than just create and articulate a new vision for the organization. Management needs to communicate openly with those affected by the change and, once again, collaborate with those same individuals to obtain their input. For example, if top management expects lower-level managers and employees to behave ethically, then top executives themselves must do the same. (p. 2)

Change-oriented leadership is characterized as "identifying external threats and opportunities, envisioning new possibilities, proposing nontraditional strategies, and influencing political support for change" (Yukl, 1999, p. 41), as well as being aware of external factors, supporting innovation, and taking risks to encourage change (Shamir & Howell, 1999; Yukl, 2004). Major change efforts frequently cause unsettling effects within an organization. The uncertainty of change, if not handled correctly, lays the foundation for a crushing wall of anxiety and resistance to change. It is especially important to have leaders who are well versed in change management techniques. Accordingly, change-oriented leaders can cope well with unstable environments because

they can include inspiration, motivation, intellectual stimulation, strategic vision articulation, sensitivity to the environment, and a risk-taking attitude (Kuhnert & Lewis, 1987; Waldman, Ramirez, House, & Puranam, 2001). Although the virtues of leadership are extolled as indispensible to successful organizational change, two other theoretical underpinnings are explored that serve as equally integral components to the change process. The following sections include an insight into the constructs of organizational culture, and an examination of organizational change theory.

Organizational Culture

In order to better understand the relevance of organizational culture, it must first be defined and then examined from a theoretical standpoint. It is also necessary to recognize the role globalization played in organizational reform, the subsequent cultural changes which have been associated with implementation barriers, and finally how the dynamics of this situation affected transformation efforts.

Definition of culture. Culture is an unseen force that compels people to think, act, and do things in a particular manner. This unseen force consists of attributes that include a set of values, beliefs, and attitudes about an issue that lead to the formation of behavioral norms. The complex and abstract nature of culture makes it difficult to define it in unambiguous terms. This is in part due to the speculative way in which it must be described. Although culture has been defined by many authors in numerous ways, the following explanation sums up a general definition of what is found in the literture on the subject.

> A standard definition of culture would include the system of values, symbols, and shared meanings of a group including the embodiment of these values, symbols, and meanings into material objects and ritualized practices… The 'stuff' of culture includes customs and traditions, historical accounts be they mythical or actual, tacit understandings, habits, norms and expectations, common meanings associated with fixed objects and established rites, shared assumptions, and intersubjective meanings. (Sergiovanni & Corbally, 1984, p. viii)

The concept of culture has been used to denote various things including sophistication, societal customs and rituals from an anthropological context, and more recently and within the context of this research, deep-rooted values within an organization. Shafritz, Ott, and Jang (2010) stated that, organizational culture is the unseen embodiment of the way in which people within the organization think, act, feel and behave. This phenomena often exhibits itself in the forms of customs, rituals, and other patterns of behavior that are present in an organization's day to day functions and activities.

When describing culture from an organizational perspective, it is important to realize that unlike societal customs, organizations typically have very specific goal-driven patterns of behavior based on a set of behavioral norms that exist within a group of individuals united by a common cause. According to Kotter (1996), behavioral norms remain intact due to the systemic perpetuation of the norms by existing group members, who praise those who conform and punish those who resist. As can be seen from this broad definition, culture is a multifaceted topic. The following description of cultural characteristics illustrates the complexity of understanding exactly how to evaluate it within an organization.

> Knowledge of an organization's structure, information systems, strategic planning processes, markets, technology, goals, and so forth can provide clues about an organization's culture, but not accurately or reliably. As a consequence, an organization's behavior cannot be understood or predicted by studying the wrong organizational elements in an attempt to understand and predict organizational behavior. (Shafritz, Ott, & Jang, 2010, p. 340)

Based on this, the success of addressing cultural issues within an organizational setting depends on understanding what to look for in order to correctly assess how to work within the inherent cultural confines of a particular organizational situation. Subsequent discussion of culture will be contextualized to an organizational setting which more appropriately serves this research. Organizational characteristics involves a group of individuals that have a cohesive bond. As noted by Shafritz, Ott, and Jang (2010), the strength of this bond is "dependent on the length of its existence, the stability of the group's membership, and the emotional intensity of the actual historical experiences they have shared" (p. 353). To better understand issues such as the formation of culture, a review of cultural theory is helpful.

Cultural theory. An examination of organizational culture in the context of organizational change reveals that, "lasting organizational reform requires changes in orgnizational culture" (Shafritz, Ott, & Jang, 2010, p. 338). In a new organization, there is an informal development progression that includes promotion of leader enspoused values and beliefs, periods of organizational success, and transformation of beliefs and values into nonnegotiable assumptions which eventually become synonymous with the

organization's identity. Shafritz, Ott, and Jang (2010) posited that, in an organization an individual with certain beliefs and values will impose the ideas on a group. Although this does not bring into being an organizational culture automatically, it does get people to follow. Only when the ensuing behavior proves successful through the accomplishent of a task or goal and the group members feel good about their situation will the leader's vision be recognized and shared. With continued success comes the conclusion that this is the proper way to think, act, and feel. Continued reinforcement, and success, will transform the original values and beliefs into nonnegotiable assumptions. Eventually, the assumptions will be taken for granted and become a new group or organizational identity.

This intangible force called culture, is passed along to new members of an organization through formal and informal practices such as orientation of employees upon hiring and the attitudes of current members toward the organization (Louis, 1980; Schein, 1968; Van Maanen, 1976; Van Maanen & Schein, 1979). Many behaviors within an organizaion are the function of these powerful invisible undercurrents known as organizational culture. A key problem with trying to change the structure of an organization's culture is that it is the, "most stable and least malleable" (Shafritz, Ott, & Jang, 2010, p. 352) category of organizational characteristic with which to deal. So, to address culture as it applies to lean implementation efforts, it must be acknowledged as an integral part of organization's characteristics. As opposed to earlier statements regarding the formation of organizational culture in a new organizataion, organizational reform efforts, which also greatly affected organizational culture, came about as the result of a changing climate in manufacturing.

Organizational reform. A growing awareness that the status quo in the manufacturing sector was changing came about as the 20th century was coming to a close. The onset of globalization in the 1970s facilitated the realization that the U.S. faced formidable competition and that there was a legimate need for organizational reform. According to Shafritz, Ott, and Jang (2010),

> Declining productivity in the United States coincided with noticeable productivity gains in many industrialized nations, particularly in Asia but also in several European countries. Overwhelming evidence pointed to the loss of U.S. position in the global marketplace. In the late 1980s, 53 of the top 100 corporations in the world were Japanese. (p. 341)

In light of these facts, U.S. manufacturers began examining ways in which to reform their outdated manufacturing management styles with more responsive, flexible, and productive methods. Although reform movements were originally inspired by the TQM philosophy used by the Japanese, lean is another example of a Japanese management style that requires organizational reform. Shafritz, Ott, and Jang (2010) noted that

> In 1980, William Ouchi focused attention on a key strategic question: Could Japanese management methods (as introduced by Deming and Juran) be utilized in the United States? At the time, most scholars and businessmen were convinced that they would not. The differences between the cultures of Japan and the United States were too great. (p. 345)

Even after all this time and with the vast research that has followed attempting to understand the cultural differences between the Japanese and U.S. styles, the answer to

this question is, *sometimes*. Although many organizations have successfully made the transition, many more are struggling with the changeover. The purpose for this study is to better understand how organizational characteristics are related to lean implementation in order to provide a greater insight into successful implemention techniques.

Implementation barriers. There are many barriers to lean implemention, but one of the most important that leads to the failure of lean implementation, is the cultural differences (Carreira, 2005). Establishing new procedures in any organization is difficult; but, to require the acceptance of ideas in a system that is culturally different from the existing organization presents extraordinary obstacles (Kotter, 1996). In addition, there are conflicting organizational change theories regarding culture. According to Kotter,

> One of the theories about change that has circulated widely over the past fifteen years might be summarized as follows: The biggest impediment to creating change in a group is culture. Therefore, the first step in a major transformation is to alter the norms and values. After the culture has been shifted, the rest of the change effort becomes more feasible and easier to put into effect. I once believed this model. But everything I've seen over the past decade tells me its wrong. Culture is not something that you manipulate easily. Attemps to grab it and twist it into a new shape never work because you can't grab it. Culture changes only after you have successfully altered people's actions, after the new behavior produces some group benefit for a period of time, and after people see the connection between the new actions and the performance improvement. (p.156)

When initial transformation efforts begin, there is a significant cultural shock that leads to defensive posturing. This is because there is no proof that the traditional methods will not continue to work just fine, and hence, no reason to change the, *it has always worked this way before*, approach. This barrier is catastrophic to new implementation efforts.

The effect of failed cultural changes often results in insurmountable organizational problems. The consequences of vastly mismatched cultural identities are plain to see in organizations that attempt acquisitions and mergers. A large proportion, possibly over 50%, fail. The source of these failures are attibutable not to the host of problems that commonly cause trouble, but rather due to cultural differences (Cartwright & Cooper, 1993).

Organizational cultures, once formed, are very difficult to change. Resistance from organization members is exceptionally resolute. Critical changes that are needed to adjust to evolving market conditions can be blocked by preexisting organizational culture, thereby jeopardizing the survival of the organization. Therefore, it is vital to understand the culture of an organization before attempting to make significant changes. According to Shafritz, Ott, and Jang (2010),

> The organizational culture perspective assumes that many organizational behaviors and decisions are not determined by rational analysis. Instead, they are, in effect, predetermind by the patterns of basic assumptions held by members of an organization because they have repeatedly led people to make decisions that 'worked in the past'. With repeated use, the assumptions slowly drop out of people's consciousness but contine to influence organizational decisions and

> behaviors even when the environment changes and different decisions are needed. They become the underlying, unquestiond, but largely forgotten, reasons for "the way we do things here" – even when the ways may no longer be appropriate. They are so basic, so ingrained, and so completely accepted that no one thinks about or remembers them—thereby our claim that organizational culture can be a formidable barrier to effecting lasting organizational change. (p. 339)

Once the concepts of organizational culture are understood and the barriers to successful change recognized, the transformation process from one organizational culture type to another has a greatly improved chance of success. However, there are some key points to consider before deciding on an approach.

Transformation. The transformation process begins with changes in behavior and attitude and only after repeated confirmation of the new method's success in achieving organizational goals does this style become anchored as the new culture. Consequently, cultural change actually takes place at the end of the transformation effort rather than at the beginning as had been traditionally thought (Kotter, 1996). Once a transformation process has been completed, it is important to watch for signs of regression. According to Kotter (1996), if organizational change efforts are not comprehensively anchored culturally, "they will always be subject to regression. Changes in a work group, a division, or an entire company can come undone, even after years of effort" (p. 148).

As can be seen, attempting to make considerable changes to an organization's culture requires a thorough understanding of concepts regarding organizational cultural. Being aware of how organizational culture is changed, the barriers to be addressed as part

of the change process, and knowing why the anchoring process prevents regressive tendencies helps to introduce change that does not alienate the organization's members and contributes to establishing the new culture in a way that it will remain intact over time.

Organizational Change

Organizational change, another category within the broader scheme of organizational characteristics, is a vital element to be cognizant of when contemplating any major organizational change initiative. Historically, there has been a high failure rate of major organizational change initiatives, approximately 70%, (Maurer, 2009). The exceptionally high failure rate suggests there is much yet to understand about organizational change in order for the implementation and control aspects of the process to become more predictable and sustainable. Kotter (1996) commented that,

> To date, major change efforts have helped some organizations adapt significantly to shifting conditions, have improved the competitive standing of others, and have positioned a few for a far better future. But in too many situations the improvements have been disappointing and the carnage has been appalling, with wasted resources and burned-out, scared, or frustrated employees. (p. 3)

In the literature, it is clear that organizational change is at best an inexact science. The high failure rate demonstrates that there is no one right way to implement organizational change. And although there are many theories about how to approach this type of change, there are three elements of organizational change commonly mentioned in

the literature. However, due to the integral nature of these elements, the timing of their implementation requires some degree of overlap.

To overcome the barriers to organizational change it is necessary to first determine the *change-readiness* of the organization and uncover specific problem areas, then identify and address the forces that contribute to the *resistance to change*, and finally, begin *the implementation process* in a sequential manner. The following descriptions of the three phases illustrate the interdependent relationship of each.

Organizational change-readiness. The utilization of effective communication is a powerful tool when implementing organizational change. To facilitate an orderly change within an organization, members need a clear understanding of how the changes will affect them, as well as a sense of direction as to their role in helping to achieve the new organizational goals (Kotter, 1996). Although leaders are involved in the process, it is usually the managers and project champions who are responsible to pass along the reasons for change and develop restructuring plans to carry out the intended changes (Kanter, Stein, & Jick, 1992; Klein, 1996).

Communication can be considered a change-readiness factor in terms of organizational change. Armenakis, Harris, and Mossholder (1993) posited that readiness for change can be facilitated by dissemination of pre-change notice early and often. Pre-change notice is the advance notification of upcoming organizational changes. This step reduces employee anxiety and promotes positive attitudes about change. Research conducted by Chawla and Kelloway (2004) illustrated that openness to change is positively affected by communication. Numerous research studies have been conducted to

determine the degree to which information and communication diminish insecurity about change (e.g., Berger & Calabrese, 1975; Kramer, Dougherty, & Pierce, 2004). In three case studies conducted to investigate the correlation between communication and readiness for change, Elving (2004) found that lack of information and high uncertainty were noteworthy predictors of low readiness for change. In a study that surveyed over 100 organizations, it was determined that there was a problem in three quarters of the situations with both the frequency and quality of the information being provided about the upcoming change (Bennebroek, Gravenhorst, Werkman, & Boonstra, 2003). As can be seen from these studies, good communication is vital to change-readiness.

However, while communication is a vital factor that affects an organization's ability to successfully implement change, it is certainly not the only aspect of the change-readiness concept. The following section discusses change-readiness from the perspective of a methodology that examines multiple factors related to organization's change-readiness.

When an organization is contemplating making a major management change, preparation is the key to a successful transition. Changes like this do not come easy or without an environmental climate that is conducive to change. One technique used to determine an organization's state of readiness for making such a change was developed and published by Jones and Bearley (1996). The Jones and Bearley model is a two-step process. The first step, which was originally based in-part on Levin's *Force-Field Analytic Problem Solving Model* (Levin, 1943) developed in the 1940s, analyzes five critical dimensions of organizational change-readiness. This step is used to identify organizational imbalances that might affect change initiatives. Then using this

information, a strategy can be developed to bring back a sense of equilibrium within the system in preparation for the planned changes. The following are characterizations of the five dimensions (Jones & Bearley, 1996) related to this model.

- *Structural Readiness*. The ability to keep a clear vision and to reorganize quickly and easily in response to external change opportunity.
- *Technological Readiness*. The ability to remain current and innovative in the exploitation of material resources and knowhow.
- *Cultural Readiness*. Having an internal ambiance that supports people and planned change efforts.
- *System Readiness*. Having systems in place that scan and provide information necessary to monitor and support the change process and identify the effects of change.
- *People Readiness*. Having leaders and other employees who can work together within an environment that is ambiguous and in flux. (p. 1)

The main premise of this process was to identify barriers to organizational change so that they may be overcome.

The second part of the Jones and Bearley (1996) model was an instrument originally developed to "analyze the ability of an organization to manage change effectively" (p. 3). The instrument is titled *Organizational Change-Readiness Scale*. The instrument utilizes a six-point Likert scale to evaluate responses about change-readiness topics from a questionnaire. The data are then analyzed to determine what changes are required for successful change implementation. Once the analysis has been performed, barriers to change can then be addressed and the implementation phase begins. This

model developed by Jones and Bearley (1996) is an example of a methodical change-readiness strategy used to assist organizations with evaluating their change-readiness status. Although there are various resistance to change assessment methods, in addition to the Jones and Bearley example, such as the *Reaction-to-Change Inventory* (De Meuse & McDaris, 1994) among others, the main premise of these methods is to formulate a way to find the root cause of the resistance to change problem so that a pragmatic approach may be developed to solve the resistance problem. Once an organization has conducted some form of change-readiness evaluation it can move forward with the next phase, addressing resistance to change issues as described next.

Resistance to change. Significant change moves an organization away from the status quo, which can be problematic for the organization. Change is often unsettling for many employees in an organization and resistance to change issues stymie, if not entirely doom, many change efforts. Issues like this cause organizational change to become extraordinarily difficult to manage effectively, which contributes in no small part to the high failure rate (Callaly & Arya, 2005).

The term *resistance* is often used to express the unwillingness of workers to support new procedures, methods, or ways to doing things (Dent, 1995). Resistance is defined as "the action of opposing something that you disapprove or disagree with" and "the ability to resist; the inherent capacity of a living being to resist untoward circumstances" (Mish, 2003, p. 1003). Resistance can also be defined as the propensity "to remain unaffected or undamaged by something" (O'Neill, 2001, p. 1050). It is easy to see an employee's natural inclination to resist change if they associate resisting change with *remaining unaffected or undamaged*.

People are often apprehensive about potential effects resulting from change that may negatively affect their employment situation.

Researchers have found that organizational change creates feelings of fear in employees. A job represents a sense of identity for most people and anything that threatens this sense of identity is resisted. For example, Dawson (1994) and Schiemann (1995) noted that the following issues create fear that leads to resistance to change behaviors: (a) significantly changed job requirements, (b) decrease in financial security, (c) emotional pressure, (d) loss of control, and (e) lower status. Employees can become worried that they may not fit in anymore and feel displaced by the changes. It is relevant to briefly mention culture and communication again here to show the interdependent nature of these issues regarding resistance to change. Just as the study of organizational culture can overcome many cultural issues, so it is with poor communication. Improved communication is considered as an effective approach for overcoming resistance to change (Kirkpatrick, 1985). If there is no consideration for employee well being by management, resistance to the planned change will be the inevitable outcome. The frightening prospect of accepting change means that employees must abandon the attitudes and practices that, in many ways, have led to their current success (Hanson, 2003). The uncertainty of this course of action causes people to try resistance tactics to hold onto what has worked in the past.

Employee resistance may be passive or active. Passive resistance is secretive and nonconfrontational. Examples of passive resistance include private conversations with employees that are pessimistic about the change, not supporting change initiatives by continuing to do things the way we have always done them, and circumventing new policies. According to Petrini and Hultman (1995), passive resistance could be caused by low

motivation. Active resistance includes thing such as verbal protests, writing grievances regarding the new changes, or even deliberate sabotage of change efforts.

According to Sevier (2003), the challenge of investigating resistance concepts is determining the root cause of the resistance. Understanding root causes of training resistance will allow for the development of well-planned solutions to improve the implementation of training (Kirkpatrick, 1993). The nature of this problem and why it occurs both deserve continued study because of the great impact of resistance on corporations. Likewise, academic research must analyze factors related to training management and process implementation because the failure rate of these programs is high (Kotter, 1995). Analyzing these types of issues is the very reason for this research, with the end result being to better understand and address problematic issues related to lean implementation in order to contribute to a higher rate of successful lean implementation initiatives. The illustration in Figure 2, developed by this author, exemplifies the complex nature of change by showing many of the factors that make up resistance to change. Once the issues regarding resistance to change have been examined and dealt with, the final phase is the implementation process.

Implementation steps. De Meuse and McDaris (1994) commented that "Today, no company can afford the status quo. The companies that thrive are those that thoughtfully embrace change so that they can manage it to their competitive advantage" (p. 55). However, as has been noted, implementing lasting change within an organization can be extremely difficult. The struggles to make the changes are often fraught with frustration on the part of the organization's leaders and managers, and fear of employment security for the employees. Kotter (1996) noted the shift away from times of long-term organizational stability to the current state of frequent organizational change has created

complex organizational challenges, largely without precedence. Organizational change theory development is relatively new; consequently, many questions still need to be answered to stem the high failure rate of organizational change. The question remains, how can the implementation of organizational change be successfully accomplished?

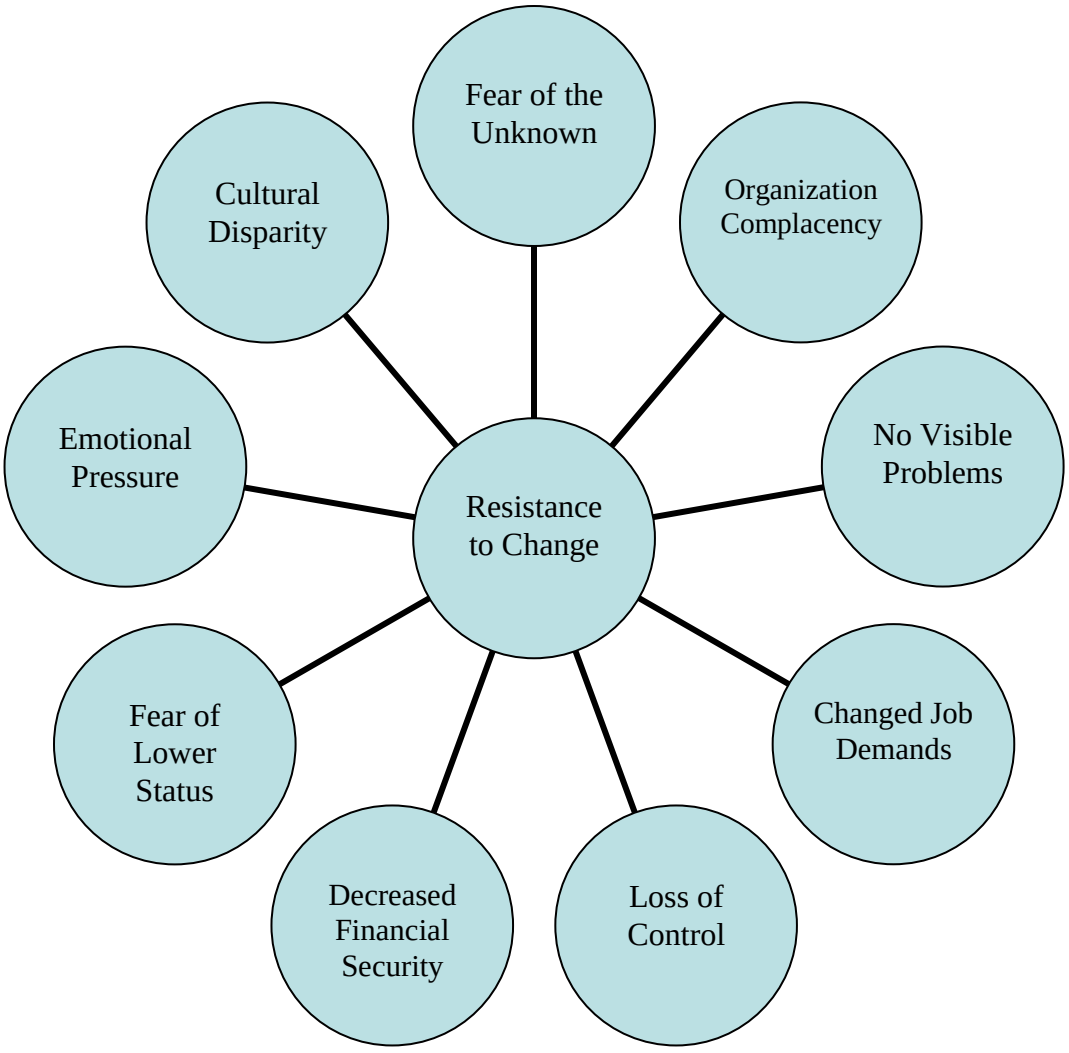

Figure 2. Resistance to change model

Although there is no single specific approach to implementing organizational change that will work effectively in all situations, there is some degree of concurrence among authors in the literature that suggests a more universal approach may be applicable in many situations. According to Kirkpatrick (1993), "It's important to communicate an expected change and the reasons for it, as completely and as far in advance as feasible" (p. 32). Communication, early and often, acts as a lubricant that aids in the facilitation of change efforts. It eliminates surprises and the inherent anxiety that comes with the unknown. The sense of *everyone*, including management and employees, working together in a cohesive manner is more likely to be supportive of an atmosphere of change. Kotter (1996) noted, "Useful change tends to be associated with a multistep process that creates power and motivation sufficient to overwhelm all the sources of inertia and this process is never employed effectively unless it is driven by high-quality leadership" (p. 20). Change initiatives based on a unified organizational goal and competent leadership provide a sense of trust and security for the employees that the company is going in the right direction. Consequently, it is imperative that key leaders have a collective vision of the future they want for the organization if change initiatives are to be successful (Callaly & Arya, 2005; Kotter, 1996).

Although there are many ways to introduce organizational change, the following example is an eight-stage model developed by Kotter (1996) to guide organizational change. This model includes ideas commonly agreed upon by many of the authors in the literature as important to introducing lasting organizational change.

The eight-stage process of creating major change is as follows:

1. Establishing a sense of urgency

2. Creating the guiding coalition
3. Developing a vision and strategy
4. Communicating the change vision
5. Empowering broad-based action
6. Generating short-term wins
7. Consolidating gains and producing more change
8. Anchoring new approaches in the culture (p. 21)

This universal model for implementing change is transferable across a broad spectrum of businesses. With this in mind, it was easy to see how it would apply to lean implementation applications.

Research in the Area of Lean

To date, there have only been three empirical research studies found related to the specific topic in this study. These studies, summarized in Table 1, were conducted by Womack, Jones, Roos, and Carpenter (1990) and Blanchard (2006; 2007).

Table 1

Summary of Existing Empirical Research Related to this Study

Author(s)	Year	Article Title	Research Method	Tool(s)
Blanchard	2007	Census of U.S. manufacturers: Lean green and low cost. Industry…	Quantitative	Survey
Blanchard	2006	Census of U.S. manufacturers: What's working for U.S.…	Quantitative	Survey
Womack et al	1990	Lean thinking: Banish waste and create wealth in your corporation…	Qualitative	Interview

The empirical research published by Womack, Jones, Roos, and Carpenter (1990) was the genesis that sparked an interest in lean from manufacturers worldwide. Based on the interest generated by this research, many lean initiatives were launched in manufacturing operations. Although the research was originally oriented toward manufacturing operations, lean concepts are gaining widespread acceptance in many other enterprise types including service, office, and healthcare settings. The other two empirical research studies that were found were conducted by Blanchard in 2006 and 2007. There were two particular areas of Blanchard's research that supported the need for this study. Each is discussed in the subsequent narrative.

One noteworthy topic in Blanchard's research is lean's increasing popularity with U.S. manufacturers. According to Blanchard (2006), "The IW/MPI (Industry Week/Manufacturing Performance Institute) Census of Manufacturers was conducted in late spring/early summer 2006" (p. 1). The census results showed lean manufacturing had increased in popularity as a primary improvement method. The number of manufacturers adopting lean as their primary improvement method increased from 35.7% to 40.5%. In the next annual IW/MPI study, Blanchard (2007) stated,

> The lean revolution is clearly underway within U.S. manufacturing companies, although the jury is still out on what exactly the end result of a lean initiative ought to be. According to the 2007 IW/MPI Census of Manufacturers, nearly 70% (69.6%) of all plants have adopted lean manufacturing as an improvement methodology. (p. 1)

As can be ascertained from the data discussed in these two studies, the use of lean by manufacturers in the U.S. has surged markedly from 40.5% to 69.6%, for a total increase

of 29.1% in just one year. Data from the 2005/2006/2007 IW/MPI Census of Manufacturers has been compiled for use in this study. The trend illustrated in Figure 3 highlights the continuing escalation of lean, and its dominant position as a management philosophy far outpacing other improvement methodologies. The increased use of lean in the manufacturing industry exemplified the need to understand problematic lean implementation.

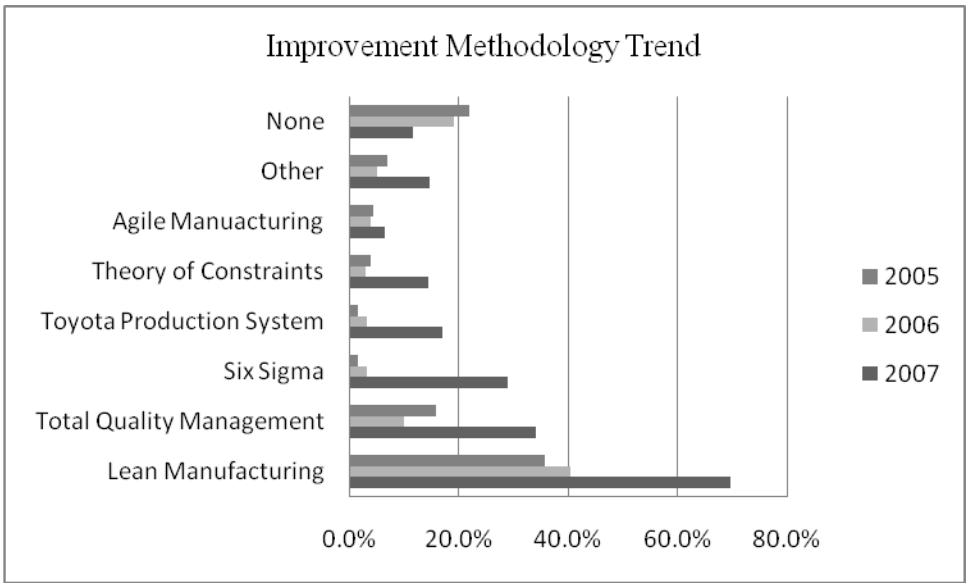

Figure 3. Improvement methodology trend (2005/2006/2007 IW/MPI)

Another noteworthy benchmark from the 2005/2006/2007 IW/MPI study is the state of manufacturers' progress toward World Class status. Regardless of the improvement methodology approach used, including lean, the data compiled from the 2006/2007 IW/MPI Census of Manufacturers' reports for use in this study, as shown in Figure 4, clearly illustrated there was still much to accomplish for the majority of manufacturers in order to achieve World Class performance. The small percentage of manufacturers that have made considerable progress (24.2%) or fully achieved (1.9%) World-Class status equals only 26.1%. Based on this evidence, nearly three fourths of all

manufacturers (73.9%) are still struggling to achieve World-Class status. This provides additional evidence of the difficulty organizations are having trying to implement these improvement methodologies.

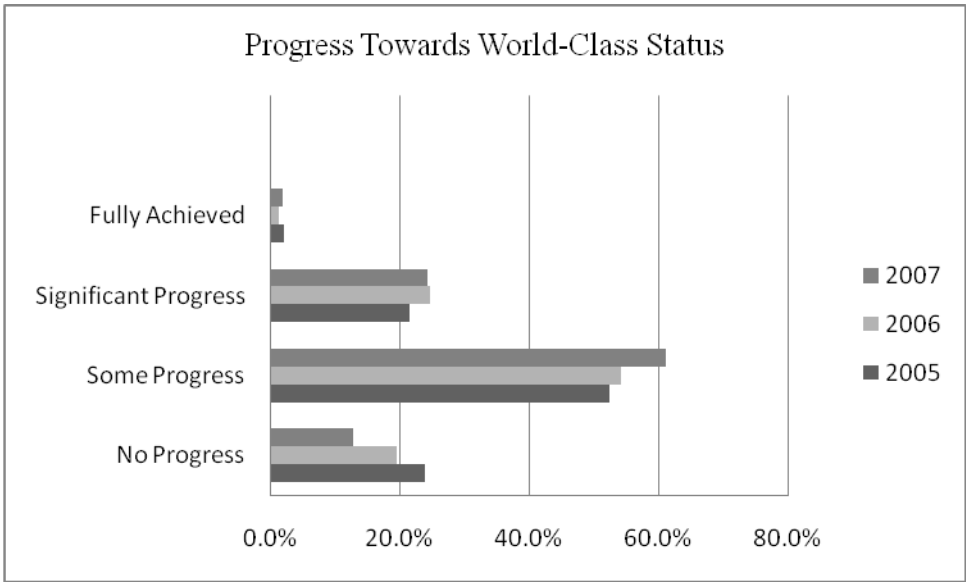

Figure 4. Progress towards world-class status (2005/2006/2007 IW/MPI)

Although there have been countless conceptual articles and books written regarding lean and its role in cost reduction through waste elimination, the increasing interest in lean, the lack of progress toward world class progress, and the lack of empirical research found on this topic provided evidence of a need for this study.

Even though lean had become the management system of choice for many U.S. manufacturers, there were still notable issues regarding the implementation of lean. According to Stamm (2004), "There are more companies that believe they have implemented lean than there are companies that have really implemented lean. There seems to be a trend toward becoming 'kinda, sorta lean'" (p. 22). In the article, Stamm related experiences visiting companies in Europe and the United States that claimed to be using lean, but found that each had in fact only limited versions of a lean management

system in use. Furthermore, Stamm (2004) also found, "Programs that are seeing diminishing success in the second or third year of implementation are symptomatic of kinda, sorta lean programs" (p. 22). The companies that were attempting to implement lean, but only doing a marginal job stand to benefit from this study; but, in order to determine whether a lean implementation effort would be successful, it was necessary to define what a lean implementation failure/success is.

Lean Failure/Success Defined

The literature indicated a strong tendency of organizations to face difficult challenges and high failure rates when attempting significant organizational change. So to better understand this phenomenon as it applied to this research, it was necessary to define failure in the context of lean implementation. The interpretation of lean failure, and for that matter lean success, is speculative at best. The subjective nature of the topic provides no definitive answers. The literature offers instead a rather broad explanation that is open to interpretation. The following examples represent some perspectives on lean failure and lean success. According to Thelen (2010-a), implementation failure can be defined as total, where implementation efforts are abandoned completely, a partial failure where actions do not reflect theory, or short-term where efforts are suspended for the time being. Thelen (2010-b) further stated,

> A successful transition to a Lean Enterprise is very uncommon. The last published estimates claim between two and five percent of all attempts succeed. To restate: a minimum of 95% of all attempted organizational lean implementations fail. Why do so many attempts fail? The hours of discussion generated on a single online

> forum concerning this question are staggering. Yet no one has been able to offer a root cause of failure that all can agree on. (p. 1)

Thelen's statement corroborates the 2005/2006/2007 IW/MPI Census of Manufacturers' data, which shows that approximately 98% of all lean implementation attempts never reach a World-Class level. An additional definition for lean failure included a comment by Dixon (2007),

> For every successful lean implementation there are many failures, where "failure" is defined as an implementation that never really provides all of the benefits that were promised. The company is '"kind'a, sort'a lean"', but doesn't enjoy the full economic, performance and cultural benefits of a World Class enterprise. (p. 1)

So, even though the exact definition of lean failure/success is somewhat vague, there is clear support that the failure rate is quite high. An examination of the rate of lean failure will exemplify the need for this research.

Lean Failure Rates

It is interesting that a management philosophy with such high failure rates would be so popular. Manufacturers see the potential of lean through the results of successful World-Class companies such as Toyota and know lean concepts have been time-tested and proven to work. However, what many manufacturers have yet to figure out is how to successfully implement lean into their organization. There have been many organizations that have attempted to implement lean, but the lean failure rates are still extraordinarily high. Kallage (2006) noted,

> One of the most frustrating and misunderstood issues regarding lean manufacturing is its implementation. Lean is a powerful organization and manufacturing model that most experts agree could be the dominant paradigm worldwide in the next five to 10 years. However, current lean implementation failure rates—well over 50% according to many lean advocates and professionals—are much too high for this to happen. (p. 1)

Even with the outstanding potential for lean in the future of manufacturing, the problematic issues that stymie implementation efforts may limit its effectiveness or worse.

According to Eaton (2004), "A far lower number are successful than you might think – less than 30%. And of those who realize the improvements less than 50% are able to sustain it, slipping back to previous or lower performance levels" (p. 1). A factor that may hinder a significant change initiative is that an organization may have already had a bad experience with change (Dwyer, 2007). A prior bad experience with change only causes additional resistance to any more ideas regarding change. There is yet another perspective from a long-time financial investment analyst and inductee into the Shingo Prize Academy. Ransom (2008) stated,

> Very few companies have advanced with lean manufacturing until you can see results financially—perhaps one or two percent. Another two-three percent are '"getting there'"—OK but not outstanding. Another 10-15% mostly "just talk lean." The majority, 80% or so don't even have the buzz words straight. Unless I see three pieces of evidence, I do not consider a management to be serious about lean manufacturing. 1) They must proclaim that they are becoming lean. They can call it whatever they want, but intentions must be boldly stated in a vision that

> everyone can understand. 2) They must tie compensation to lean systems. You are not becoming lean if you reward people for doing unlean things. 3) They have to drive the company with lean metrics—time and inventory measures. You have to persist to see results. You won't see much change in the financials for 12 to 18 months, sometimes longer. Clearly, confirming the sustainability of superior performance takes much longer—years. Most managements waffle around, make only a half-hearted attempt, and never get rid of the inconsistencies in their own leadership. (p. 1)

The bottom line for most businesses is profitability. Lean is one type of management philosophy many businesses utilize as a financially advantageous business strategy to remain competitive. In light of the accelerating move by manufacturers toward lean, there is a clear need for additional research to understand the cause of and factors that contribute to the current failure rate of lean implementation.

Why Lean Implementations Fail

There is much speculation as to why lean implementations fail. It is a complex subject that has a host of factors, including leadership, culture, and change as well as many others equally as important. The literature provides some insight into the subject through the following authors' perspectives. According to Kallage (2006), "Almost all lean experts agree that the main reasons for implementation failures involve senior management and ownership. These people are ultimately responsible for everything that happens, or doesn't, in the company" (p. 2). Other conjecture insists failure to successfully integrate culture change and an endless bombardment of new programs has

inhibited support of lean initiatives as a fad that too will quickly pass (Padgett 2004; Parks, 2002). Parks (2002) went on to state,

> If lean works for Toyota and others, then what causes these failures? While each failure can be attributed to a different cause, underlying all of them are the fundamental issues of corporate culture and change management. Creating a lean workplace requires changing the corporate culture to embrace a different way of doing business. Changing the corporate culture requires using a robust change management strategy. Done right, a lean implementation can result in a disciplined, orderly workplace that continually improves and remains competitive. Done wrong, lean becomes yet another management process that failed. (p. 1)

As can be seen from these various perspectives, there is no clear answer as to why lean implementations fail. Lean implementation failures seem most likely caused by a series of issues that have come together to form a virulent atmosphere of conflict. This conflict, which contains both business and humanistic elements, has proven extremely difficult to marshal into an organized and productive force for positive change.

Examples of Lean Implementation Failures

Stamm (2004) stated, "there are more companies that believe they have implemented lean than there are companies that have really implemented lean" (p. 22), and a comment from an article in the *Industrial Engineer* ("The Lean Prescription", 2006) that stated, *"less than half* of the lean initiatives had produced satisfactory results" (p. 16) are unambiguous signs that there is a important and widespread problem here. This research is designed to investigate the specific problems related to lean implementation

efforts by examining the relationship of organizational characteristics to successful lean implementation.

Although the automotive industry is known for its wide-spread use of lean, many other industries have also attempted to utilize lean manufacturing practices. To bring this problem more into focus as it pertains to this research, subsequent examples provided clear evidence of problems specifically regarding lean implementation whether it was in an organization, a particular industry, nationally, or even internationally. Specific examples of two different non-automotive industries that were experiencing problems with lean implementation are mentioned below.

One example of a failed lean project took place in a startup Class 3 medical device company over a period of just three months. According to Tolman (2007), although there were several issues that plagued the project and ultimately led to the failure, the primary cause was a lack of collaboration among management personnel in charge of the project. These items included the dismissive relationship the manufacturing engineers had with production members, the attempted undermining of the Director of Operations by the Senior Manufacturing Engineer, and the lack of top management support to guide a collaborative effort. As can be seen in the next example, these issues are common.

MEECO Incorporated, a U.S. company, is an industrial process furnace and oven manufacturer of instruments and related products for measuring, displaying, and controlling industrial process variables. The decision to implement lean in the facility was met with some skepticism. According to Bergson (2001), "At MEECO, adopting an innovative manufacturing process that gives employees more responsibility is at times a tough sell" (p. 1). Hourly employees are not alone in their reservations of accepting the

lean implementation. Even the plant manager expressed concern about who had *ownership* of a conveyor belt process and "other senior managers have resisted the concept", noted Bergson. (2001, p. 1) Bergson (2001) further stated, "My plant staff has, in fact, undermined all the managers who tried to implement change" (p. 2). MEECO is not alone in the struggle to successfully implement lean. Many other companies are equally disappointed in the results of their lean implementation efforts.

The pharmaceutical industry is also experiencing disappointing results, according to an article in *Industrial Engineer* ("The Lean Prescription", 2006). In the article, survey findings regarding lean implementation initiatives in the pharmaceutical industry were discussed.

> Despite its popularity in the automotive and high-tech industries, lean manufacturing hasn't enjoyed the same success in the pharmaceuticals industry, where complex manufacturing processes are used. This is according to the results of a recent survey of more than 1,500 pharmaceutical manufacturers conducted by software developer Invistics. The survey showed that while more than half of respondents said their companies have implemented lean, Six Sigma, or operational excellence, *less than half* of the lean initiatives had produced satisfactory results. (p. 16)

The Industrial Engineer ("The Lean Prescription", 2006) article further stated, "According to Invistics President and CEO Scott Geller, 'Many companies in industries that traditionally haven't applied lean and Six Sigma are now trying to benefit from these techniques and they are learning that it is not as straightforward as they expected it to be' (p. 2). Much has been written about the success of lean, but a key component that is often

misunderstood is the complexity of the implementation phase. Successful lean implementation requires more than understanding the methodology of lean. "Lean is not a quick fix, and the lean journey is sometimes fraught with detours, speed bumps and potholes. Lean concepts are simple, but sustainable lean conversion is rarely simple" (Alukal, 2006, p. 68).

Summary

The emergence of lean is actually the result of a long evolutionary process that dates back hundreds, or even thousands, of years. This ongoing process of adaptation to the ever-changing approaches in manufacturing is manifesting itself, as currently seen, in the transformation from traditional to lean methodologies. As time moves on, lean, unlike its predecessor, has continued to adapt, in-part due to its model of continuous improvement.

The conceptual framework of organizational leadership, organizational culture and organizational change provide the foundation upon which to understand the critical components that affect lean implementation. Through an exhaustive literature review, these two components emerged as divisive in the overarching theme of organizational characteristics. Understanding the effect they each have on lean implementation is crucial to successful lean transitions.

When an organization makes a substantial change, there are many challenges to be faced. These challenges, more often than not, lead to failure of the change initiative. The high failure rate associated with organizational change is also applicable to lean implementation. Whether the lean implementation is local, national, or international, there

is a common theme of problematic lean implementation. This study examined these issues to better understand how they can be addressed successfully, thus promoting successful lean implementation efforts.

CHAPTER III

RESEARCH METHOD

Statement of the Problem

A management system for manufacturing operations has been developed that is improving operational efficiency for many organizations. The system, known as lean, is rapidly growing in popularity and has been proven effective in the U.S. and abroad. However, there is a disconnect between some U.S. companies that want to utilize lean and those that are able to successfully implement it. Unless problems associated with implementation are understood and addressed, issues that contribute to problematic lean implementation in these companies are likely to continue.

Purpose of the Study

The purpose of the study was to investigate the relationship between organizational characteristics and issues associated with lean implementation. In particular, the study identified organizational characteristics which, for the purposes of this study, include (a) *organizational leadership,* (b) *organizational culture,* and (c) *organizational change* to determine how each influences lean implementation efforts, and (d) also determine the extent to which *intrinsic organizational factors* impact lean implementation efforts.

Research Design

Based on a general problem, problematic lean implementation, with the specific purpose of the study being to bring about a better understanding of the problem so that

solutions may be developed, this research utilized a mixed-method research design. The mixed-method approach combines applicable elements from both qualitative and quantitative research methodologies relevant to the particular research problem. The mixed-method design utilizes qualitative and quantitative methods that work with a singular purpose, to produce richer, fuller, more in-depth findings than is possible with either methodology used alone.

For this research, the *exploratory mixed-method research design* (Snyder, 2006) was chosen. The exploratory design utilizes qualitative methodology to collect and analyze data followed in turn by supplementary research performed during a quantitative phase. The main idea was to use qualitative techniques to explore a particular phenomenon in order to develop a quantitative instrument to measure the phenomenon or to use quantitative techniques to investigate relational qualitative data. Table 2 illustrates the mixed-method data collection plan used in the research.

Table 2

Mixed-Methods Data Collection Plan

Research Type	Method	Tool
*RQ1	Qualitative	Structured Interview
*RQ2	Qualitative	Structured Interview
*RQ3	Qualitative	Structured Interview
**RQ4	Quantitative	On-line Survey
**IAC Meeting Minutes	Qualitative	Document Analysis

*Research Questions
** Industrial Advisory Committee

Once the research methodologies for the study had been identified, a sequential list of steps was developed that guided the progression of the study. Each step represents an important component that must be performed in order to ensure study validity. The qualitative and quantitative methodologies are listed in Table 3 as they apply to each step in the study. In this study, there was a need to do preliminary research in the form of interviews, which were qualitative in nature, to narrow the focus of the study. The following narrative briefly describes the nature of qualitative research as used in this study.

Qualitative Research

In doing research, it is common to find complex characteristics that are not easily measured quantitatively. The use of human subjects in research, for example, often presents data that are complex in nature and difficult to articulate. The use of qualitative research allows a number of data collection techniques such as narrative, document analysis, and observations that work in unison to derive useful meaning when faced with these types of situations. However, qualitative research is frequently noted for its lack of objectivity (Best & Kahn, 2006).

The subjective nature of qualitative research is due to the researcher interaction in the research process, introducing researcher bias. Yet, there are techniques used in qualitative research that substantiate the legitimacy of the results and negate the effect of subjectivity introduced by researcher bias. These techniques will be explained in the subsequent discussion of qualitative research methodology.

Table 3

Sequential Steps for Developing Table

Steps	Description	Qualitative/Quantitative
1.	Develop pilot study	Qualitative
2.	Select pilot study participants	Qualitative
3.	Request Human Subjects Committee permission	Qualitative/Quantitative
4.	Conduct pilot study to test interview instrument	Qualitative
5.	Make revisions to interview instrument	Qualitative
6.	Select interview participants for study	Qualitative
7.	Conduct interviews for study	Qualitative
8.	Transcribe study data	Qualitative
9.	Code and analyze study data	Qualitative
10.	Perform Document Analysis	Qualitative
11.	Develop online survey instrument	Quantitative
12.	Select pilot study participants	Quantitative
13.	Conduct pilot study to test online survey	Quantitative
14.	Make revisions to survey instrument	Quantitative
15.	Select survey participants for study	Quantitative
16.	Administer online survey instrument	Quantitative
17.	Collect and analyze study data	Quantitative

The qualitative portion of the study was designed to answer the following research questions.

Question 1: What role does organizational leadership play in lean implementation?

Question 2: What role does organizational culture play in lean implementation?

Question 3: What role does organizational change play in lean implementation?

The research questions refer to three specific characteristics that affect lean implementation success.

Qualitative Data Collection Methods

The qualitative portion of this research utilized a combination of interviews and document analysis. The interview questions for the study, developed from an initial pilot study, were designed to elicit candid in-depth responses from the participants. By using a predetermined set of open-ended queries, the structured interview process served to keep the participants focused on the interview questions. The document analysis was based on meeting minutes from the Department of Industrial Technology's Industrial Advisory Committee (IAC) meetings which were held in the College of Engineering at Southern Illinois University Carbondale. The participants from both the pilot study and interviews had extensive lean experience in a variety of academic and workplace environments and provided valuable data for the study. In addition to the qualitative techniques of interviews and document analysis, demographic data were collected in order to describe the characteristics of the IAC member organizations.

Data Collection and Analysis

The practice of data collection and analysis was multilayered. An important first step was to select an appropriate research design that informed the course of action for the study. The qualitative data for the main portion of this study were collected using the exploratory design concept, defined as the exploration of a topic using qualitative methods to establish the basis from which to design the remainder of the study (Snyder, 2006). The subsequent steps discussed here are qualitative in nature and detailed in the following sections.

Instrument Development

The process of developing an interview instrument for this research study required a series of steps. The following narrative describes in sequential fashion the course of action used to accomplish this, including information about the initial research conducted on the topic, steps to develop a pilot study, participant information, and finally instrument development for the research study.

Pilot Study Instrument Development

The preliminary steps began with the development of an instrument with which to conduct a pilot study. To do this, an extensive literature review pertaining to problematic lean implementation issues was undertaken as a preface to constructing the interview instrument for the pilot study. A thorough review of literature relevant to this specific topic was conducted to the point of saturation. Next, the data were evaluated to determine what salient characteritics were mentioned foremost in the literature regarding these

issues. Then, based on the frequency with which the salient characteristics associated with problematic lean implementation were cited in the literature, an interview instrument for the pilot study was developed. Questions pertaining to the subject matter were crafted as open-ended questions in the development of the interview instrument in order to facilitate in-depth responses from the interview participants during the pilot study.

The following list is an example of questions used in the interview instrument for the pilot study.

1. How does the culture of an organization affect its ability to effectively adopt a new management philosophy?
2. How does an organization overcome employee resistance to change when trying to implement new management rules?
3. When a organization tries to implement lean as its management system, what salient organizational characteristics inhibit its acceptance?

A demographic questionnaire was included in the question set as well. These questions were then used to conduct the pilot study, which in the case of this research consisted of conducting interviews with two faculty members from the Southern Illinois University Carbondale (SIUC) Department of Technology.

Pilot Study Participants

The IT faculty selected for the pilot study possessed extensive knowledge of lean and specialized in Industrial Technology. They taught a course on lean through lecture content and practical application in conjunction with area manufacturers as part of the IT curriculum, as well as exemplified how lean concepts are utilized in the Six Sigma

courses. One of the faculty members had not only taught lean for five years, but also worked as a lean consultant to ten different industrial manufacturers. The other faculty member did research in the area of lean, had seven years experience with lean, and had worked in conjunction with six different industrial manufacturers on lean-oriented projects. This experience qualified these IT faculty members to serve effectively as pilot study participants. Access to the IT faculty members consisted of going to the office of each and requesting their permission to do the interview for this study. The IT faculty participants received no monetary compensation for their participation in the study, but were told they would receive a complete copy of the study once it was completed.

Pilot Study

The two Industrial Technology faculty were interviewed for the pilot study once contact was made, approval to do the interviews was granted from the Human Subjects Committee, and interviews were scheduled. A pilot study utilizing interviews was conducted in private IT faculty offices. The interviewees were encouraged to be forthright and give detailed answers based on their personal experiences in the manufacturing industry. The pilot study interviews with the Southern Illinois University Carbondale Department of Industrial Technology faculty lasted approximately 40 minutes each.

Based on the data from these interviews, a clear sense of direction for the research study began to emerge. Once the pilot study interviews were completed, the results were analyzed and refocused in order to develop an interview instrument for the research study that more accurately answered the research questions. To ensure validity of the data, member checking with the Industrial Technology (IT) faculty participants was conducted

to determine if the interview data were interpreted accurately. Corrections to the interview data were then made as needed in preparation for development of the research study instrument.

Research Study Instrument Development

As a result of the the pilot study findings, the term organizational characteristics was disected into four separate components that could be analyzed more distinctly. Three of the components, *organizational leadership*, *organizational culture*, and *organizational change*, were examined using qualitative methods. The remaining component, *intrinsic organizational factors*, was examined quantitatively. To further ensure validity, the newly developed research study instrument, as illustrated in Appendix C, was member checked and acknowledged as accurate by the IT faculty pilot study participants as well.

The research study instrument sought to uncover comprehensive data regarding organizational leadership, organizational culture, organizational change, and the role each plays in lean implementation. The following list is an example of questions that were used in the interview instrument.

1. What do you see as the biggest cultural challenges when an organization changes from a traditional manufacturing philosophy to lean?
2. Has your organization's leadership/management had any formal training in the area of change management? If so, to what extent?
3. Who leads lean implementation in your organization, the leaders or hired consultants?

A demographic questionnaire was included in the question set as well. Once the interview instrument for the research study was completed, participants from the Industrial Advisory Committee were contacted in order to request interviews.

Industrial Advisory Committee Participants

The target population for the research study consists of regional business leaders who are members of the Southern Illinois University Carbondale (SIUC) Industrial Advisory Committee (IAC). The committee, a collaborative endeavor between a diverse group of regional businesses and SIUC, is comprised of regional business leaders and faculty members from the Department of Industrial Technology (IT), located within the College of Engineering as Southern Illinois University Carbondale. The IAC has specific guidelines required for membership acceptance as outlined in the group's bylaws. These membership guidelines verify qualification of industry related experience for the IAC members who participated in this research. The following are the committee's purpose and membership requirements, as stated in the Industrial Advisory Committee Bylaws (n.d.).

> ARTICLE III: Purpose
>
> The committee shall serve in an advisory capacity to the Industrial Technology program and its faculty. The function of the Committee shall include, but not be limited to, the following:
>
> A. Validation of program content (outlined in Section 6.14 of the NAIT standards for Accreditation); specifically, validation of major program outcomes/student

compentencies (outlined in Section 6.3.12 of the NAIT Standards for Accreditation)

B. Review curriculum content and recommend changes/additions

C. Assist in providing appropriate industrial projects for use in curriculum, when possible

ARTICLE IV: Membership

The Committee shall consist of a minimum of three (3) industrial members. Appointments and terms shall be as follows:

A. Members shall be appointed for a two-year renewable term

B. Nomination of members will be based on the following recommended qualifications:

1) 2 years or more of experience in an industry-related field

2) Job responsibility includes management of personnel (p. 1)

Although the Industrial Advisory Committee Bylaws noted in ARTICLE IV: Membership are minimum standards for membership, the IAC group participating in this study has many years of additional manufacturing industry experience in a wide-range of industrial manufacturing settings. During the scheduling of the interviews, the IAC members disclosed some of their previous experiences in manufacturing. The following information represents a cumulative snapshot of IAC members' lean knowledge that qualified them for this study:

- Industrial manufacturing experience ranging from 5 – 25+ years
- Lean consulting for many individual manufacturers

- Presenting lean concepts at conferences
- Learning the Toyota production system/lean directly from the Japanese
- Lean Enterprise instruction to global industrial manufacturing suppliers

Also included is practical experience in industrial manufacturing environments with lean applications such as (a) Value stream mapping, (b) Kaizen activities, (c) Mistake proofing, (d) Order leveling, (e) Pull systems, (f) Single part flow, and (g) Continuous improvement.

The committee's role in validating program content, and program outcomes and student competencies is to ensure appropriate educational curriculum for the IT program based on current and projected industry requirements. Based on the minutes of the meeting documentation, it was the Industrial Advisory Committee that suggested a lean course be implemented as part of the educational curriculum for the IT program. The support of manufacturing industries, represented by the IAC, in making available industrial projects further exemplifies their understanding of and commitment to the lean philosophy as a necessary and integral part of the curriculum in the Industrial Technology program at SIUC.

Research Study

Access to the IAC members consisted of requesting contact information from one of the participating faculty members who is a member of the Industrial Advisory Committee. The participants from this population were emailed a request for an interview. A follow up phone call was used to make personal contact with each non responder. The eight area business leaders who belong to the IAC were interviewed for the qualitative portion of the study once contact was made, approval to do the interviews

was granted from the Human Subjects Committee, and interviews were scheduled. The interviews were conducted in the privacy of an office. The interviewees were encouraged to provide candid and comprehensive answers to the interview questions. Due to the the emergent nature of the interview process, and the extended list of interview questions, the interviews with the business leaders from the Industrial Advisory Committee lasted an average of approximately 60 minutes.

Participants in the study did not receive monetary compensation for their participation in the research study but were told they would receive an executive summary of the study. Interviews were an appropriate form of data collection for this group of participants because individual case studies would be too lengthy for the timeframe of this study. Also, a survey for this portion of the study would not provide the in-depth information required to answer the research questions.

Human Subjects Committee Approval

A consent form, interview protocol, and human subjects application are all documentation required for the Human Subjects Committee (HSC) approval before the interview process can begin for the pilot study. A sample consent form presented to each participant included in the pilot study is found in Appendix A. Prior to the pilot study, each participant read and signed the consent form and was informed of the voluntary nature of the interview, confidentiality of their participation, and right to stop the interview and withdraw from the study at any time. The procedures were followed and HSC permission to proceed with the pilot study was approved. No one in the pilot study chose to terminate their participation throughout the initial interview process and

subsequent follow up member checking with the IT faculty participants validated the data interpretation and subsequent refinement of the interview protocol.

Each participant interviewed for the pilot study was assigned a unique alpha/numeric identification code to ensure confidentiality, as did the participants for the study once HSC approval was granted for that step in the process. All interview data and the resultant analyses were summarized in such a way as to provide an overall perspective of the current trend without compromising individual confidentiality.

Access to the SIUC faculty participants consisted of going to the office of each and requesting their participation in the study, to which each agreed. The data collected from the pilot study were then transcribed, coded, and inspected for themes. No qualitative data analysis software was used in the processing of information. The data were all manually processed in each step of the analysis. The process of identifying suspected themes as well as emergent themes that had not originally been considered through the literature review was used to inform the research study interview protocol.

Structured Interviews

The structured interviews for the study were based on data gained from the pilot study. Interviews provide a rich source of data that is often difficult if not impossible to secure from other sources. A strong argument for using interviews is the opportunity to get direct information based on the participant's personal experience (Patton, 1990). The premise of a structured interview is to use a set of predetermined questions in order to obtain consistent information from all the different participants being interviewed. Acording to Lofland and Lofland (1995), the use of a structured interview helps to avoid

researcher bias. To gather data through interviews, there are a number of different interview techniques.

The way in which the structured interviews were conducted for this study was to begin with the questions in a sequential manner and probe for additional information, by way of increasingly specific topical questions, to elucidate particular points when necessary. The participant, in the answering of a specific question, sometimes answered questions that were further down on the list and had not yet been asked. This is natural part of the interview process. Subsequent interview questions continued to be asked in the predetermined sequence, adapting to the new sequential order of unanswered questions. Interview participants were encouraged to express themselves without reservation.

Transcription

The interviews for the study were recorded on a digital voice recorder. The reason for the recording was to ensure a complete recount of the interview conversation. Field notes utilizing hand writen notes during the interview process and material added from memory after the interview had been concluded, are inclined to be incomplete. The use of a recording device allows for a word for word verification that all the data is accounted for (Patton, 1990). The actual transcription was completed by the researcher and transcription assistants Billie Cooper, Misty Cooper, Hope Cooper, Cindy Garris, and Debra Bunting. All transcription work received a final check for accuracy by the researcher.

Data Coding and Analysis

To understand the process of qualitative data analysis, a brief definition is required. According to McMillan and Schumacher (2006), "Qualitative data analysis is primarily an inductive and systematic process of coding, organizing the data into categories, and identifing patterns (i.e., relationships) among the categories" (p. 364). The main premise of recognizing these relationships is to better understand the particular phenomenon under study.

Qualitative research typically generates large amounts of data. So, once the data have been gathered, there must be a plan to organize them effectively. The researcher normally has preconceived ideas of how the data should be arranged, so predetermined categories are often a simple way to get started. The data are then ready to be delineated further, so the data are coded by reading the material and looking for recurring subject matter. The data are then examined for duplication of codes which establishes the number of codes within the material. The next step is to refine the content of the series of codes into a more specific meaning known as a category. There can be serveral categories derived from the codes. So, the revising process is repeated to bring the number of categories down into one or two main patterns that represent relationships between the categories. McMillan and Schumacher (2006) stated, "In searching for patterns, researchers try to understand the complex links among various aspects of people's situations, mental processes, beliefs, and actions" (p. 373).

Document Analysis

All Industrial Advisory Committee meeting minutes, which included ten documents from 2004 to 2009, were available on-line from the SIUC Industrial Technology website. A document analysis was conducted on the minutes from the Industrial Advisory Committee meetings. The Institutional Review Board requirements to conduct the study are identical to the previously outlined steps for the qualitative pilot study. This procedure was followed in order to be granted permission to proceed with the human subjects portion of the study which involved both the on-line surveys and interviews. The steps that were used to conduct the qualitative portion of this mixed methods study are outlined in the subsequent sections.

Validation

An important element of the analysis process is validation. One way in which qualitative research is validated is through a process called triangulation. Triangulation helps to ensure meaningful research results.

> Researchers use triangulation, which is the cross-validation among data sources, data collection strategies, time periods, and theoretical schemes. To find regularities in the data, the researcher compares different sources, situations, and methods to see whether the same pattern keeps recurring. (McMillan & Schumacher, 2006, p. 374)

Triangulation techniques will vary within each given research situation, based on the data present within a given study; but, the main premise remains the same. The recurring patterns among the different data sources indicate some degree of validity of qualitative

data findings. In this study, the interview transcript data from the pilot study and consequent refined interview protocol was member checked with the IT faculty participants to provide a source of validity. A secondary data analysis will be conducted on the minutes from the Industrial Advisory Committee meeting as well.

Quantitative Data Collection Methods

The quantitative portion of the study utilized an on-line survey to generate data regarding intrinsic organizational factors. Intrinsic organizational factors are inherent, or built-in elements of an organization such as age or size. The on-line survey questions were designed to provide a convenient and anonymous method for survey participants to express their viewpoints about the extent to which a variety of intrinsic organizational factors affect lean implementation. The quantitative portion of the study was designed to answer the following research question. *Question 4*: To what extent do the following intrinsic organizational factors affect lean implementation? The research question refers to a set of sixteen factors that are associated with lean implementation success.

Instrument Development

The on-line survey instrument created for the quantitative portion was developed using a number of sources including data from the initial pilot study, data acquired from an exhaustive literature review that focused on lean implementation issues, and the previously mentioned list of organizational characteristics found in the literature. From this data, a set of intrinsic organizational factors was derived that are associated with lean implementation. The following list of organizational characteristics and the questions

regarding them have been selected specifically to gain insight into the lean implementation process.

- Organizational adaptability
- Leadership effectiveness
- Teamwork-oriented
- Number of management levels
- Union
- Nonunion
- Management/employee buy-in
- Understanding of organizational culture theory
- Management/employee training
- Management/employee relationship
- Management/employee communication
- Environment of continuous improvement
- Employee resistance to change
- Age of organization
- Number of employees
- Understanding of change management theory

These factors were then incorporated into a survey instrument designed to determine the extent to which each plays a role in lean implementation. An example of the paper copy of the survey instrument, as presented in Appendix C, was submitted to the Human Subjects Committee (HSC) for approval due to the use of human subjects in the study.

Procedures

Once HSC approval was obtained, completion of the on-campus registration process was then required in order to use LimeSurvey (2010). LimeSurvey is software designed to develop an on-line survey. Then, an on-line survey was developed based on the approved paper model using the LimeSurvey software. Once a working on-line survey model was completed, a pilot study using the on-line survey was conducted with a U.S. manufacturer that was not a member of the Illinois Manufacturers' Association. After the

pilot study had been completed, a follow up on-line survey was immediately administered to the same manufacturer used in the pilot study in order to validate the relevance of the questions in the on-line survey instrument. Suggested revisions were incorporated into the Illinois Manufacturers' Association on-line survey model to enhance research validity. An example of the validation survey instrument is found in Appendix D.

Research Study Participants

The target population for the quantitative portion of the study consisted of members of the Illinois Manuacturers' Association (IMA) (N = 4,259). Jim Nelson, Vice President, Communications and Marketing, Illinois Manufacturers' Association (IMA) was contacted and permission was requested to conduct an on-lin survey involving the IMA members. Once permission was granted, the survey was sent to Nelson who subsequently distributed the on-line survey to the IMA members with a notice to complete the on-line survey within ten days. A followup reminder notice was sent to the participants five days later.

Comprised of organizations in the manufacturing sector, the following statement on the IMA website provides insight as to the association's historical origins, high percentage of organizational participation, and diverse membership.

> The Illinois Manufacturers' Association was founded in 1893 by a group of seven businessmen concerned that state lawmakers would enact legislation curtailing the number of hours women could work in Illinois. From those humble beginnings, the IMA has grown to be the oldest and largest state advocacy association for industry in the United States with more than 4,000 members. Eighty-five percent

> of Illinois' 670,000 manufacturing workers are employed by the member companies of the IMA. From corporate giants like Boeing, Caterpillar, and Deere to the smallest family owned and operated enterprises, the IMA is the "Voice of Industry" in Illinois. (Illinois Manufacturers' Association, 2010, n.p.)

The large and diverse membership of the IMA represented a significant opportunity to learn about lean implementation issues from those who are directly involved in the field of manufacturing. Nelson, provided demographic data categorizing the percentage of organizations with regard to the number of employees as illustrated in Table 3 (J. Nelson, personal communication, March 8, 2010).

Table 4

Organization Population Percentages

	Organization Populations						
	<25	25-49	50-99	100-199	200-499	500-999	>1000
Organization Percentages	17.96%	21.09%	22.83%	17.50%	15.30%	3.71%	1.62%

With regard to whom within each IMA member organization answered the on-line surveys for this study, 91% of the of the on-line surveys were answered by the president/CEO, 18% by the vice president, 8% by the COO/CFO, 14% by human resource personnel, and 28% by various managers within each organization. According to Nelson (Personal communication, February 25, 2010), survey rates tend to be very low with this population because, they receive many emails each day and often do not have time to respond to such survey requests.

As with any organizational management philosophy, including lean, it is imperative that the president and upper management be well versed in the organization's management philosophy if it is to be effective. This is typically done by providing in-depth training to the president and managers for the particular philosophy guiding the organization. This training qualifies both the president and managers of the organizations in this study to be able to make informed decisions regarding this survey.

Operational Definitions of Survey Participants

Respondent. An Illinois Manufacturers' Association survey participant who responds to the initial survey request.

Late Respondent. An Illinois Manufacturers' Association survey participant who does not respond to the survey request within the first five days, but does respond after the five day reminder has been sent.

Non Respondent. An Illinois Manufacturers' Association member who does not respond to either the initial survey request or the five day reminder.

Data Analysis

The response data was collected in preparation for data analysis. Since a census of the entire population was used instead of a sample, inferential statistics were not used. The data collected from the on-line survey was imported into SPSS. A descriptive statistical analysis was performed using SPSS, in order to "transform a set of numbers or observations into indices that describe or characterize the data" (McMillan & Schumacher, 2006, p. 150). Both the *demographic* and *intrinsic organizational factor* sections of the

Illinois Manufacturers' Association survey were examined using descriptive statistics to determine the frequency and percentage distributions. Grapical displays were also utilized to visually illustrate the data characteristics. The survey instrument utilized a five-point Likert scale. The results of the survey were tabulated to determine the extent to which each intrinsic organizational factor affects lean implementation.

The data were also analyzed using the Spearman's correlation coefficient for ranked data, also known as Spearman's rho. This was done to determine the strength and direction of a correlation between the *lean success rate* from question number 13 in the demographic section of the survey, and *each of the individual intrinsic organizational factors* in questions 1 – 16 listed in the intrinsic organizational factors section of the survey.

The test statistic used depends on the data type. Although Pearson's r is commonly used for correlation, in the case of ranked variables it is not appropriate because there can be no assumption of normality of ranked data. However, there is another option for examining correlations that works well for the application in this study. When using ordinal data that naturally occurs in the form of ranks or where the ranks have been substituted for raw scores, an appropriate correlation is Spearman's rho. (Howell, 2007; Morgan, Leech, Gloeckner & Barrett, 2007; Walonick, 2003) In this case, the Spearman's rho statistic was chosen because the research design is used to examine the relationship between two or more rank ordinal variables, the *intrinsic organizational factors* and the *lean implementation success rate*.

Reliability issues for the survey instrument were addressed by utilizing Cronbach's coefficient alpha, which is also sometimes known as Alpha. Cronbach's alpha measures

internal consistency of the survey instrument to ensure the instrument questions all measure the same thing. (George & Mallery, 2008; Leech, Barrett & Morgan, 2008) An advantage to using Cronbach's alpha is that there is no need to administer the survey multiple times to check reliability and it was therefore appropriate for this study where the survey was administered just once.

The scale for the data from the *lean implementation success* question is 1 – Not successful; 2 – Slightly successful; 3 – Moderately successful; 4 – Mostly successful; and 5 – Very successful. The scale for the data from the *intrinsic organizational factors* questions is 1 – No effect; 2 – Only slightly; 3 – Moderately; 4 – Often; and 5 – Very much. The correlation scale is Strong Positive [1.00 to .60]; Positive [.60 to .20]; No Relationship [.20 to -.20]; Negative [-.20 to -.60]; and Strong Negative [-.60 to -1.00].

The correlation illustrates the extent of the relationship between the lean implementation success rate and the intrinsic organizational factors. Although it is not possible to show a direct causal relationship between these two items, it is feasible to show to what extent each of the 16 individual intrinsic organizational characteristics may be associated with lean implementation success or failure. Through the use of demographic data collected during the interveiw process, descriptive statistics were also utilized to describe the characteristics of the Illinois Manufacturers' Association. Once the qualitative and quantitative data were collected, each were analyzed separately. The results were then compiled in order to sysnthesize the results of each type of the study when drawing conclusions.

CHAPTER IV

RESEARCH FINDINGS - QUALITATIVE

The purpose of the study was to investigate the relationship between organizational characteristics and issues associated with lean implementation. In particular, the study identified organizational characteristics which for the purposes of this study included (a) *organizational leadership,* (b) *organizational culture,* and (c) *organizational change* to determine how they influence lean implementation efforts, and (d) determined the extent to which *intrinsic organizational characteristics* impact lean implementation efforts. In order to accomplish this purpose, the study utilized both qualitative and quantitative elements. This chapter discusses the qualitative portion of the study.

Participant Information

Interviews were conducted with the eight business leaders who are members of the Industrial Advisory Committee (IAC) at Southern Illinois University Carbondale. The role of the IAC is to provide advisory services for the Industrial Technology program regarding content, outcomes, and competencies to ensure program validity. Members of the IAC are required to have a minimum of two years experience in an industry related field and be responsible for management of personnel.

The IAC interview protocol was developed through a pilot study process and included 21 questions pertaining to lean implementation. The questions were organized in four distinctive groupings. The first six questions were associated with organizational culture. The next seven questions were linked to organizational change. The third set of

four questions were about organizational leadership. The final set of four questions focused on general issues related to lean implementation success and failure.

The researcher contacted each interviewee individually and arranged meetings by scheduling interview times and locations. The interviews were conducted in private offices or conference rooms. Each interviewee was assigned a coding number to ensure confidentiality. The database containing all interview data was stored on a secure computer in a private office.

Data generated from the interviews were utilized to examine the role of organizational leadership, organizational culture, and organizational change in lean implementation. Document analysis was conducted on the IAC's minutes of the meeting notes to provide supporting evidence in the form of triangulation to cross validate the importance of lean as a management philosophy in manufacturing. Using narrative and document analysis, findings were produced that addressed three of the four research questions from the study. Through the use of demographic data collected during the interview process, descriptive statistics were also utilized to provide an overview of the characteristics of the organizations associated with the IAC members.

Participant Demographics and Organizational Factors

Both demographic and organizational factor data were collected during the interviews. The data pertained not only to the interview participants' personal experiences but to each participants's respective organization as well. The data were aggregated to provide a holistic rather than individualistic view of industry practices, as well as to protect the confidentiality of individuals and organizations in the study. The subsequent

discussion details the demograhpic data through a series of introductory narratives and tables that summarize the data.

The population of eight Industrial Advisory Committee (IAC) members requested to participate in the study held management positions in manufacturing organizations. Based on the demographic data, the respondents were grouped into four categories – department manager of manufacturing, quality manager, engineering manager, and continuous improvement manager. The largest group of participants were quality managers (50%). The second largest group of participants were department managers of manufacturing (25%). Other demographic data that provide insight into the organization's individual makeup were also examined.

Organizational ownership in the context of this study is based on whether an organization is privately or publicly owned. Publicly owned organizations represented a large majority (75%) of all the organizations examined, with privately owned organizations accounting for the minority (25%). Union status also represented an important characteristic for these manufacturing organizations. In this study, nonunion organizations represented an overwhelming number (100%) of organizations with zero union organizations (0%). Another demographic is the nationality of the organizations. Examination of the data illustrated that all (100%) the organizations in this study were internationally owned with zero (0%) wholly owned U.S. organizations.

Table 4 summarizes the data collected from the interview participants regarding organizational characteristics such as ownership, union status, and nationality. The data are presented as frequencies and percentages in the table. The data collected in this study are intended to represent only the local facility, not the global enterprise. The percentage

of participants for each category was derived by dividing the number of participants in each category by the total number of participants interviewed.

Table 5

Interviews: Frequencies and Percentages for Interview Participants, Organizational Ownership, Union Status, and Nationality

Factors	N	Percentage of Participants
Category		
Department Manager of Manufacturing	2	25.0%
Quality Manager	4	50.0%
Engineering Manager	1	12.5%
Continuous Improvement Program Manager	1	12.5%
Organization ownership		
Publicly	6	75.0%
Privately	2	25.0%
Union status		
Union	0	0.0%
Nonunion	8	100%
Organization nationality		
A national (US) company only	0	0.0%
An international (Global) company	8	100%

N = 8

The demographic data also provided insight into organizational age, size with respect to the number of employees, and length of lean involvement. The age range of the organizations had a diverse spread with 21 – 50 years representing the highest percentage (50%). The second largest group of participants, the 50 + years group, accounted for one quarter (25%) of the total. The 1 – 5 years and 6 – 20 years organizational age ranges made up the remaining amount (12.5% each).

Organizational size in the context of this study is based on the number of employees in the organization. The range in size was also quite diverse with the most common size organization (37.5%) having 501 – 1000 employees. The 1 – 100 and 101 – 500 employee organizations represented the second most common size (25% each) with the least common size (12.5%) being the largest organization size of 1001 + employees.

Organizations with 11 – 20 years involvement with lean were the most commonly (37.5%) represented. The organizations with 0 – 5 years and 6 – 10 years accounted for the second most common (25% each) length of lean involvement. Only one organization (12.5%) in the study had been involved with lean 20 + years.

Although the interview population size is small, the Industrial Advisory Committee (IAC) represents an important group of research participants. The IAC members are lean practitioners who provide the SIUC College of Engineering, Department of Technology, management level insight into current and future manufacturing industry trends. This is one way the Industrial Technology (IT) program remains up to date with curriculum that will help ensure continued readiness for future industry professionals. Table 5 summarizes the demographic data collected from the

interview participants regarding organizational age, number of employees, and length of involvement with lean.

Table 6

Interviews: Demographic Data, Frequencies and Percentages for Organizational Age, Number of Employees, and Length of Lean Involvement

Demographic Data	N	Percentage of Participants
Age of orgnization		
1 – 5	1	12.5%
6 – 20	1	12.5%
21 – 50	4	50.0%
50 +	2	25.0%
Number of employees		
1 – 100	2	25.0%
101 – 500	2	25.0%
501 – 1000	3	37.5%
1001 +	1	12.5%
Length of lean involvement		
0 – 5 years	2	25.0%
6 – 10 years	2	25.0%
11 – 20 years	3	37.5%
20 + years	1	12.5%

N = 8

In an effort to better understand how organizations utilize lean, the next question focused on the extent to which each organization in the study had implemented lean (i.e. *fully* implemented lean, *mostly* implemented lean, *partially* implemented lean, *only slightly* implemented lean, or a response of *not at all* in regard to the extent of lean implementation). Based on the demographic data, the largest group of lean implementers (75%) was in the *mostly* category. The second largest group, represented by one quarter of the organizations (25%), reported to be implementing lean *fully*.

Organizations come in all sizes and consequently so do their budgets. Does the size of an organization's total annual budget have an impact on lean implementation? To see if an organization's budget impacted lean success, the total annual budget of each organization was examined. The most common response (37.5%) came from organizations with a total annual budget of $100 million to $500 million (US). The next most often represented size (25%) was $1 million to $10 million (US). There was one organization that had an annual budget of $10 million to $100 million (US), another one that responded with *Don't know*, and a final one that declined to state a dollar amount by responding *Would rather not say*. These three responses (12.5% each) accounted for one organization each. The two other categories of *Less than $1 million (US)* and *$500 million to $1 billion (US)* received no responses, which represented zero (0%) each.

The collection of data from the interview portion of the study was designed to enhance the understanding of issues associated with lean implementation as reported by the interview participants. Table 6 summarizes the data collected from the interview participants regarding the extent of lean implementation within each organization and each organization's total budget for the year.

Table 7

Interviews: Frequencies and Percentages for the Extent of Lean Implementation and the Organization's Total Annual Budget

Factors	N	Percentage of Participants
Extent of lean implementation		
Fully	2	25.0%
Mostly	6	75.0%
Partially	0	0.0%
Only slightly	0	0.0%
Not at all	0	0.0%
Organization's total annual budget		
Less than $1 million (US)		0.0%
$1 million to $10 million (US)	2	25.0%
$10 million to $100 million (US)	1	12.5%
$100 million to $500 million (US)	3	37.5%
$500 million to $1 billion (US)	0	0.0%
Don't know	1	12.5%
Would rather not say	1	12.5%

N = 8

The lean philosophy is comprised of a series of tools that work in conjunction to eliminate waste from the organization in order to improve overall operational efficiency.

Since the tools are an integral component of lean it was important to examine which were most commonly used by the organizations in this study. This part of the demographics section takes a look at the use of the tools both as a whole set and on an individual basis. The idea was to take note of which tools the organizations used and determine the frequency with which each tool was utilized.

The whole philosophy describes an organization that utilized every one of the lean tools. In this study, a considerable percentage (62.5%) of the organizations had employed the whole philosophy. However, the remaining organizations chose to select some tools while disregarding others. The following describes which lean tools were most popular and those that, while accepted to a large degree, were not always embraced.

There were six lean tools that were adopted by all (100%) of the organizations. This group of tools included *5S*, *Error Proofing*, *Setup Reduction*, *Visual Communication*, *Continuous Improvement*, and *Kaizen Events*. The remaining five lean tools were utilized by most (75%) of the organizations. These lean tools included *Just-in-time*, *Kanban*, *Pull System*, *Value Stream Mapping*, and *Total Productive Maintenance*. The final category, *None* indicating there were no lean tools used, had zero (0%) responses from the organizations.

The organizations in the study had different ideas about how many and which lean tools to utilize. The extent to which they agreed, and differed, is reflected in Table 7. This table summarizes the data collected from the interview participants regarding which lean tools their respective organizations had implemented.

Table 8

Interviews: Frequencies and Percentages for Lean Tools the Organizations Had Implemented

Lean Tools	N	Percentage of Participants
Lean tools the organizations implemented		
The whole philosophy	5	62.5%
5S	8	100%
Just-in-time	6	75.0%
Kanban	6	75.0%
Pull system	6	75.0%
Error proofing	8	100%
Value stream mapping	6	75.0%
Setup reduction	8	100%
Visual communication	8	100%
Total productive maintenance	6	75.0%
Continuous improvement	8	100%
Kaizen events	8	100%
None	0	0.0%

N = 8

When an organization chooses to implement lean as its management philosophy there are many challenges to overcome, as with any significant change management initiative. So, a question was posed to the interview participants as to whether the organization would still attempt lean implementation if given the option. The response rate was a unanamous (100%) agreement of *yes* to do lean again, with zero (0%) *no* responses.

Another area of interest was the number of management levels or levels of hierarchy in the chain of command within the organizations. The idea was to see if there was an association between the number of management levels and lean implementation success. The most responses (50%) came from the *four + levels* category. The *three levels* category accounted for over one third (37.5%) of all responses. One quarter of the responses (25%) came from the *two levels* category and there were zero (0%) responses in the *one level* category.

Another interview finding was the perceived measure of lean implementation success. Interview participants were asked how successful the organization's lean implementation success had been. The highest response rate (50%) came from the *very successful* category. The second largest category (37.5%) was *mostly successful*. The moderately successful category accounted for the remaining response (12.5%), with the *slightly successful* and *not successful* categories both receiving no (0%) responses.

This data provides insight into not only the number of levels of management hierarchy within the organizations, but also an overall organizational perception of lean implementation in terms of success. Table 8 summarizes the data collected from the

interview participants regarding organizational involvement with lean, number of levels of management, and the extent of lean implementation success.

Table 9

Interviews: Frequencies and Percentages for Organizational Lean Involvement, Levels of Management, and Extent of Lean Implementation Success

Factors	N	Percentage of Participants
Organizational choice to do lean again		
Yes	8	100%
No	0	0.0%
Management level in organization		
1	0	0.0%
2	2	25.0%
3	3	37.5%
4 +	4	50.0%
Extent of lean implementation success		
Not successful	0	0.0%
Slightly successful	0	0.0%
Moderately successful	1	12.5%
Mostly successful	3	37.5%
Very successful	4	50.0%

N = 8

Interview Findings

The data from the Industrial Advisory Committee (IAC) interviews have been used to answer the research questions pertaining to organizational leadership, organizational culture, and organizational change. The interviews were originally recorded on a digital voice recorder. The data were then transcribed, coded, and finally examined for overarching themes.

The subsequent narrative answers the research questions with the data presented in an aggregated form so as to provide a more accurate depiction of general industry trends in Illinois while maintaining participant confidentiality. Direct quotes for this section were coded using IAC 1, IAC 2, IAC 3 and so forth and no dates were used to ensure the IAC member's confidentiality. The section was organized by listing the research questions one through three with a series of headings that represent common themes for each question respectively.

Research Question 1

What role does organizational leadership play in lean implementation?

Leadership

Participants were unanimous in stating that leadership is vital to successful lean implementation. Leaders must have not only the foresight to know what direction to lead the company but also a solid understanding of *how* to take the organization in the new direction. Understanding change management concepts was considered very important.

Nearly all the participants acknowledged their organization utilizing change management training in one form or another. It was deemed necessary for the leadership to receive training in order to understand the concepts of a new change initiative, such as lean. For some organizations, the leaders had formal courses in change management. Some had in-house training for everybody involved in the change process and others brought in outside instructors specializing in organizational change.

Only one participant stated their organization had no formal training for change management. The only way the employees of this organization learned anything about change management was by trial and error. "Consequently, I believe all managers involved in change should go through change management training" (IAC 8). The training is important and should be done often. It is crucial to know how to successfully handle confrontations from employees when implementing change. Hot-tempered issues with employees can be troublesome; but, knowing how to address volatile situations can diffuse the situation. It can make the difference between success and failure when making changes.

Although it is important for the leader to have a vision for the organization and understand change management techniques, those alone are not enough. Leaders must also be able to foster teamwork and create an atmosphere of cooperation to get things accomplished effectively. "It is important to move away from the *Army of One* mentality and transition to a teamwork mindset" (IAC 2). To do this, leaders must be good at communicating. They should be good at listening to other's opinions with a certain amount of humility. Leaders must be open and honest without being overly critical. They

have to convince employees that they need not approach the new process with a sense of fear. "Mistakes are going to be made the first time out and that is OK" (IAC 2).

The interview participants noted there needs to be full lean training for all leaders and managers. They should be able to understand lean concepts, expectations, metrics of the process, how lean tools work, and how to intepret data. Managers must realize and be able to communicate that lean is about eliminating waste *not* employees. The mindset of employee elimination will cause employees to fight back by resisting all lean implementation efforts.

Leadership Commitment

Leaders must also demonstrate commitment to the lean implementation process for others to see. If a leader does not convince the employees there is a real sense of commitment, the lean implementation initiative will die. According to IAC 4,

> You have to have a good working relationship with all facets of the operation. You have to know manufacturing. If you don't, seek to understand. Go out to the floor and actually do the work yourself if you have to. Many times I've been assembling parts. My lean facilitator says it's easier to do it this way, and I say, I'm a new employee, so you show me. I'll go work on it and do it. Then employees see you doing the work. That's the key. All of a sudden, wow, he is trying to understand what we're doing. They are seeing the general manager do the job, seeking to understand.

A leader's participation in the implementation process is an important way to demonstrate management buy-in. The act of participation shows leader commitment to

the process. It is powerful for the employees to see a leader actually perform the operations in order to gain an understanding of the process. According to IAC 5, "Handing out T-shirts and putting up posters is no substitite for constantly asking questions and participating in the change process. Also, if there is a problem the leader should go and check it themselves. This simple act will demonstrate a personal commitment to the success of the lean implementation process".

Leadership Styles

There are many different leadership styles utilized in lean implelmentation. Selecting a single predominate leadership style that worked well for implementing lean based on the interview responses was not possible. Although, there was an agreement that overall a *blended* style tended to work best. Other popular leadership styles were *people-oriented*, *task-oriented*, and *commanding*.

The blended leadership style was the most accepted choice because many interview participants often noted characteristics of varioius leadership styles integrated as one at their organization. Leadership involves balancing a number of issues and the ability to be adaptable. This often means utilizing the best characteristics from numerous leadership styles. This results in the distinct lines of the different leadership styles fading and emerging as a more blended style, unique to the particular organizational needs. A good leader needs to understand that just as blended leadership styles are often utilized, different blends may be necessary with different people or groups even within the same organization.

"A leadership style can also change as the organization matures" (IAC 2). A young organization may originally have a highly adaptive model and become more reserved toward change as it matures. Also, a leader should know it is important not to push people to adapt too quickly or employees will feel *they* are being attacked rather than the problem trying to be solved. A heavy handed approach can sometimes lead to confrontations that can quickly escalate into a big problem.

Overall, there is no one best leadership style that works in all situations. It is important to have a style that is positive, and that honestly embraces open communication, promotes individual champions, embraces employee empowerment, and ultimately makes everyone feel like they are working together toward a common goal. And finally, it is important to utilize every leadership style necessary to effectively move the organization toward its goals.

Leadership Sources

Prior success in lean implementation is an important skill for a leader to have. It builds confidence in everyone involved in the change. However, several interview participants stated if the there was no one currently in the organization with lean implementation experience it was acceptable to bring in someone from outside the organization with lean expertise. This was typically done either by hiring a leader with the necessary lean skills or hiring lean consultants to facilitate the initial lean implementation and train the staff.

If consultants are utilized, there must be a team in place to carry on after the consultants leave. Although consultants may initially be utilized in the lean

implementation process, it is important that lean initiatives be eventually led exclusively in-house by the organization's leaders. This is especially significant because sometimes the lean implementation plans initiated by the consultants may not stick after they leave. It is also essential for the organization's survival for leaders to be active participants in their own success by learning the lean implementation concepts. Creating a sense of ownership for the lean implementation process and self sufficiency to be able to carry on after the consultants have gone are essential steps when using consultants. "Due to the complex internal dynamics of an organization, leaders will always understand the bigger organizational picture much better than a consultant ever could" (IAC 5).

Research Question 2

What role does organizational culture play in lean implementation?

Cultural Definition

To answer this question it was helpful to define organizational culture from the interview participant's perspective. In this case, the perception was that organizational culture is a mixture of two predominant factors. This first factor is the interpersonal behavior of people within the organization as a whole. The general belief is that there is a tacit set of rules that guide the way people function within the organization. These unspoken rules create a particular flavor or feeling that is like the fingerprint of the organization. It was also noted that this flavor varies from department to department and even regionally where the organization has various sites in different geographic locations.

The second factor was leadership values and how they impact the organization. The culture of an organization is viewed as a direct reflection of the leadership's values. These values are based on the philosophies, ethics, and guiding principles of the leaders and managers at all levels. These values trickle down and influence how the employees treat one another, how the organization treats its customers, and even how open the organization is to new ideas such as lean implementation.

Leadership's Role in Cultural Change

The biggest cultural challenge of changing from a traditional manufacturing philosophy to lean was overwhelmingly stated as leadership by the interview participants. There are many pitfalls facing leadership when making such a transition. A key challenge was a lack of senior management support for lean initiatives. Support means not only issuing the change directive, but being an active and observable participant in the change process as well.

Changing culture is a top down process that starts with the organization's leaders and goes all the way through the organization. "Without the support of leaders, lean initiatives soon die" (IAC 3). Middle management/supervisor resistance was also noted as a considerable deterrent to lean implementation. "Some middle managers feel at risk of losing their positions if lean is implemented and some supervisors are reluctant to share secrets that helped them attain high productivity goals with those on other shifts" (IAC 7). It has been noted in the interviews that there is a tendency by some supervisors to protect their status within the organization by keeping these secrets, forgetting the real competition is from other manufacturers. "It was also reported that supervisors sometimes

resist conforming to standardized methods. This is problematic because each worker may have a different method for processing the work which can lead to quality problems due to inconsistencies in the final product" (IAC 4).

Cultural Change

The second biggest cultural challenge was change itself. According to the interview participants, change is very frightening to many people. Consequently, people are often resistant to the idea of any type of change. This natural resistance can make changing the entire culture of an organization especially difficult. It is vital to get across to employees the idea that organizations either evolve or perish. As IAC 2 notes,

> You know, kaizen is the future of your organization. I worked next to a printing plant in Sparta that was a huge plant. They only utilized a little bit of the building when I started working for a company next door. Then eventually, they closed the doors. I knew somebody that had that worked, so I asked him what the deal was. I thought they were a leader. He said, oh yeah. Years ago, they came up with a printing technology that was so innovative that it changed the face value on comic books around the world. That's how aggressive and effective it was. It had a huge impact on the price because they were the lowest cost and highest quality producer of multicolored comic books. Well what happened? They decided not to change. What do you mean? Well they thought they had it all figured out. All they had to do was do a good job every day. Well it took twenty years, and that is really a compliment to what they had accomplished in the 80s or maybe the 70s because it took twenty years for everybody to pass them by. And then finally, they shut

> down. But that taught me right there, that if you're not willing to change and be uncomfortable every day, it's inevitable it's either a year from now or twenty years from now it will eat you up, because the market's changing fast. The economy is changing fast, and you got to be up front.

There are two crucial elements to successfully negotiating cultural change in an organization. First, breaking life long traditions and beliefs requires leadership commitment to the change process. This can only occur when people see the need for not only change, but an ongoing type of change that becomes a part of their everyday lives. This type of cultural change must start at the top and filter down. Second, people can be extremely resistant to change they are not a part of. There must be a collaborative relationship between leaders and employees. "In order to promote the cultural change process successfully throughout the organization, everyone must be an active participant in the change" (IAC 1). Employees need to be involved in the change process and see positive benefits before long-held cultural beliefs begin to change.

Cultural Differences

Cultural differences were also noted as being a major obstacle to cultural change. The interview data indicated American companies can not truly achieve lean without understanding the origins and mindset of the Japanese culture. The Japanese mindset of group consensus and teamwork can be counterintuitive to the independent nature found in American culture. Japanese workers focus on the success of the group or company and American employees tend to be more self focused. "The Japanese are more focused on planning everything out and utilize high analytical skills" (IAC 2). Americans workers

must see practical evidence to have buy-in, whereas Japanese workers quickly follow the leader's directives. Another distinct difference relates to how fast to implement lean. It is important not to push implementation plans too quickly or a backlash may occur with American workers.

Cultural Negativity

A final cultural issue of significance associated with lean implementation concerns negativity. It is important to avoid a negative mentality when implementing lean. Lean is associated with job elimination and that causes an immediate resistance to lean implementation efforts. Employees often have a negative perception of lean before they even get properly introduced to the concepts. It is vital for leaders to begin communication with all employees as early and often as possible about what lean is and what lean is not and the immediate need for action. "Open and honest communication is the key to heading off negativity about lean before it can take root and cause long term or even permanent implementation issues" (IAC 3).

Addressing Cultural Change

Cultural issues affecting lean implementation were addressed in a number of ways. According to the data, education/training and leadership involvement were the predominant techniques utilized in dealing with cultural issues when implementing lean. When education/training was implemented, every employee received numerous sessions including frequent follow ups regarding lean. The concepts of lean were defined for

employees to help them understand that the goal of lean is waste elimination, not job elimination. Employees must be made aware that change is inevitable.

It was important to explain the benefits of change to the company and employees through training in order to reduce the fear factor. Education served to reduce employees' resistance. On the leadership side, it is crucial to find ways to bridge the gap between the two cultures. The first requirement is to get all the upper managers on board. "As part of the education/training some upper level managers not only went through the regular training sessions but received additional training based on their level within the organization as well" (IAC 8). Effective leaders often teach lean concepts to others as well as identify lean champions for each of the lean tools. Leadership participation in such a hands on way demonstrates strong positive support for the lean initiatives and gains respect from the employees. Active leader participation is a powerful motivator which promotes and ultimately leads the way to cultural change.

There must also be accountability at all levels of management and this includes disciplinary action of any employee in the organization who is unwilling to cooperate with lean implementation efforts. "A few disruptive employees can and will sabotage the lean implementation efforts if corrective steps are not taken early on. Constructive criticism is always welcomed but actions by employees with the intent to inhibit lean implementation success must not be tolerated" (IAC 8).

Employee involvement was cited as another critical cultural factor in lean implementation success. People need to be involved in the change process from very early on and throughout the entire process. It is essential that employees feel they are a valued part of the change process rather than of victim of it. There should be teams

formed with a mix of qualified people including machine operators, engineers, managers and so forth. The team leader is responsible to encourage quieter members to contribute. Each team member's opinion should carry equal weight and no one person should overpower the others. The production information should be updated by the people who actually do the work in the department so they can see how their efforts are making an impact. "Involving employees in projects gives them a sense of ownership of the process and is a key factor in building support for the change" (IAC 1).

Motivational Techniques

When attempting to make cultural changes, it is very helpful to have a form of motivation in place to promote these changes. Showing the employees how the change directly benefits them, not just the company, is often an effective enticement to remain open minded about the change and give it a chance. Demonstrating success on easier projects first to gain employee support and then working up to more difficult ones from there is a good way to get started. It is also important to select projects that have a big benefit for employees, and again, not just the company. "Showing employees the before and after results and documenting improvements gives employees a sense of accomplishment which makes them feel happy to be a part of the improvement process" (IAC 3). Once the change process has been refined, the good ideas should be applied to other areas of the organization where applicable.

The Role of Communication

Several interviewees commented that open and honest communication is the cornerstone of a lean organization. The mentality of shut up and do as you are told is outdated and counterproductive. This closed leadership style builds walls of resentment and antagonism. Using top down directives without face to face communication creates a confrontational relationship between leaders and employees, which leads to problematic lean implementation.

Data revealed a strong association between good communication and successful lean implementation. It is important to disseminate the organization's short and long range plans among the entire employee population. The leaders should communicate openly and honestly about the need for change. Communication is an effective way to reduce the fear associated with change and to break down barriers between individual departments so teamwork can occur.

This type of communication supports change by promoting an understanding of the issues facing the organization and fostering an atmosphere of empowerment among the employees. It is important to keep employees updated through both monthly meetings and daily briefings regarding production, safety, upcoming changes, and so forth. "There should also be feedback loops integrated into the system that reports continuous improvement results in order to establish whether changes are working as anticipated" (IAC 2).

Leaders and managers should make an extra effort to be on a first name basis where possible and have an open door policy. Implementing a program to elicit employee suggestions/participation, and following up on every suggestion with the employee

whether the idea is utilized or not, is especially important. If the employees receive no feedback on their ideas, the behavior of offering suggestions is soon extinguished. Since one of lean's tools is continuous improvement, new ideas are absolutely vital to the development of new improvement initiatives.

As mentioned previously, employee involvement is critical to successful lean implementation efforts. Communication is an essential key in making this happen. Employees *want* to be heard and get upset when they feel their concerns are not listened to. Open communication fosters an environment that lets employees know that management cares about them. Acknowledgement of a job well done cultivates a good working relationship between managers and employees. "Employees embrace face to face communication with management" (IAC 4). It is important to communicate face to face with employees, not in an email or by voicemail. Leaders should genuinely listen to employee concerns, ask for suggestions, and let them know what is going right for the company and what is going wrong. "True open communication cannot just be proclaimations from the top down. It has to be feedback from the bottom going back up as well and it has to be done on a regular basis" (IAC 8).

Everyone has life experiences and if the leaders are not capitalizing on them, a vital resource of knowledge that can advance the organization's cause is lost. Change has a better chance of succeeding if employees are told the need for it, their role in it, and how it is going to benefit them.

Change Theory

In order to effectively change the culture of an organization there must be some understanding of theory associated with how to facilitate this type of change. Conventional wisdom has been to convert the culture first so that meaningful change may then take place. The interview data overwhelmingly shows the prevalence of demonstrating postive change first and then the culture subsequently adapatating to the new philsophy.

The main premise of this philosophy is that in order to change something as ingrained as an organization's culture, which is in essence it's core attitudes, values, and beliefs, a directive cannot just be issued from the top. In order to change these core organizational characteristics, tangible proof must first be demonstrated through sustained success, proving that there is indeed a better way.

Reading books and presenting abstract ideas does not translate well into employee motivation, understanding, or acceptance of change. Trying to force the idea of an abstract idea without substantiation can actually create an adversarial relationship between the employees and management.

Attempting to effectively facilitate change in organizational culture must involve demonstrated and sustained success, some form of beneficial change for the employees, and leadership commitment as evidence this is not just another flavor of the month idea. These are critical elements that lead to reducing employee resistance, and ultimately getting employee buy-in. It is at this point when the culture is changing.

Issues in Organizational Culture Change

Front line supervisors are extremely important when an organization is making the change to a lean culture. They are essentially modeling the new desired behaviors that are expected of everyone. The employees will be watching very closely to see if the supervisors are following the new procedures. Without the front line supervisors being constantly vigilant to ensure the new procedures are being followed, it is like fighting a losing battle. Even one person set on intentionally undermining the lean initiative can have a crippling effect on the entire lean implementation effort. Some supervisors/managers and employees may be convinced of the advantages of the new way through education. However, if someone insists on acting with an obstructionist attitude, they should no longer be a part of the organization, no matter how valuable they are or how long they have been there.

The lean philosophy presents a particular challenge to organizations in the form of balancing their resources. Traditional management philosophies typically operate with much higher finished goods inventories in order to safe guard against stockouts. When transitioning to lean, which operates with much lower finished goods inventories, production issues begin to arise that had been previously hidden. Organizations often begin to face the conflicting goals of meeting sales quotas versus maintaining low finished goods inventory levels. It is tempting to raise the inventory levels back up to more easily meet the sales quotas rather than find ways to meet the sales quotas *while* keeping low inventories. The way an organization addresses issues will provide tacit evidence, to the employees, of its commitment to the lean philosophy. If the organization chooses to raise the inventory levels in order to meet sales quotas rather than solve the root inventory

problem, the mixed messages being sent to the employees will undermine both the credibility of lean and the organization's leaders as well as inhibit further lean implementation efforts.

It is important to balance the goals of the company with what is good for the employees. "Caution must be exercised that lean is not used with the sole intent of eliminating jobs. Using lean in this situation will cause immediate employee resentment and resistance to lean concepts and further implementation efforts" (IAC 4).

Also, the lean projects that are chosen must have quantifiable outcomes. "Do not waste time trying to employ lean inappropriately to tackle touchy feely types of issues" (IAC 4). The outcome will not be clear and lead to the assumption by employees that lean will not work for the types of problems in their particular organization.

Research Question 3

What role does organizational change play in lean implementation?

Organizational Change

Large organizational change, such as the implementation of a new management philosophy, occurs infrequently for the majority of companies. Most organizations are relatively stable and more commonly make smaller fine tuning type changes. Frequent organizational change can be problematic. Introducing recurrent large change can cause a backlash by being disruptive to the existing power structure which results in resentment in some employees. Also, numerous organizational changes might be perceived as flavor of the month type initiatives.

Overcoming Employee Resistance

Several interviewees acknowledged it is important for leaders to start by making the facts and purpose for the change clear. Leaders must explain why changes are necessary *and* be genuinely open to listening to employees' concerns and feelings on the subject. The importance of building and maintaining good leadership/employee relationships cannot be overstated. Leaders must demonstrate concern for employee anxiety by keeping them updated on what is happening. "Not allowing employees time to adjust to the new changes can cause alienation leading to a backlash and failed change initiatives" (IAC 6).

According to data collected for this study, the most effective way to overcome employee resistance when implementing organizational change such as lean is through communication-based activities. "Employee resistance can be countered with meetings, training, and patience with employee attitudes during the beginning of the change process. There should be a lean facilitator who leads meetings about the lean change with a structured agenda so these assemblies do not turn into free for all gripe sessions" (IAC 2). The lean facilitator should establish a positive point of view and enthusiastically encourage employee input and hands-on participation in preparation for lean implementation. When employees see and understand the benefits of lean through these types of active communication, negative effects such as misunderstanding, confusion, fear, and ultimately resistance to change can be largely avoided. Once the employees' resistance to change has been reduced and lean benefits have been effectively communicated *and* demonstrated, the organizational environment can begin to foster a shift in the culture toward the support of lean implementation.

When making a significant organizational change such as implementing lean, everyone including managers must be active participants in the implementation process to show the tools are used across the board equally. It is also important to utilize employee empowerment techniques that enable employees to be a significant part of the decision making process. Employees are more likely to embrace a process when they feel a sense of ownership in the process, which leads to reduced resistance to the change initiative. Employees are no longer part of the problem, they are now part of the solution.

Other ways to reduce employee resistance to change involve the way leaders handle the proposed change. According to IAC 4,

> We have specific training classes on facilitating change. All lean facilitators, area reps, and company personnel go through it to learn how to manage and facilitate change. It's very vital. Because it's real easy, like when I'm out trying to tell somebody how to do a job and somebody pops off on me, how do you respond? If you go blaring back at them, you're done. You have to know how to handle that, you have to calm down. It's not the end of the world here. And there comes a point in time where the supervisor has to get involved and say, you know what, straighten up. There's that guideline there. You have to know when to pull back and when not to. That's very critical to make it a success and not a failure, because if you got somebody administrating change that is a hot head, you're in trouble. Because, you're going to have somebody on the floor, I will guarantee you that is going to pop off on you. And when that happens, how do you handle it? It's a moment of truth.

There must be active *and* visible participation by the leaders in the lean implementation process. IAC 4 noted, "When employees actually see the leaders actively participating in the process, such as personally doing education/training, it conveys an important sense of commitment to the lean implementation process". Leaders must prove they are truly committed to the lean initiatives or the employees will go back to doing it the original way.

When asking employees to change there also needs to be a sense of urgency to get the lean initiative launched. Without some type of underlying sense of pressure, change initiatives often flounder. Leaders need to utilize this technique with a balanced approach. "The announcement for a need for change should get everyone's attention and provide motivation for change, yet be done without creating a panic about the company's survival" (IAC 8).

Organizational Size

Organizational size has a definite impact on lean implementation according to numerous interviewees. Although larger organizations are capable of implementing lean, implementation tends to be more problematic. Issues inherent to larger organizations such as diminished homogeneity of the culture, many levels of bueracracy, and increasingly problematic communication issues create challenges that can stifle successful lean implementation.

Change can be successfully implemented in larger organizations, but there must be a culture that is open to change and high levels of effort put into sustaining effective communication. It is vital that communication channels be able to convey information

throughout all levels of bureaucracy within the organization in order to keep everyone involved on the same page.

Another significant perspective in the data supported the contention that the leadership was more important than the size of the organization. This position stated that no matter the size of the organization, successful lean implementation depends on the people at the top. "If the people at the top do not commit to it, a small organization will have just as much trouble with lean implementation as a large organization" (IAC 7).

Organizational Age

When considering how age affects organizational change, the interview data shows that younger organizations have a definite advantage when trying to implement changes such as lean. Younger organizations tend to be much more adaptable and open to frequent change. Although a new organization is typically more accepting of drastic change, it can start to become more hesitant to make big changes or adapt as quickly as it ages. As an organization ages people get set in their habits. The longer they perfom a job, the more resistanat to change they become. That is a significant concern organizations should be aware of when attempting to implement change. "The older an organization gets, the more time it has had to develop deeply ingrained routines and the harder it will be to break free of those paradigms. Consequently, older organizations tend to more often get stuck in a *it is just the way we have always done it and that is the way we are going to keep doing it* mindset" (IAC 5). An older leadership structure may also experience more difficulty changing than a younger one.

Issues in Organizational Change

There are numerous items that are associated with successful organizational change in the context of lean. Data from the interview participants provided insight into some of these issues in the following comments. Management must be consistent in their behind the scenes support of lean implementation and maybe even more importantly, their role of public participation in the process. Without some form of visible involvement from leaders, employees assume the lean initiative is not that important. If employees sense that the management is not committed to long term change, they will out last the change efforts and stamp out the new initiative. Programs fail without both behind the scenes and overt top down support.

When beginning lean there are some techniques that will be conducive to the implementation process. First, it is important to focus training efforts on employees that are interested in advancing. It is best to find an area with the most positive support for lean and begin to implement efforts slowly, one piece at a time. Also, "Do not waste valuable time and resources on those that are hyper-resistant to training or begin lean in areas of high negativity. It will only create an atmosphere of antagonism" (IAC 2). The training has to be something in which employees can get some measure of real value. If employees feel the training is a waste of time, they will become disenfranchised with the proposed change and resist further change efforts.

The initial projects should not be about improvement so much as they are about gaining an understanding of the lean concepts and how to apply them. At the conclusion of the projects there are typically presentations to discuss the implementation process. These presentations should not be based on good or bad results, but rather the depth of

conceptual understanding gained as a result of working directly with lean. "When discussing the presentation and giving the team feedback, leaders must exercise extreme caution to not come off as overly critical. This is a learning step and team members can be especially sensitive to criticism which could turn them off to the lean philsosophy entirely" (IAC 2). It is essential that leaders be aware that at this step, it is much more important to help the team members understand the lean concepts rather than actually making improvements.

As the lean concepts start to become clear, improvements will begin to take place. It is important that employees see that *they* can make improvements. As momentum is gained with each success, these implementation techniques can be utilized in other areas with similar characteristics. It is important that every group learn the lean concepts the same way so there is consistency throughout the organization when applying the techniques.

Additional Lean Perspectives

Interview participants were asked about their perceptions of lean. Although waste elimination was generally agreed to be the key concept with continuous improvement also often mentioned, there was another interesting attitude about lean. Some participants believed that utilizing the entire set of lean tools was not always an appropriate choice in every situation. The belief of nearly all the interviewees was that every organization has its own unique make up and sometimes there are situations where some of the lean tools are just not practical to use. The idea was that each organization should pick and choose lean tools as applicable in the context of its own particular needs.

By comparison, there was also support for using all the lean tools. One participant stated that there is no reason not to use all the lean tools since they work in collaboration with one another. "If all of the lean tools were not all being utilized, it may be because the organization's leaders are not really sure they are all useful" (IAC 8).

Definition of Lean Success/Failure

In attempting to gain a more clear understanding of lean and how to know if it has been successful, the interview participants defined lean success/failure. The data revealed there was a strong belief that you have to be able to measure lean success or failure in terms of money. It has to be measurable and quantifiable so that it can be converted into dollars. If you cannot measure it in some quantifiable form to determine fiscal profit/loss or if it is not profitable it is considered a failure. For the most part it was commonly agreed either lean was making money or not, and hence successful or not.

However, another perspective was that when choosing a project it was important to compare the cost of the problem versus the cost of the lean team solution to the problem. The solution to the problem must not cost more than the savings that would be generated from implementing the change. Also, the bottom line is that the lean project must not only be cost effective for it to be considered a lean success but also be the lean project that is the *most* financially advantageous to the organization at that particular time. Start with lean projects that provide the most payback.

By comparison, another compelling belief was that lean success indicated an organization was able to successfully integrate the continuous improvement mindset into its products and services. The organization was hitting its targets and improving in its

efforts to reach its operational goals. "Success is if the organization is better off having implemented lean" (IAC 1).

Areas of Successful Lean Implementation

The most frequently noted area for successful lean implementation was *cellular manufacturing*. Using group technology to take advantage of product family characteristics worked very well in these organizations. The next two most frequently noted areas of successful lean implementation was listed as worked well *everywhere* and *kanban*. The data revealed that leadership strongly commited to lean, supportive of lean initiatives, and effective as communicators is considered the number one factor responsible for successful lean implementation.

Areas of Failed (Challenging) Lean Implementation

Although there were no reports of outright failure, there was an area noted as particularly problematic. The area most frequently noted as challenging for lean implementation was *value stream mapping*. Gaining a thorough understanding of the process was problematic for supervisors and employees. One interview participant conducted extensive research on value stream mapping, yet found no conclusive answers as to exactly how it is done even when contacting Toyota, the lean exemplar for this participant's organization. The next most challenging areas were *supervisor participation* and overall *weak buy-in*. These two challenges have common roots indicative of a bigger problem. "Leaders who demonstrate a lack of commitment in time, resources, and effort

through active participation create a situation that is easily picked up on by employees which sets the lean implementation up for failure" (IAC 8).

Organizational Characteristics That Inhibit or Facilitate Lean Implementation

The data show a nearly unanamous agreement that leadership is the number one factor responsible for successful lean implementation. Leaders that are strongly commited to lean, support the lean initiatives, are effective communicators, and lead by example have the essential characteristics necessary to facilitate lean implementation successfully.

By comparison, it was not surprising then that poor leadership was listed as a major inhibitor to successful lean implementation. Leaders who demonstrate a lack of commitment in time and resources, and effort through active participation create a situation that is easily picked up on be employees, which sets up the lean implementation process for failure.

Document Analysis

The reason for doing a document analysis was to establish the relevance of lean in university curriculum with regard to the successful implemenation of lean in manufacturing organizations. When examining the various characteristics that affect lean implementation, data indicated the education of an organization's leaders and employees in lean concepts has been associated with successful lean implemention. This document analysis shows support for the validity of this data finding by demonstrating continuing Industrial Advisory Committee (IAC) support for integrating lean as part of university curriculum. The documents used in the analysis were a series of minutes of the meeting

from the IAC meetings. The IAC, as previously mentioned, is comprised of a group of Industrial Technology (IT) faculty from Southern Illinois University Carbondale (SIUC) and area business leaders that serve on an advisory committee for the IT program in the Department of Technology at SIUC. The call for lean to become part of the Industrial Technology curriculum was made by members of the Industrial Advisory Committee.

The IAC meeting minutes, which included ten documents from 2004 to 2009, were authored by various IAC committee members and available on-line from the SIUC Industrial Technology website. The area business leaders in the IAC serve in an advisory capacity for the Inndustrial Technology (IT) program at SIUC in the context of keeping the IT program up to date with evolving industry needs.

One of these needs was to integrate a lean course into the IT curriculum. The following data are summarized from the meeting minutes (Industrial Advisory Committee, Meeting Minutes, 2004; 2005; 2006; 2009.).

> April 30, 2004 – Curriculum Recommendations: The faculty discussed the changes in the curriculum since the April 2003 IAC meeting. Two new courses have been approved and will be offered in the near future: *Lean Manufacturing* and Six Sigma. In addition, the faculty presented ideas on adding a new specialization to the IT program, with suggestions from the faculty to name the specialization "*Lean quality systems*".
>
> April 22, 2005 – Review Undergraduate Curriculum: The Industrial Technology faculty discussed two new courses that have been added to the curriculum, Lean Manufacturing (IT 465) and Six Sigma (IT 490). Both courses

were developed due to recommendations made in the IAC meeting from the previous year.

April 21, 2006 – Proposed Revisions to Existing IT Program: Six Sigma II and Six Sigma III concepts could be incorporated into the *Lean Manufacturing course*.

Novermber 3, 2006 – Short/Long Term Goals: Certification courses that were suggested included Project Management, Six Sigma Green Best (two courses), Six Sigma Black Belt, and *Lean Manufacturing*.

November 9, 2007 – Review Undergraduate Curriculum: Five course were identified to be part of the certificate program: Six Sigma Green Belt I and II, Six Sigma Black Belt, Project Management, and *Lean Manufacturing*. A discussion ensued regarding the courses to be added to the initial list, with the following recommendations: Risk Management course, *Lean Manufacturing II*, Project Management II, Cost Estimating, Production and Inventory Control, Safety, First-Line Supervision, and Manufacturing Processes.

April 17, 2009 – Industrial Technology: Discussion ensued on the benefits of offering an IT minor. The recommended course for an IT minor: Six Sigma I and II, Safety, Cost Estimating, *Lean Manufacturing*, and Project Management.

The data findings indicate significant IAC support for the integration of a lean manufacturing course into the IT curriculum, the creation of an IT minor incorporating the lean manufacturing course, and the development of a certificate program for lean manfuacturing with a possible expansion to include a lean manfuacturing II course as well. The rigorous push by the IAC members to advance lean curriculum in so many

ways indicates their strong belief in the need for future industry leaders to be well versed in the lean ideology. This establishes the relevance of lean education in the university curriculum and importance of lean to the manufacturing industry.

Summary of Interview Data

This summary discusses findings from Industrial Advisory Committee (IAC) interview data. There were eight interview participants involved in the qualitative portion of the study. The participants were business leaders with working knowledge in lean practices from a mix of publicly and privately owned organizations. The participants' organizations ranged from less than five years in age to over 50 years old and ranged from less than 100 employees to more than 1000 employees. The following research questions are followed by summarized findings from the research data.

Research Question 1

What role does organizational leadership play in lean implementation?

Data analysis conducted for research question one found leadership an essential component to successful lean implementation. Change management was noted as a particularly important leadership characteristic when implementing any type of major organizational change, including lean. Leaders also need to demonstrate commitment to the change process and this is done very effectively by supporting lean initiatives both behind the scenes and as a visible and active participant in the change process. The blended leadership style was selected as the most often utilized because it is applicable to a wide variety of workplace scenarios. Leaders can be brought in from either outside

souces or in the form of consultants for a particular job. However, leaders are much more often cultivated from within the organization because of their inside knowledge of the organizational culture.

Research Question 2

What role does organizational culture play in lean implementation?

The definition of organizational culture as defined by the interview data is a set of unspoken values, opinions, and beliefs that create a unique sentiment within the organization. The culture of an organization is typically a reflection of the leadership's philosophies, ethics, and guiding principles and trickles down and throughout the entire organization.

Interview participants' perceptions of the key concepts of lean were generally agreed to be about waste elimination. The biggest cultural challenge of changing from a traditional manufacturing philosophy to lean was identified in the data as leadership. There *must* be support from leaders or change initiatives will die. The second biggest obstacle to cultural change is change itself. People have an inherent resistance to most types of change caused by a fear of the unkown. Promoting communication, education/training, and employee involvement very early and continuing it throughout the entire process is an effective way to overcome this resistance. Instead of the *change is happening to me* mindset, which is essentially a victim mentality, employees become *participants in their own success* through empowerment in the change process that leads to a sense of ownership and ultimately reduced resistance.

Cultural differences were also noted as being a major obstacle to cultural change. The Japanese culture is more group oriented and uses high analytics and the American culture is fiercly independent and more risk oriented. It is important to allow enough time for the two cultures to acclimate when implementing lean or there may be a backlash by American workers. There is an issue of negativity sometimes associated with lean regarding employee elimination. It is important for leaders to communicate early and often with employees about what lean is and what it is not in order to reassure them and head off a wall of resistance.

Cultural change issues are most effectively addressed through open and honest communication, education/training, and leadership involvement both supporting the change initiatives from behind the scenes and actively participating in a visible way to show commitment to the lean implementation process. Finding ways to motivate employees to make significant cultural changes is helpful. This can be done by demonstrating the direct benefits to employees. It is important to let the employees know lean is not intended to be just for the organization's benefit alone. The change must be a positive move for everyone or it will be defeated by extreme resistance.

Open and honest communication is essential for any organization. *The shut up and do what you are told* mentality is outdated and counterproductive. Top down directives without a face to face communication style is self defeating. The nature of lean is about employee empowerment and an open communication style is a critical part of that. Open communication supports change by fostering an atmosphere of empowerment among employees. Another powerful characteristic of open communication is that it reduces the fear assocaited with the unkown, which is why change is frightening to so many

employees. True open communication cannot be just top down edits. It must have a feedback component to it that embraces employee feedback.

Understanding change theory is imperative in order to be able to effectively facilitate change in an organization. The question is which change model is more effective, one where culture is changed first or one where success is demonstrated first? The data indicated that in order to change core organizational characteristics, tangible proof must first be demonstrated through sustained success, proving that there is a better way.

The behavior exhibited by front line supervisors is a telling statement about the support for the change initiatives that employees pick up on. It is vital that the supervisors are consistent in the behavioir supporting lean implementation or implementing lean will be a losing battle. If there are supervisors who cling to obstructionist attitudes, they will poison the entire lean philosophy. They must be convinced through additional education/training or removed from the process.

There will be issues that come up as a result of lean. A particular challenge for organizations is balancing their resources. The challenge more specifically is how to operate with lower finished goods inventories and still meet sales quotas. Backsliding to old ways of doing things by raising finished goods inventories will negate the image of leadership commitment to lean in employees eyes and sabatoge lean implementation efforts. Missing sales quotas will decrease profits and potentially lose future sales. There will be some tough decisions to be made while fine tuning lean.

It is important to judiciously balance the goals of the company with what is good for the employees. Caution must be exercised to not use lean for the sole intent of

eliminating jobs. This will cause immediate employee resentment and resistnce to lean concepts and further lean implementation efforts. It is also important to utilize lean in situations where the results are quantifiable. Do not waste time employing lean inappropriately on touchy feely issues. The outcome will not be clear and lead to the assumption by employees that lean **does** not work.

Research Question 3

What role does organizational change play in lean implementation?

Most organizations experience major organizational change infrequently. Introducing this type of frequent organizational change can be destabilizing by upsetting existing power structures leading to employee backlash and lack of support for change.

Organizatinal size does have an impact on lean implementation efforts. The larger the organization, the more challenges there are to effectively communicate through the increased levels of bureaucracy. Organizational age also influences lean implemention efforts. Younger organizations tend to be much more adaptable and open to frequent change. Although lean implementation can and does occur successfully in organizations of any size or age, the ideal facility for change of this type tends to be both smaller and younger.

To implement lean successfully, the leadership must be consistent in their support of lean both behind the scenes and in their role of public participation in the process. If employees sense leaders are not commited to the process, they will outlast the change efforts and effectively stamp out the new initiative. Begin lean implementation efforts slowly, in areas of positive support, and with employees interested in advancing. Leaders

must exercise extreme caution when critiquing employee efforts, so as to not crush employees enthusiasm for lean. The initial projects should not be about improvement, rather they should be focused on employees understanding lean concepts and how to apply them. Employees will soon see lean implementation successes and transfer lessons learned from those efforts to other areas within the organization.

CHAPTER V

RESEARCH FINDINGS - QUANTITATIVE

The purpose of the study was to investigate the relationship between organizational characteristics and issues associated with lean implementation. In particular, the study identified organizational characteristics which for the purposes of this study included (a) *organizational leadership,* (b) *organizational culture,* and (c) *organizational change* to determine how they influence lean implementation efforts, and (d) determined the extent to which *intrinsic organizational characteristics* impact lean implementation efforts. In order to accomplish this purpose, the study utilized both qualitative and quantitative elements. This chapter discusses the quantitative portion of the study.

Respondent Information

Surveys were administered to members of the Illinois Manufacturers' Association (IMA). IMA members are manufacturing organizations located in Illinois. The role of the IMA is, "To provide timely and accurate information on the actions taken by Illinois lawmakers in the General Assembly and other branches of government that affect manufacturing and its related sectors; and the IMA's positions on those actions that have, or could have, a positive or negative impact on the economic climate in the state of Illinois" (Illinois Manufacturers' Association, n.d., p. 1).

The IMA interview protocol was developed through a pilot study process and included 16 questions pertaining to intrinsic organizational factors. The researcher contacted the respondents through J. Nelson, Vice President Communications and

Marketing for the IMA. Nelson distributed the survey to the IMA members through the organization's listserve. This method of surveying the members ensured their anonymity. The database containing all survey data was stored on a secure computer in a private office.

Data generated from the interviews were utilized to determine the extent to which particular intrinsic organizational factors affect lean implementation. The findings addressed the fourth research question from the study. Through the use of demographic data collected during the survey process, descriptive statistics were also utilized to provide an overview of the characteristics of the organizations associated with the IMA members.

Respondent Demographics and Organizational Factors

Both demographic and organizational factor data were collected during the survey. The data pertained not only to the survey respondents' personal information but to each respondents's respective organization as well. The data were aggregated to provide a holistic rather than individualistic view of industry practices as well as protect the anonymity of individuals and organizations in the study. The subsequent discussion details the data through a series of introductory narratives and tables that summarize the data.

The population of 4,261 Illinois Manufacturers' Association (IMA) members requested to participate in the study held management positions in manufacturing organizations. Due to the wide variation of answers for the question regarding respondent *title*, the respondents were grouped into five general categories – president/CEO, vice president, human resources manager, COO/CFO, and manager. The largest group of

respondents were president/CEO (31%). The second largest group of respondents were managers (27%). Other data that provide insight into the organization's individual makeup were also examined.

Organizational ownership in the context of this study is based on whether an organization is privately or publicly owned. Privately owned organizations represented a large majority (87%) of all the organizations examined with publicly owned organizations accounting for the minority (13%). Union status also represents an important characteristic for these manufacturing organizations. In this study, nonunion organizations represented a majority (63%) of organizations and only one quarter were union organizations (25%). Another demographic is the nationality of the organizations. Examination of the data illustrated that a little less than half (40%) of the organizations in this study were internationally owned with the remainder (60%) wholly owned U.S. organizations.

Table 9 summarizes the data collected from the survey respondents regarding organizational characteristics such as ownership, union status, and nationality. The data collected in this study are intended to represent only the local facility, not the global enterprise.

Table 10

Survey: Frequencies and Percentages for Interview Participants, Organizational Ownership, Union Status, and Nationality

Factors	N	Percentage of Participants
Category*		
President/CEO	16	31%
Vice President	9	18%
COO/CFO	4	8%
Human Resources	7	14%
Manager	14	27%
No Response	2	2%
Organization owned		
Publicly	7	13%
Privately	45	87%
Union status		
Union	13	25%
Nonunion	33	63%
Mix of union and non-union	6	12%
Organization nationality		
A national (US) company only	31	60%
A international (Global) company	21	40%

N = 52 *This question was answered by only 50 respondents

The demographic data also provided insight into organizational age, size with respect to the number of employees, and length of lean involvement. The age range of the organizations had a diverse spread with 50 + years representing the highest percentage (71%). The second largest group of participants, the 21 - 50 years group, accounted for one quarter (25%) of the total. The 6 – 20 years organizational age range represented the remaining amount (4%), with 1 – 5 years having zero percent (0%).

Organizational size in the context of this study is based on the number of employees in the organization. The range in size was also quite diverse with the most common size organization (54%) having 1 – 100 employees. The 101 – 500 employee organizations represented the second most common size (31%) and the 501 – 1,000, and 1,000 + employees organizations represented the two smallest categories (6% and 10% respectively).

Organizations with 0 - 5 years involvement with lean were the most commonly (44%) represented. The organizations with 6 – 10 years accounted for the second most common (40%) length of lean involvement. The last two responses of 11 – 20 years and 20 + years represented the least amount (12% and 4% respectively).

Table 10 summarizes the demographic data collected from the survey respondents regarding organizational age, number of employees, and length of involvement with lean.

Table 11

Survey: Demographic Data, Frequencies and Percentages for Organizational Age, Number of Employees, and Length of Lean Involvement

Demographic Data	N	Percentage of Participants
Age of orgnization		
1 – 5	0	0%
6 – 20	2	4%
21 – 50	13	25%
50 +	37	71%
Number of employees		
1 – 100	28	54%
101 – 500	16	31%
501 – 1000	3	6%
1001 +	5	10%
Length of lean involvement		
0 – 5 years	23	44%
6 – 10 years	21	40%
11 – 20 years	6	12%
20 + years	2	4%

N = 52

In an effort to better understand how organizations utilize lean, the next question focused on the extent to which each organization in the study had implemented lean (i.e. *fully* implemented lean, *mostly* implemented lean, *partially* implemented lean, *only slightly* implemented lean, or a response of *not at all* in regard to the extent of lean implementation). Based on the demographic data, the largest group of lean implementers (40%) was in the *partially* category. The second largest group, represented by one quarter of the organizations (25%), reported to be implementing lean *mostly*. The remaining categories of *fully*, *only slightly*, and *not at all* represented the remaining organizations (12%; 15%; and 8% respectively).

Organizations come in all sizes and consequently so do their budgets. Does the size of an organization's total annual budget have an impact on lean implementation? To see if an organization's budget impacted lean success, the total annual budget of each organization was examined. The most common response (50%) came from organizations with a total annual budget of *$10 million to $100 million (US).* The next most often represented size (27%) was *$1 million to $10 million (US).* There were four organizations (8%) that had an annual budget of *$100 million to $500 million (US),* six organizations (11%) that responded with *Would rather not say*, and one each, *Less than $1 million (US)* and *Don't know*, that were one each (2%).

The collection of data from the survey portion of the study was designed to enhance the understanding of issues associated with lean implementation as reported by the survey respondents. Table 11 summarizes the data collected from the survey respondents regarding the extent of lean implementation within each organization and each organization's total budget for the year.

Table 12

Survey: Frequencies and Percentages for the Extent of Lean Implementation and the Organization's Total Annual Budget

Factors	N	Percentage of Participants
Extent of lean implementation		
Fully	6	12%
Mostly	13	25%
Partially	21	40%
Only slightly	8	15%
Not at all	4	8%
Organization's total annual budget		
Less than $1 million (US)	1	2%
$1 million to $10 million (US)	14	27%
$10 million to $100 million (US)	26	50%
$100 million to $500 million (US)	4	8%
$500 million to $1 billion (US)	0	0%
Don't know	1	2%
Would rather not say	6	11%

N = 52

The lean philosophy is comprised of a series of tools that work in conjunction to eliminate waste from the organization in order to improve overall operational efficiency. Since the tools are an integral component of lean it was important to examine which were most commonly used by the organizations in this study. This part of the data takes a look at the use of the tools both as a whole set and on an individual basis. The idea was to take note of which tools the organizations used and determine the frequency with which each tool was utilized.

The whole philosophy describes an organization that utilized every one of the lean tools. In this study, less than a quarter (21%) of the organizations had employed the whole philosophy. The remaining organizations chose to select some tools while disregarding others. The following describes which lean tools were most popular and those that, while accepted to a certain degree, were not as well embraced.

There were four lean tools that were adopted by more than one third of the organizations. This group of tools included *5S* (48%), *Just-in-time* (40%), *Setup Reduction* (54%), *and Continuous Improvement* (67%). The remaining lean tools included *Error Proofing* (29%), *Kanban* (37%), *Pull System* (29%), *Value Stream Mapping* (35%), *Visual Communication* (37%), *Kaizen Events* (23%), and *Total Productive Maintenance* (17%) and the final category was *None* (8%).

The organizations in the study each had different ideas about how many and which lean tools to utilize. The extent to which they agreed, and differed, is reflected in Table 12.

Table 13

Survey: Frequencies and Percentages for Lean Tools the Organizations had Implemented

Lean Tools	N	Percentage of Participants
Lean tools the organizations implemented		
5S	25	48%
Continuous improvement	35	67%
Error proofing	15	29%
Just-in-time	21	40%
Kaizen events	12	23%
Kanban	19	37%
None	4	8%
Pull system	15	29%
Setup reduction	28	54%
The whole philosophy	11	21%
Total productive maintenance	9	17%
Value stream mapping	18	35%
Visual communication	19	37%

N = 52

When an organization chooses to implement lean as its management philosophy, as with any major change management initiative, there are many challenges to overcome.

So, a question was posed to the interview participants as to whether the organization would still attempt lean implementation if given the option. The positive response rate was very high (85%) in agreement of *yes* to do lean again, with a modest percentage (15%) of *no* responses.

Another area of interest was the number of management levels or levels of hierarchy in the chain of command within the organizations. The idea was to see if there was an association between the number of management levels and lean implementation success. The most responses (44%) came from the three *levels* category. The two *levels* category accounted for nearly one third (31%) of all responses. Fifteen percent of the responses (15%) came from the four + *levels* category and the smallest category (10%) was in the one *level* category.

Another interview finding was the perceived measure of lean implementation success. Interview participants were asked how successful the organization's lean implementation success had been. The highest response rate (37%) came from the *moderately successful* category. The second largest category (27%) was *slightly successful*. The *mostly successful* category accounted for nearly one fifth (19%) of the responses with the *not successful* and *slightly successful* categories both receiving approximately one tenth (10%) or less (8%) of the responses respectively.

This data provides insight into not only the number of levels of management hierarchy within the organizations but an overall organizational perception of lean implementation in terms of success. Table 13 summarizes the data collected from the interview participants regarding organizational involvement with lean, number of levels of management, and the extent of lean implementation success.

Table 14

Survey: Frequencies and Percentages for Organizational Lean Involvement, Levels of Management, and Extent of Lean Implementation Success

Factors	N	Percentage of Participants
Organizational choice to do lean again		
Yes	44	85%
No	8	15%
Management level in organization		
1	5	10%
2	16	31%
3	23	44%
4 +	8	15%
Extent of lean implementation success		
Not successful	5	10%
Slightly successful	14	27%
Moderately successful	19	37%
Mostly successful	10	19%
Very successful	4	8%

N = 52

Survey Findings

The surveys were administered on-line through the Illinois Manufacturers' Association (IMA) office using a listserve. The surveys were administered as a census of a population and as such were sent to all 4,261 IMA members. The data from the completed IMA surveys were compiled in the LimeSurvey website in preparation for analysis. The data have been used to answer Research Question 4 regarding intrinsic organizational factors. This research question was answered by using correlation to evaluate the extent to which each *intrinsic organizational factor* was associated with *how successful lean implementation efforts have been*, which was question number 13 in the demographics section.

The data are presented in an aggregated form to provide a more accurate representation of general industry trends while maintaining respondent anonymity. This section was organized by first restating Research Question 4. Then the correlations from the survey data were presented in Table 14. Finally, a series of detailed explanations regarding characteristics of the survey were provided. It must be reiterated that in the case of ranked variables there can be no assumption of normality. Therefore, when using Spearman's rho for nonparametric variables, as used for this portion of the study, SPSS offers no option to collect data such as means and standard deviations.

Research Question 4

To what extent do the following intrinsic organizational factors affect lean implementation?

Table 15

How Intrinsic Organizational Factors Correlate with the Lean Implementation Success

	Correlations	
	Intrinsic Organizational Factors	Lean Implementation Success Rate
SQ1:	Age of the organization	.321
SQ2:	Organizational adaptability	.320
SQ3:	Leadership effectiveness	.122
SQ4:	Teamwork oriented	.218
SQ5:	Management/employee training	.124
SQ6:	Management/employee relationship	.259
SQ7:	Number of management levels	.140
SQ8:	Management/employee buy-in	-.014
SQ9:	Union organization	.025
SQ10:	Nonunion organization	.142
SQ11:	Management/employee communication	.338
SQ12:	Understanding of organizational culture theory	.084
SQ13:	Number of employees	.157
SQ14:	Employee resistance to change	-.149
SQ15:	Environment of continuous improvement	.111
SQ16:	Management's understanding of change management theory	-.025

SQ: Survey Question

The correlation scale is Strong Positive [1.00 to .60]; Positive [.60 to .20]; No Relationship [.20 to -.20]; Negative [-.20 to -.60]; and Strong Negative [-.60 to -1.00]. It is important to note that although there were three intrinsic organizational factors that received a negative number for the correlation, these correlation values were so weak that they were considered to have No Relationship to the the question about success they were being correlated with.

Survey Characteristics

In order to better understand specific issues related to this survey, items such as the survey's reliability coefficient, the number of surveys sent, survey response rate, the number of usable surveys, an account of nonrespondents, and a breakdown of respondents and late respondents have been examined in this section.

Reliability Coefficient

The reliability coefficient for the survey was examined using Cronbach's Alpha. This test of reliability checks for internal consistency of the survey questions to be sure they are all measuring the same thing. Cronbach's Alpha was chosen because it was designed for surveys that are administered only once, such as in this case. The resultant reliability coefficient for this survey was .924.

Survey Data

The surveys were originally sent to 4,261 Illinois Manufacturers' Association members (IMA). Five days later a follow up survey was sent to 4,259 IMA members as a

reminder to complete the survey. The survey had bounce rates of 36.9% for the original survey and 37.1% for the reminder surveys and an open rate of 19.7% for the original survey and 17.0% for the reminder survey. The variation in the number of surveys sent, bounce rates, and open rates, was due to membership fluctuation between the original send date and the reminder send date. The was a response rate of 1.22% for completed surveys with 16 surveys that were not completed and therefore unusable. The email run history (J. Nelson, personal communication, September 20, 2010) as illustrated in Table 15 summarizes key survey data.

Table 16

IMA Survey Email Run History

IMA Survey	N	%	Date/Time
Reliability Coefficient		.924	
Original Survey			
Date/Time			9/8/2010 8:03 AM EDT
Surveys sent	4261		
Bounce rate	1571	36.9	
Opens	530	19.7	
Reminder Survey			
Date/Time			9/13/2010 11:52 AM EDT
Surveys sent	4259		
Bounce rate	1582	37.1	
Opens	456	17.0	

Survey details. The survey report in Table 16 details additional data noteworthy to the findings. The original number of IMA surveys started were 68 but only 52 were completed. This left the 16 partially completed surveys that were unusable. There were 37 respondents that completed the original survey. Fifteen additional respondents completed the survey after the reminder notice was sent out.

Table 17

Survey Report

IMA Survey	N	%
Surveys Started	68	1.60
Surveys Completed	52	1.22
Surveys Unsuable	16	
Respondents	37	
Late Respondents	15	
Non-Respondents	4193	98.4

Operational Definition of Email Run History Terms

Original Survey. The initial survey request sent to the Illinois Manufacturers' Association members that provided a ten day window of time to complete.

Reminder Survey. A follow up survey request sent five days after the original survey request to serve as a reminder there were only five days left to complete the survey.

Surveys Sent. The total number of surveys sent out by the Illinois Manufacturers' Association to its members.

Bounce Rate . The rate at which emails are unable to be delivered.

Opens. The number of emails that were opened by the recepients.

Summary of Survey Data

This summary discusses findings from Illinois Manufacturers' Association (IMA) survey data. IMA members are manufacturing organizations located in Illinois. Data generated from the surveys were utilized to determine the extent to which particular intrinsic organizational factors affect lean implementation. Data analysis conducted on the survey instrument found that it had a high internal consistency, resulting in a reliability coefficient of .924. The findings addressed the fourth research question from the study.

Research Question 4

To what extent do the following intrinsic organizational factors affect lean implementation?

According to the survey data, there were no strong positive correlations, negative correlations, or strong negative correlations between lean implementation success and the 16 intrinsic organizational factors. There were, however, five positive correlations. The list included (Survey Question) SQ 1 (age of the organization), SQ 2 (organizational adaptability), SQ 4 (teamwork oriented), SQ 6 (management/employee relationship), and SQ 11 (management/employee communication). There were eleven intrinsic organizational factors that had no relationship with lean implementation success. The list

included (Survey Question) SQ 3 (leadership effectiveness), SQ 5 (management/employee training), SQ 7 (number of management levels), SQ 8 (management/employee buy-in), SQ 9 (union organization), SQ 10 (nonunion organization), Sq 12 (understanding of organizational culture theory), SQ 13 (number of employees), SQ 14 (employee resistance to change), SQ 15 (environment of continuous improvement), and SQ 16 (management's understanding of change management theory).

The survey had a completion rate of 1.22%, an open rate of less than 20% for each of the original and reminder surveys, and a bounce rate averaging 37% for both. There were 52 completed surveys with 4,193 non-respondents to the survey.

CHAPTER VI

CONCLUSIONS, IMPLICATIONS, AND RECOMMENDATIONS

Statement of the Problem

A management system for manufacturing operations has been developed that is improving operational efficiency for many organizations. The system, known as lean, is rapidly growing in popularity and has been proven effective in the U.S. and abroad. However, there is a disconnect between some U.S. companies that want to utilize lean and those that are able to successfully implement it. Unless problems associated with implementation are understood and addressed, issues that contribute to problematic lean implementation in these companies are likely to continue.

Purpose of the Study

The purpose of the study was to investigate the relationship between organizational characteristics and issues associated with lean implementation. In particular, the study identified organizational characteristics which for the purposes of this study include (a) *organizational leadership,* (b) *organizational culture,* and (c) *organizational change* to determine how each influences lean implementation efforts, and (d) also determine the extent to which *intrinsic organizational characteristics* impact lean implementation efforts.

Discussion of Findings

The study identified three organizational characteristics that were the basis for Research Questions One through Three. Through a series of interviews with members of the Industrial Advisory Committee (IAC), the role of these organizational characteristics in lean implementation was examined. A document analysis of the IAC minutes was also conducted, looking for evidence of lean support from within the manufacturing sector. Research Question Four utilized results of an on-line survey, administered to the Illinois Manufacturers' Association (IMA), in order to gain a deeper understanding of the extent to which intrinsic organizational factors affect lean implementation. The following sections compare and contrast the qualitative and quantative findings, and examine key findings from the Research Questions One through Four, which provide empirically-based support for the conclusions.

Comparison of Qualitative and Quantitative Findings

Once the qualitative and quantitative data were collected, each type was analyzed separately. The data were then evaluated in order to synthesize the results of the study for drawing conclusions. The subsequent narrative is an examination of those conclusions.

Consistent Findings

There were five distinct areas in which the qualitative and quantitative data from the study were in agreement. When compared, the synthesis of data from both the interviews *and* surveys provided evidence that the following items were associated with successful

lean implementation through supportive interview data and positive correlations from the survey data.

- Age of the organization
- Organizational adaptability
- Teamwork oriented
- Management/employee relationship
- Management/employee communication

Organizational age was discussed in the interview data as being advantageous for younger organizations because of their increased adaptability to drastic change. The advantages of age were considered to decrease, however, as the organization aged and became entrenched in rituals developed over time, making change more problematic. The survey data showed a positive correlation when associating organizational age with lean implementation success.

Organizational adaptability was supported equally by the interview and survey data as important to successful lean implementation efforts. The ability of an organization to change was considered vital to its survival. An organization's orientation toward teamwork was equally supported by both as well. The unity of an organization's leaders and employees toward a common cause supports lean implementation efforts.

The *relationship of management and employees* received positive support by the data from both data sources. A poor working relationship will result in an uncooperative spirit within the workplace and inhibit efforts to promote lean implementation. *Management and employee communication* was also supported by the data as a vital component in successful lean implementation. A fundamental precept of lean is open

communication and without it success would be hindered and provide only a watered down version of lean.

The document analysis of the Industrial Advisory Committee (IAC) minutes provided evidence of strong support for the advancement of lean principles. Industry leaders represented in the IAC at Southern Illinois University Carbondale suggested a variety of academic offerings in the context of lean within a university setting. This support for lean education demonstrates their belief in the importance of and need for future manufacturing industry leaders to be competent in the lean philosophy in order to maintain a competitive edge in the global market place. These findings are all consistent with efforts to successfully implement lean.

Inconsistent Findings

Although there were some important consistencies discovered in the findings, there was a sharp contrast on three main points between the qualitative and quantitative data. The greatest point of disagreement was about the importance of leadership. The interview data described *leadership* conclusively as the most important organizational characteristic associated with lean implementation success. This data also revealed that poor leadership was also the most important factor in lean implementation failures. This conjecture was supported by the information found in the literature, such as the following. "Specific leader behaviors—the ability to motivate, communicate, and build teams—are predictors of successful implementation of organizational change" (Gilley, McMillan, & Gilley, 2009, p. 1). However, the correlation based on the survey data concluded that there was no relationship between *leadership* and *lean implementation success*.

The interviewees also considered *employee resistance* to be especially problematic. The literature review found much support for this position as well in the following posit. Change is often unsettling for many employees in an organization and resistance to change issues stymie, if not entirely doom, many change efforts. Issues like this cause organizational change to become extraordinarily difficult to manage effectively, which contributes in no small part to the high failure rate (Callaly & Arya, 2005). The correlations from the survey data, however, considered *resistance to change* to have no relationship to *lean implementation success*.

The third factor was *management's understanding of change management theory*. The interview data found substantial support for the position that this was a key element of successful change, such as when implementing lean. The literature review had numerous citations supporting the importance of and need for this characteristic when attempting organizational change. The following passage is one such example.

The complex nature of organizational change will require proven management models that are steeped in increasingly comprehensive change model theory. There is a positive linkage between leaders' change management skills and successful organizational change. Conversely, deficits in change management skills, inadequate knowledge of change process techniques, and failure to transform organizational systems have been acknowledged as barriers to success (Bossidy & Charan, 2002; Gilley, 2005). Yet again, based on the correlations of the survey data, *management's understanding of change management theory* was considered to have no relationship with *lean implementation success*.

These discrepencies bring to light a concern with the survey data which could most likely be explained by the low response rate to the survey request. The low response rate could be responsible for skewing the validity of the survey data.

Research Question 1

What role does organizational leadership play in lean implementation?

Leadership is considered by the interview participants to be the most important element when attempting organizational change. This is consistent with Gandossy and Verma (2009), "Top companies realize that the biggest constraint to pursuing growth opportunities and surviving in today's fast-paced, dynamic world is talent" (p. 45). It is considered necessary for leaders to receive training in the concepts of change management to be able to effectively address issues of organizational change, such as the implementation of lean. Another equally important facet leaders need in order to successfully implement lean is a solid working knowledge of lean concepts, data interpretation, process metrics, and understanding of how lean tools function.

Leaders must also be able to avert employees' fear of change by being open about the changes when implementing lean and assuring them it is OK to make mistakes when learning the new process. At this stage, making sure the employees learn lean concepts is *much* more important than doing everything perfectly. It is *especially* important to not be overly critical of employee performance when the organization is going through the lean implementation learning curve. The exacerbation of an already stressful situation can cause employees to resent the new lean initiatives. The consequences of mishandling this decisive stage of lean implementation can deal implementation efforts a death knell.

A leadership characteristic that is considered crucial when leading change is the ability to demonstrate commitment to the new process. An effective way to do this is through active leadership participation in the change process. Doing things such as teaching the lean concepts, doing reviews, and taking part in various other lean activies on the shop floor. It is consistent with the position of Drucker (1999) and Howkins (2001), that organizational leaders strongly influence the work environment through routine interpersonal interactions. It sends a powerful message to employees when they see leaders performing hands-on operations directly facilitating the desired change. When leaders exemplify their commitment to lean implementation, employees are more likely to embrace the change as well. Blended leadership is a widely accepted leadership style because of its adaptability to a variety of manufacturing scenarios. A leader must be able to balance many diverse issues within the organization while accomodating the differences among people and even groups within the same organization. Overall, there is no one leadership style that works best in all lean implementation situations. However, it is vital that the leaders put forth a positive attitude about the change, are openly and honestly communicative, promote lean champions, and embrace employee empowerment. Ultimately, a good leader must recognize the need to incorporate as many different leadership styles as necessary to accomplish the goals of the organization.

Ideally, when making an organizational change such as implementing lean, leaders within an organization would have prior lean implementation experience. The positive effect of confidence in the leadership of an organization cannot be overstated. When major changes are made to an organization by a leader with a background of proven success, employees are more assured that the company and in turn their livelhoods are

going to be secure. The employees' confidence in the leadership will reduce their anxiety and subsequent resistance to change.

However, if the leadership has no prior experience with lean implementation, there is another alternative that can bridge the gap to successful lean implementation. Consultants with lean expertise can be brought in temporarily to facilitate the lean implementation. The key to successfully utilizing lean consultants is to understand the temporary nature of their role and have in place an internal network of employees specially trained in lean by the consultants *before* they leave. This is an essential step because without subsequent follow up to reinforce lean practices, the lean transition may stall and eventually fail. The training of internal lean specialists is also important because the employees know the internal workings of the organization far better than a consultant on temporary assignment ever could. The goal should be to ultimately create an in-house team of lean specialists and lean champions who can not only sustain but promote and carry on the lean philosophy long after the consultants are gone.

Research Question 2

What role does organizational culture play in lean implementation?

Organizational culture is an integral aspect of organizational change. Trying to effect organizational change, such as when implementing lean, without understanding the role of culture in change can be problematic to implementation efforts. This is in concurrence with Cartwright and Cooper's (1993) argument that the source of problems associated with organization change are often attibutable to cultural differences. The interviewee's perception of organizational culture is that an organization's philosophies,

ethics, and guiding principles are a direct reflection of the leader's actions at all levels of the organization. These characteristics trickle down and ultimately affect how the employees and the organization as a whole operate.

Therefore, the biggest cultural challenge of changing from a traditional manufacturing philosophy to lean is ensuring leadership support. Without this support, lean initiatives quickly wither and die. Changing culture is a top down process that starts with the organization's leaders and goes all the way through the organization. Leaders must demonstrate not only a strong behind the scenes backing for the proposed lean initiatives, but present visible evidence of their support by actively participating in lean activities on the shop floor and demonstrate evidence of positive change to bolster employee buy-in. This is in line with Shafritz, Ott, and Jang's (2010) belief that only when an ensuing behavior proves successful through the accomplishent of a task or goal and the group members feel good about their situation will the leader's vision be recognized and shared.

Another important cultural issue is change itself. Change is frightening to many people and there is often resistance to it. One way to address this concern is through top down support from the organization's leaders as previously mentioned. However, there are other implementation techniques that should be used in conjunction with leadership support to effectively facilitate cultural change within an organization. The majority of interviewees believed it was helpful to *demonstrate* successful change before expecting lasting organizational change to occur. The eventual shift in the organization's culture was a result of many small victories. This is supported by Kotter's (1996) contention, "Culture changes only after you have successfully altered people's actions, after the new

behavior produces some group benefit for a period of time, and after people see the connection between the new actions and the performance improvement" (p.156).

Employees need to be made aware of the inevitability and need for change and be involved with it from the very early stages. Employees should be educated through lean training with frequent follow ups. The training should also make it clear that lean's benefits extend to not only the company, but to the employees as well, which will encourage employee support. It is especially important initially to select projects that have subtantial benefits for the employees to demonstrate this point. In addition, it is vital that everyone be an active participant in the change process from early on throughout the entire process in order to effect successful cultural change within the organization. Involving employees in lean initiatives gives them a sense of ownership of the process is a key factor in building support for the change. It is essential that empoyees feel they are a valued part of the change process, rather than a victim of it.

Collaborative Relationship

The data clearly illustrates the need for a different leader/employee relationship paradigm when attempting to implement lean in an American company. This paradigm shift will require a dramatic change in the culture of the organization to succeed. In order to do this, there must be a fundamental understanding of the differences in the organizational cultures of Japanese and American organizations and what can be done to make the cultural shift successfully.

It must first be recognized that although lean concepts are arguably universal in nature, their implementation is based on a Japanese oriented culture. The cultural mores

of the Japanese are distinctly different than those in America, which is no secret. However, many organizations mistakenly focus on only the operational concepts of lean and what physical changes will be needed to make it work in their facility rather than considering the process of *how* to implement lean. Understanding the issues of cultural disparity is an integral component of successfully facilitating the *how* when implementing lean and cannot be ignored.

An example of an important difference in the two cultures is when a change is suggested in a Japanese company, employees immediately and without question follow through with the change for the good of the group. Conversely, in an American company employees will question the changes. They will want to know why change is necessary and how it will benefit them individually. This resistance, while nonexistent in a Japanese company, presents a major obstacle for an American company trying to implement lean.

The key to overcoming this obstacle for American companies interested in implementing lean is to begin building collaborative relationships with the employees. The following suggestions explain how some traditional methods are barriers to lean implementation. Also, provided are examples of what must be done to effectively counteract these methods and change the organizational culture in order to successfully implement lean.

Traditional manufacturing management methods employ a top down approach that create a power differential between leaders and employees. This power differential is the result of numerous factors including top down directives, the marginalization of employee contributions, and closed communication channels. The top down directives are issued from the leaders and expected to be followed by employees without question. Employees

are not typically considered a source of intellectual contributions and as such, are not fully respected as a valuable resource to the organization. The channels of communication are utilized in a one way only information flow and there is little recognition of the need to facilitate employee feedback.

The consequences of this type of leader/employee relationship are counterproductive to establishing valuable workplace relationships, which leads to the subsequent stifling of organizational productivity. This approach creates a mentality of *it is us against them* for leaders as well as employees rather than one of teamwork. The ensuing antagonistic relationship causes many problems with workplace satisfaction and ultimately results in a negative environment for everyone involved.

Organizations that implement lean must be aware of the feelings of disparity employees experience in this environment and make efforts to create new leader/employee relationship paradigms that focus on building collaborative relationships within the organization. It is important for the organization to acknowledge through its actions that the proposed changes of implementing lean are not just directed for the advancement of organizational causes alone. There has to be demonstrable actions by the organization in support of employee benefits as well. To get employee buy-in, the implementation of lean must be presented as a win-win situation for everyone involved. Otherwise, if only the organization has something to gain there is no incentive for employees to make the change.

Employee resistance is a serious issue facing organizations when attempting organizational change such as lean implementation. Employing collaborative techniques as previously mentioned is an effective way to reduce this. Another important method of

reducing employee resistance is open communication. The cornerstone of lean is of open and honest organizational communication. A key part of an open communication channel is the development and integration of a systemic feedback platform for employees at all levels.

Employees need to know they are a respected part of the organization and their feedback whether in the form of a complaint or new idea submission is always welcomed, highly valued, and greatly appreciated. Although not every comment requires action, each and every one should be given careful consideration. Also, employees should be notified of the outcome so they will know they are truly listened to and will continue to feel valued and be participative in organizational issues. Feedback provides benefits on many levels and is an indispensable part of an open communication system. There are a number of ways employee feedback benefits both the employees and the organization including the following.

- Creates a sense of employee partnership with the organization
- Makes it easier for employees to suggest problem solving ideas
- Fosters open communication throughout the entire organization
- Instills a sense of teamwork among employees and leaders

When employees are kept up to date with organizational changes they are more likely to accept the changes. However, when they are allowed to have a say in developing organizational procedures to navigate the proposed change through their feedback, they begin to experience a true sense of partnership with the organization. The shift in leader/employee paradigm begins to occur at this point from one of in-house

organizational opponents to collaborators which effectively diffuses many issues of employee resistance.

The data revealed a strong association between open communication and successful lean implementation. This is supported by Kotter's (1996) contention that the utilization of effective communication is a powerful tool when implementing organizational change. To facilitate an orderly change within an organization, members need a clear understanding of how the changes will affect them, as well as a sense of direction as to their role in helping to achieve the new organizational goals. It is vital to keep employees updated on the organization's short-term and long-term goals, challenges facing the organization, and upcoming changes. This is an important form of empowerment and an effective way to reduce fear associated with change by breaking down internal barriers. This way everyone can move forward capitalizing on the synergy of teamwork rather than in splintered, uninformed groups. Closed communication styles build walls of resentment and promote an atmosphere of isolationism, neither of which are conducive to successful lean implementation.

True open communication cannot be just top down proclamations. There has to be a legitimate feedback system going from the bottom to the top as well and it has to be done as part of a systemic solution to enhance overall organizational communication. With the advent of a feedback system of open communication, an employee suggestion program should be developed to capitalize on employee ideas. New ideas are vital to the promotion of continuous improvement, a central tenent of lean.

It is also important to balance the goals of the company with what is good for the employees. One way to promote cultural change within an organization is to demonstrate

sustained success through tangible proof of positive change. This supports Kotter's (1996) contention that the transformation process begins with changes in behavior and attitude and only after repeated confirmation of the new method's success in achieving organizational goals does this style become anchored as the new culture. This change must signify, in no small part, a beneficial turn for the employees. This is a critical element that is necessary to start reducing employee resistance, obtaining employee buy-in, and ultimately begin changing the current organizational culture in favor of one that embraces the lean philosophy.

Research Question 3

What role does organizational change play in lean implementation?

Everyone interviewed agreed that understanding organizational change is instrumental to successfully implementing lean. This is consistent with statements by Bossidy and Charan (2002) and Gilley (2005) that deficits in change management skills, inadequate knowledge of change process techniques, and failure to transform organizational systems have been acknowledged as barriers to success. There were several key areas of organizational change revealed in the research, including how to overcome employee resistance to change. Leaders must first explain *why* the changes are necessary and be genuinely open to listening to employee's concerns about the subject. The importance of building and maintaining good leadership/employee relationships is of the essence for trust, a positive agent of change, to be established. When making organizational change, such as the implementation of lean, everyone including managers must be active participants in the change process to show that change is happening across

the board equally. When employees actually see leaders actively participating in the process it shows a sense of commitment to the lean implementation process. Leaders must prove they are truly committed to the lean initiatives or employee resistance will outlast management's lean implementation push and things will go back to the way they were.

A sense of urgency is crucial when beginning a lean implementation. Change initiatives often flounder when there is no sense of urgency. Also, when making changes, it is important to utilize employee empowerment techniques that enable employees to be a considerable part of the decision making process. Making employees collaborators in the change efforts rather than opponents to it is a must for lean to be sucessfully implemented. Clement's (1994) belief in the importance of the need to "collaborate with those same individuals to obtain their input" (p. 2) is supported here.

Organizational size does impact lean implementation. While still capable of implementing lean, larger organizations tend to have more problems with the implementation process. Issues inherent with organizational size such as diminished homogeneity of culture, increased levels of bueracracy, and increasingly problematic communication create extra challenges that tend to stifle lean implementation efforts. One way to counter these issues is by taking extra efforts to ensure communication channels are well-organized. By doing this, the information can effectively reach all levels of the organization to keep everyone updated and moving in sync.

Organizational age affects lean implementation as well. Younger organizations tend to be much more adaptable and open to frequent change. However, as organizations age, routines become deeply ingrained and the ability to adapt to drastic change often becomes more difficult. Unless an organization's paradigm is one of frequent change,

breaking free of the *we have always done it this way* archetype will become increasingly difficult as the organization ages. Even with these issues, lean has been successfully implemented in organizations of all sizes and ages. However, no matter what the size or age of the organization, if the leaders do not commit to the change, lean implementation efforts will fail.

When deciding where to begin lean implementation efforts, it is important to focus implementation efforts on employees that express the most positive support for the changes. Selecting an area where there is hyper-resistance will only result in wasting valuable time and resources, and create an air of animosity. Once a suitable area has been selected, it is important to ensure the lean training is presented in such a way as to provide beneficial results to the employees. Otherwise, the employees will become disenfranchised with the lean implementation process and resist further change efforts.

Leadership is the most important factor in organizational change and in turn, successful lean implementation. This conforms to Clement's (1994) posit that "Management's leadership in the change effort seems to be the key determinant of whether that change will succeed" (p. 2). Leaders who exhibit a strong commitment to lean initiatives, are effective communicators, and lead by example have the greatest potential to facilitate lean implementation successfully. In contrast, poor leadership is the greatest inhibitor to successful organizational change, and in turn successful lean implementation. Leaders who demonstrate a lack of commitment in time, resources, and effort through active participation create a situation that is easily picked up on by employees which sets the lean implementation process up for failure.

Research Question 4

To what extent do intrinsic organizational factors affect lean implementation?

To try to answer this question, an on-line survey was administered to the Illinois Manufacturers' Association (IMA) from September 8, 2010, through September 17, 2010. The survey was available on-line for a total of consecutive ten days. The study examined the extent to which a variety of *intrinsic organzational factors* affected *successful lean implementation* for these manufacturers. The survey started off well with some respondents taking the survey. Then, a reminder was sent out at the half way point to notify IMA members that there were only five days left to fill out the survey before it was to be closed.

The correlation scale used was for the analysis was: Strong Positive [1.00 to .60], Positive [.60 to .20], No Relationship [.20 to -.20], Negative [-.20 to -.60], and Strong Negative [-.60 to -1.00]. Based on the results from the survey, there were no strong positive correlations, negative correlations, or strong negative correlations between the level of lean implementation success and the intrinsic organizational factors selected for the study. There were 11 intrinsic organizational factors with no relationship with the lean implementation success. However, there were five positive correlations which included (Survey Questions), SQ 1 (age of the organization), SQ 2 (organizational adaptability), SQ 4 (teamwork oriented), SQ 6 (management/employee relationship), and SQ 11 (management/employee communication).

The survey ultimately proved to be relatively ineffective as a data gathering tool however, due to an extremely low response rate. The suvey resulted in only 52 completed surveys from the 4,261 IMA members with a completion rate of just 1.22%. Even though

this is historically a normal survey response rate for this population (J. Nelson, personal communication, September 20, 2010), such a low response rate marginalized the validity of the quantitative portion of the study.

Level of Confidence

To determine the overall study validity, several factors were examined. The qualitative portion of the study utilized interviews for the data gathering process. The first factor was the validity of the interview instrument used to interview Industrial Advisory Committee (IAC) members. Once the interview instrument was developed, it was examined by the faculty members from the Department of Technology at Southern Illlinois University Carbondale who participated in the study as lean experts. There were only minor revisions and each were addressed. Another important component that affected the study validity was the IAC member participation in the study. There was a 100% participation rate of those who were asked and qualified as lean experts. The next factor was the document anaylsis of the minutes from the IAC meetings. The document anaylsis corroborated the interview findings that lean education is vital to lean success in the workplace. Based on these circumstances, the level of confidence in the results was high.

The quantitative portion of the study utilized interviews for the data gathering process. One important component of that process was the on-line survey used to survey members of the Illinois Manufacturers' Association (IMA). The reliability of the (IMA) survey instrument was examined. Using Cronbach's Alpha, the reliability coefficient was found to be .924 which indicated the survey instrument had very good internal reliability.

The survey response rate from the IMA members, however, was extremely low at only 1.22%. This low response rate adversely affected the validity of the survey data. Therefore, the level of confidence in the results of the IMA survey was low.

So, although the interview portion of the study went very well, the on-line survey response rate was extremely low which had a negative impact on the validity of the study. Therefore, when examining the overall validity for the study, the level of confidence in the results was medium.

Conclusions

Based on the research data, lean researchers and practitioners must understand that organizational leadership, organizational culture, and organizational change are inherently interconnected. Issues that affect one affect the others as well, and leaders must be well versed in the workings of all three before sustainable lean implementation success can occur. The following conclusions have been drawn from a synthesis of the research data:

1. There is a need to consider alternative possibilities to the way lean is utilized other than the traditional Toyota production system (TPS) model. Lean is a management model based on (TPS) which was designed specifically to meet the needs of Toyota. Although lean concepts are universal in design, not every organization is able to effectively utilize all the lean tools due to any number of constraints. Each organization is unique and has its own particular needs and may utilize lean tools that are applicable to their own specific situation. It must be understood that there is more than one right way to utilize lean.

2. There is much more to implementing lean than knowing in what order to introduce the lean tools. The fundamental building blocks of organizational leadership, organizational culture, and organizational change must be in place before the disconnect between wanting to become involved in lean and an actual successful lean implementation can occur.
3. Effective leadership or the lack of it, is the number one factor in lean implementation success or failure respectively. The greatest advancements to successful lean implementation will come from leaders who are fully committed to lean, provide the necessary resources for the change, and are highly visible advocates of the lean implementation process.
4. It is crucial that leaders master change management techniques in order to overcome barriers to lean implementation. Change management has a very high failure rate across all industries, so when implementing a cross-cultural management system as complex as lean, it becomes even more imperative to understand the intricacies of this important management process.
5. Advanced communication channels with integrated feedback systems are a vital part of any successful lean implementation, especially so the larger an organization gets. Good communication is instrumental for building intra-organizational relationships, while erasing departmental boundaries and tensions. The integrated feedback system is also a must for taking advantage of employees' contributions such as improvement suggestions.
6. Lean should be utilized on projects that are financially quantifiable such as setup reduction, reduced work in process, and so forth. The project results should be

measureable and indicative of monetary gain or loss. Lean is an inappropriate tool for feel good issues where the results cannot be quantified. Without quantifiable results to verify positive gains within an organization, lean may appear to be ineffective and lose valuable support.

7. Leaders must understand that lean implementation is not a one-person task. There needs to be an elaborate network of lean specialists and lean champions working in conjunction with organizational leaders to carry out the implementation process effectively.
8. Leaders must understand the crucial role of organizational culture in order to effectively facilitate cultural change. Changing the long established beliefs and values of any organization is challenging, but doing so from a cross-cultural perspective (Japanese to American) it is exceptionally challenging. The keys to changing organizational culture are building collaborative relationships between leaders and employees and demonstrating and sustaining success through new methods until they, over time, become institutionalized.
9. Researchers need to be aware that surveying, which would be an effective data gathering technique for some research study populations, has been problematic when used to conduct surveys with members of the Illinois Manufacturers' Association. The fact that the on-line survey response rate is typically low demonstrates the need for alternative research methods when working with this population. The demands of busy schedules and competition for these manufacturing leaders' time may affect future survey response rates as well, and ultimately, research validity.

It must be noted that, even though the quantitative portion of the study was negatively impacted by the low survey response rate, the rich data source of interviews and document analysis from the qualitative portion of the study provided substantial support for the conclusions presented here.

This study uncovered many levels of complexity affecting the lean implementation process. Much of the complexity stems from the role of deeply ingrained organizational factors that are not easily understood or manipulated. Bringing about an increased awareness and understanding of what these factors are and how they affect lean implementation provides organizations with additional opportunities to overcome difficult lean implementation issues. Lean as a management philosophy is much more than just a series of tools. The implementation of lean requires an in-depth understanding of not only the visible forces such as the intrinsic factors that impact an organization, but the invisible ones as well. Things like the ability of leadership to transform an organization, how to produce cultural change, and the need for change management skills are intangible characteristics that are vital to successful lean implementation. Understanding the complex and integral nature of these relationships will provide a foundation upon which to advance lean implementation theory where it has been so far, only marginally successful.

Implications

The findings of this research study have implications for lean researchers trying to solve lean implementation issues and lean practitioners interested in implementing lean in a practical sense. These groups include those who have tried to implement lean with

limited success, and those who have had success with lean implementation but are searching for other alternatives to achieve even greater lean implementation success.

Researchers

- Now that there is a heightened awareness of the integral relationships of organizational leadership, organizational culture, and organizational change, researchers can begin examining how these issues are associated with this lean implementation more closely.
- It would be beneficial for researchers find/develop alternative methodologies to gather data from manuacturing organizations when surveying proves ineffective.
- Developing change management techniques that are lean-based and universally applicable in manufacturing operations would facilitate successful lean implementation.

Practitioners

- A continuous improvement (CI) culture must be institutionalized throughout the organization by way of procedural practices that are integrated into established routines. The establishment of these procedures simultaneously works to secure lean's position as the new way of doing things and provides effective ways to continually improve the operational efficiency of the organization.
- Practitioners could advance lean implementation by developing an effective feedback system that works as an integral branch of the organizational

communication system, sending information both up and down the chain of command quickly and efficiently.

- Leaders can develop a systematic way to build a network of lean specialists within an organization. Once systemized, lean could be quickly established throughout other facilities within the organization.

Recommendations for Further Research

Lean is a manufacturing management philosophy that continues to rapidly gain in popularity among organizations searching for a competitive edge. Even so, with proven results from the lean exemplar Toyota, it remains a mystery why only about 2% of the organizations that attempt to utilize the lean philosophy have achieved world class level success. With this in mind, there is still evident need for further research in this area. The following list contains some suggested areas of research to address these issues.

1. Conduct a national study utilizing the National Association of Manufacturers (NAM). A broad reaching study such as this would provide approaches to lean implementation that are generalizable to a national manufacturing organization population. The study should use strategies to increase the response rate if data are collected through online methods.
2. Conduct a study focusing specifically on lean implementation practices. Lean's popularity is without question. However, questions about strategies to effectively implement lean leave much unanswered. Organizations need to understand how to successfully navigate the implementation process if they are to take advantage of the benefits of lean.

3. Conduct a study focusing on failed and problematic lean implementation experiences. Doing a post-mortem on such lean implementations can provide advanced warning of barriers that inhibit or completely debilitate implementation efforts. This knowledge will help other organizations be better prepared to overcome these issues.
4. Conduct a study focusing on organizations with highly successful lean programs. Organizations interested in implementing lean will benefit from understanding the specifics of successful lean programs, especially their implementation techniques and how barriers to success were overcome.
5. Conduct a study focusing on lean implementation techniques and success rates of other types of organizations such as healthcare, retailing, construction, hospitality and so forth. Knowledge gained for this study will provide fresh perspectives on how to successfully implement lean in any industry.

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APPENDICES

Appendix A

INTERVIEW CONSENT FORM

My name is John Cooper and I am a graduate student at Southern Illinois University Carbondale. I am requesting your participation in my research study because of your knowledge in the area of lean manufacturing. The purpose of the study is to research what organizational characteristics affect lean implementation in a manufacturing operation. The purpose is to improve successful implementation rates among those companies attempting lean implementation.

Participation is voluntary and you can elect to withdraw at any time. If you choose to participate in the study, it will take approximately 45-60 minutes to complete the interview process. You will be answering questions pertaining to your knowledge of Lean and the manufacturing industry.

The interview will be taped (digitally recorded). The recording will be erased upon completion of the project. All your responses will be kept confidential within reasonable limits. Only those directly involved with the project will have access to the data. If you have questions about the study please feel free to contact me at jjcooper57@yahoo.com or (618) 925-3495 or my research advisor Dr. Beth Freeburg at freeburg@siu.edu or (618) 453-3321.

Thank you for your participation.
Sincerely,

John J. Cooper
Ph.D. Candidate
Southern Illinois University Carbondale

This project has been reviewed and approved by the SIUC Human Subjects Committee. Questions concerning your rights as a participant in this research may be addressed to the Committee Chairperson, Office of Research Development and Administration, SIUC Carbondale, IL 62901-4709. Phone (618) 453-4533. E-mail: siuhsc@siu.edu

I agree to be recorded during this interview. Signed_____ Date: _____

Appendix B

SURVEY CONSENT FORM

Dear Illinois Manufacturers' Association Member: September 8, 2010

The staggering loss of high-paying manufacturing jobs in Illinois since 1990 has been devastating to the local economy and in turn, drastically reduced the standard of living for many Illinois workers. The trend has been to replace the high-paying manufacturing jobs with low-wage work with low/no benefits. However, a solution may be found in the use of a manufacturing management philosophy known as lean.

Many manufacturers have recognized the potential of lean for improving organizational competitiveness in the global marketplace, but have found implementation problematic. Consequently, in an effort to improve this situation, I am writing to request your participation in an on-line survey that identifies intrinsic (fundamental) organizational characteristics present in Illinois manufacturing organizations. The intent of the survey is to gain a better understanding of the role these characteristics play in lean implementation. A clearer understanding of this subject could be beneficial to many Illinois manufacturers. The survey will be evaluated to help formulate future lean implementation strategies and the results shared with respondents.

This on-line survey is designed using check boxes to make it user-friendly and less time consuming to complete. The survey is completely confidential and should take only about 10 – 15 minutes to complete. You have the option to stop participation in the survey at any time. Completion of this survey will serve as your voluntary consent to participate in this survey. Please complete the survey within ten (10) days. If you have any questions or comments, please feel free to contact me at jjcooper57@yahoo.com or (618) 925-3495 as well as my research advisor Dr. Beth Freeburg at freeburg@siu.edu or (618) 453-3321.

Thank you for your participation.

Sincerely,

John Cooper
Ph.D. Candidate
Southern Illinois University Carbondale

This project has been reviewed and approved by the SIUC Human Subjects Committee. Questions concerning your rights as a participant in this research may be addressed to the Committee Chairperson, Office of Research Development and Administration, SIUC, Carbondale, IL 62901-4709. Phone (618 453 4533. Email:siuhsc@siu.edu.

Appendix C

Interview Instrument for Industrial Advisory Committee Members

Introductory Comments

- Thank you for participating in this interview.
- The purpose of the interview is to get your perspective on questions pertaining to organizational culture and organizational change and the effect they have on lean implementation in your organization.
- This conversation is confidential and will in no way be connected to any individual or organization. You have the option to stop participation in the interview at any time.
- The context of the study is industry-wide rather than with individual organizations. The data gained from this interview will be aggregated with other interviews to assess industry trends with regard to lean implementation.

Demographic Section

1. What is your position within the organization? _____

2. To what extent has your organization implemented or tried to implement lean?
   - O Fully
   - O Mostly
   - O Partially
   - O Only slightly
   - O Not at all

3. Is your organization:
   - O Publicly owned
   - O Privately owned

4. Is your organization:
   - O Union
   - O Nonunion

5. Age of the organization in years?
   - O 1 – 5
   - O 6 – 20
   - O 21 – 50
   - O 50 +

6. Number of employees in organization?
   - O 1 – 100
   - O 101 – 500
   - O 501 – 1000
   - O 1001 +

7. Is your organization:
   - O A national (US) company only
   - O A international (Global) company

8. How long has your organization been involved with lean?
   - O 0 – 5 years
   - O 6 – 10 years
   - O 11 – 20 years
   - O 20 +

9. What is your organization's total budget this year?
   - O Less than $1 million (US)
   - O $1 million to $10 million (US)
   - O $10 million to $100 million (US)
   - O $100 million to $500 million (US)
   - O $500 million to $1 billion (US)
   - O Don't know
   - O Would rather not say

10. What parts of lean does/did your organization try to implement?
    - O The whole philosophy
    - O 5S
    - O Just-in-time
    - O Kanban
    - O Pull system
    - O Error proofing
    - O Value stream mapping
    - O Setup reduction
    - O Visual communication
    - O Total productive maintenance
    - O Continuous improvement
    - O Kaizen events
    - O None

11. Would your organization get involved with lean again if given the choice?
    - O Yes
    - O No

12. How many levels of management are in your organization?
    - O 1
    - O 2
    - O 3
    - O 4 +

13. How successful has your lean implementation been?
    - O Not successful
    - O Slightly successful
    - O Moderately successful
    - O Mostly successful
    - O Very successful

Interview

1. What does the culture of an organization mean to you?

2. What does lean mean to you?

3. What do you see as the biggest cultural challenges when an organization changes from a traditional manufacturing philosophy to lean?

4. What does your company do to address these cultural challenges at all levels of the organization?

5. What role does communication play in overcoming cultural differences when making significant oranizational changes?

6. In the literature, there are two schools of thought concerning organizational culture and change. One says to convert the organizational culture first and then meaningful change can take place. The other says you must first demonstrate positive change and then the organizational culture will adapt to the new philosophy. What are your thoughts on the subject and how does your organization address the issue?

7. What are some of the issues not previously mentioned, both positive and negative, that your organization has experienced regarding organizational culture and its role in lean implementation?

8. What is the historical relationship to organizational change in your facility? (i.e., Does your facility make significant organizational changes frequently or infrequently and why or why not?)

9. What steps has our organization taken to overcome employee resistance to change when trying to implement a new management system such as lean?

10. How does the size of an organization affect organizational change?

11. How does the age of an organization affect organizational change?

12. What are some of the issues not previously mentioned, both positive and negative, that your organization has experienced regarding organizational change and its role in lean implementation?

13. What leadership characteristics do you see as essential to successfully directing significant organizational change in the context of lean?

14. Has your organization's leadership/management had any formal training in the area of change management? If so, to what extent?

15. To what extent was your organization's leadership/management trained in lean before implementation efforts began?

16. What leadership style was used to accomplish lean implementation goals in your organization? (i.e., visionary/inspirational, commanding, situational, people-oriented, task-oriented, transitional, transformational, or maybe some other type of leadership style)

17. How does your organization aquire new leaders? (i.e., Are they brought in from outside sources or cultivated from within the organization?)

18. Who leads lean implementation in your organization, the leaders or hired consultants?

19. Define lean success/failure.

20. In what areas has lean been most succcessfully implemented? Why?

21. In what areas has lean implementation failed? Why?

22. When a company tries to implement lean as its management system, what organizational characteristics inhibit its acceptance? Facilitate it?

Appendix D

Survey Instrument for Illinois Manuacturers' Association

Dear Illinois Manufacturers' Association Member: September 8, 2010

The staggering loss of high-paying manufacturing jobs in Illinois since 1990 has been devastating to the local economy and in turn, drastically reduced the standard of living for many Illinois workers. The trend has been to replace the high-paying manufacturing jobs with low-wage work with low/no benefits. However, a solution may be found in the use of a manufacturing management philosophy known as lean.

Many manufacturers have recognized the potential of lean for improving organizational competitiveness in the global marketplace, but have found implementation problematic. Consequently, in an effort to improve this situation, I am writing to request your participation in an on-line survey that identifies intrinsic (fundamental) organizational characteristics present in Illinois manufacturing organizations. The intent of the survey is to gain a better understanding of the role these characteristics play in lean implementation. A clearer understanding of this subject could be beneficial to many Illinois manufacturers. The survey will be evaluated to help formulate future lean implementation strategies and the results shared with respondents.

This on-line survey is designed using check boxes to make it user-friendly and less time consuming to complete. The survey is completely confidential and should take only about 10 – 15 minutes to complete. You have the option to stop participation in the survey at any time. Completion of this survey will serve as your voluntary consent to participate in this survey. Please complete the survey within ten (10) days. If you have any questions or comments, please feel free to contact me at jjcooper57@yahoo.com or (618) 925-3495 as well as my research advisor Dr. Beth Freeburg at freeburg@siu.edu or (618) 453-3321.

Thank you for your participation.

Sincerely,

John Cooper
Ph.D. Candidate
Southern Illinois University Carbondale

This project has been reviewed and approved by the SIUC Human Subjects Committee. Questions concerning your rights as a participant in this research may be addressed to the Committee Chairperson, Office of Research Development and Administration, SIUC, Carbondale, IL 62901-4709. Phone (618 453 4533. Email:siuhsc@siu.edu.
Appendix D Survey Instrument for Illinois Manuacturers' Association

SURVEY INSTRUMENT FOR MEMBERS OF THE

ILLINOIS MANUFACTURERS' ASSOCIATION

Demographic Section

1. What is your position within the organization? [ ]

2. To what extent has your organization implemented or tried to implement lean?
   - O Fully
   - O Mostly
   - O Partially
   - O Only slightly
   - O Not at all

3. Is your organization:
   - O Publicly owned
   - O Privately owned

4. Is your organization:
   - O Union
   - O Nonunion

5. Age of the organization in years?
   - O 1 – 5
   - O 6 – 20
   - O 21 – 50
   - O 50 +

6. Number of employees in organization?
   - O 1 – 100
   - O 101 – 500
   - O 501 – 1000
   - O 1001+

7. Is your organization:
   - O A national (US) company only
   - O An international (Global) company

8. How long has your organization been involved with lean?
   - O 0 – 5 years
   - O 6 – 10 years
   - O 11 – 20 years
   - O 20+ years

9. What is your organization's total budget this year?
   - O Less than $1 million (US)
   - O $1 million to $10 million (US)
   - O $10 million to $100 million (US)
   - O $100 million to $500 million (US)
   - O $500 million to $1 billion (US)
   - O Don't know
   - O Would rather not say

10. What parts of lean does/did your organization try to implement?
   - O The whole philosophy
   - O 5S
   - O Just-in-time
   - O Kanban
   - O Pull system
   - O Error proofing
   - O Value stream mapping
   - O Setup reduction
   - O Visual communication
   - O Total productive maintenance
   - O Continuous improvement
   - O Kaizen events
   - O None

11. Would your organization get involved with lean again if given the choice?
   - O Yes
   - O No

12. How many levels of management are in your organization?
   - O 1
   - O 2
   - O 3
   - O 4 +

13. How successful have your organization's lean implementation efforts been?
   - O Not successful
   - O Slightly successful
   - O Moderately successful
   - O Mostly successful
   - O Very successful

Illinois Manufacturers' Association Survey

The following question will be used to evaluate each intrinsic organizational factor.

To what ***extent*** do each of the following intrinsic organizational factors affect your organization's lean implementation efforts? Please mark the most appropriate box.

1. Age of the organization
   Check one:
   - □ No effect
   - □ Only slightly
   - □ Moderately
   - □ Often
   - □ Very much

2. Organizational adaptability
   Check one:
   - □ No effect
   - □ Only slightly
   - □ Moderately
   - □ Often
   - □ Very much

3. Leadership effectiveness
   Check one:
   - □ No effect
   - □ Only slightly
   - □ Moderately
   - □ Often
   - □ Very much

4. Teamwork oriented
   Check one:
   - □ No effect
   - □ Only slightly
   - □ Moderately
   - □ Often
   - □ Very much

5. Management/employee training
   Check one:
   - □ No effect
   - □ Only slightly
   - □ Moderately
   - □ Often
   - □ Very much

6. Management/employee relationship
   Check one:
   - □ No effect
   - □ Only slightly
   - □ Moderately
   - □ Often
   - □ Very much

7. Number of management levels
   Check one:
   - □ No effect
   - □ Only slightly
   - □ Moderately
   - □ Often
   - □ Very much

8. Management/employee buy-in
   Check one:
   - □ No effect
   - □ Only slightly
   - □ Moderately
   - □ Often
   - □ Very much

9. Union organization
   Check one:
   - □ No effect
   - □ Only slightly
   - □ Moderately
   - □ Often
   - □ Very much

10. Nonunion organization
    Check one:
    - □ No effect
    - □ Only slightly
    - □ Moderately
    - □ Often
    - □ Very much

11. Management/employee communication
    Check one:
    - □ No effect
    - □ Only slightly
    - □ Moderately
    - □ Often
    - □ Very much

12. Management's understanding of organizational culture theory
    Check one:
    - □ No effect
    - □ Only slightly
    - □ Moderately
    - □ Often
    - □ Very much

13. Number of employees
    Check one:
    - □ No effect
    - □ Only slightly
    - □ Moderately
    - □ Often
    - □ Very much

14. Employee resistance to change
    Check one:
    - □ No effect
    - □ Only slightly
    - □ Moderately
    - □ Often
    - □ Very much

15. Environment of continuous improvement
    Check one:
    - □ No effect
    - □ Only slightly
    - □ Moderately
    - □ Often
    - □ Very much

16. Management's understanding of change management theory
    Check one:
    - □ No effect
    - □ Only slightly
    - □ Moderately
    - □ Often
    - □ Very much

Appendix E

Validation Instrument for Illinois Manufacturers' Association Survey

EVALUATION TOOL TO ASSESS VALIDITY OF THE ILLINOIS MANUFACTURERS' ASSOCIATION ON-LINE SURVEY

1. How long did it take to complete the on-line survey?
   - ○ 0 – 5 minutes
   - ○ 6 – 10 minutes
   - ○ 11 – 15 minutes
   - ○ 16 – 20 minutes
   - ○ 20 + minutes

2. Did the on-line survey take too long to complete?
   - ○ yes
   - ○ no

3. How easy was the on-line survey to complete?
   - ○ very easy
   - ○ easy
   - ○ moderate skill required
   - ○ difficult
   - ○ very difficult

4. Does the on-line survey adequately explore the various intrinsic organizational characteristics that affect lean implementation?
   - ○ yes
   - ○ no

5. What other intrinsic organizational characteristics should have been added or removed from the on-line survey, if any?

6. What are the strengths and weaknesses of the on-line survey?

7. Is the Illinois Manufacturers' Association (IMA) an appropriate population for the on-line survey?
   - ○ yes
   - ○ no

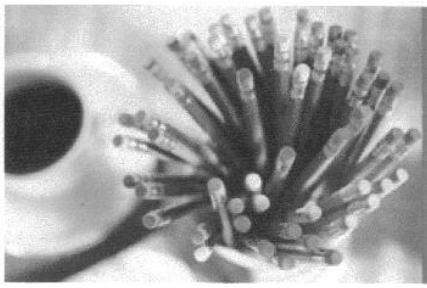
8. Is the on-line survey used for this study appropriate for the skill level of the intended computer users?
    - yes
    - no

9. Were the on-line survey questions understandable?
    - very understandable
    - understandable
    - moderately understandable
    - not very understandable
    - not at all understandable

10. To what extent will the data generated by this on-line survey provide usable results for the purpose of this study?
    - very usable
    - usable
    - moderately usable
    - not very usable
    - not at all usable

Appendix F

Initial Request: Cover Letter for Illinois Manufacturers' Association Survey



From the
Illinois Manufacturers' Association
for immediate release . . .

From IMA: From time to time the IMA is asked to help university studies that examine issues affecting manufacturing in Illinois. Whenever we receive such a request IMA staff reviews the details to assure the research is indeed part of a university study. Below is such a request. This PhD dissertation examines real and potential roadblocks to successfully implementing Lean Manufacturing principles. We send the request along to you.

Dear Illinois Manufacturers' Association Member,

I would like to encourage you to participate in a very important research study that examines issues associated with our endangered manufacturing sector. The purpose of this research is to investigate ways to protect our eroding share of Illinois manufacturing jobs. The following link will connect you to an on-line survey at Southern Illinois University Carbondale: http://tinyurl.com/http-IMAsurvey-com where you will take a brief survey regarding lean manufacturing.

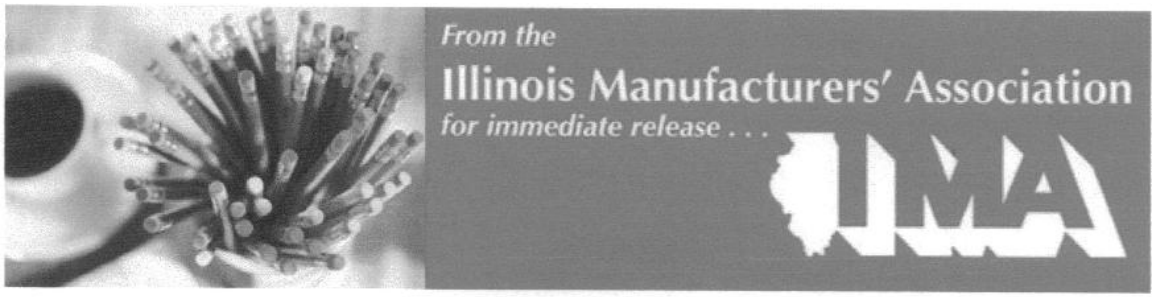
Your participation in this research is greatly appreciated.

John J. Cooper
Ph.D. Candidate
Southern Illinois University Carbondale

Illinois Manufacturers' Association
220 East Adams St.
Springfield, Illinois 62701
217-522-1240

Appendix G

Follow Up Request: Cover Letter for Illinois Manufacturers' Association Survey



From IMA: From time to time the IMA is asked to help university studies that examine issues affecting manufacturing in Illinois. This is a reminder from PhD Candidate Cooper. Mr. Cooper's dissertation examines real and potential roadblocks to successfully implementing Lean Manufacturing principles.

Dear Illinois Manufacturers' Association Member,

If you have not yet taken the IMA survey I would like to encourage you to participate now. **The survey which ends Friday, September 17** is your opportunity to actively contribute in research that seeks to protect our endangered manufacturing sector. The following link will connect you to an on-line survey at Southern Illinois University Carbondale: http://tinyurl.com/http-IMAsurvey-com where you will take a brief survey regarding lean manufacturing.

Your participation in this research is greatly appreciated.

John J. Cooper
Ph.D. Candidate
Southern Illinois University Carbondale

IMA

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VITA

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Master of Science in Education, Manufacturing Systems, May 2005

Dissertation Title:

How Significant Organizational Characteristics Affect the Implementation of a Lean Management Model

Major Professor: Elizabeth W. Freeburg, Professor and Chair
Department of Workforce Education and Development

Publications:

Cooper, J. (2009/Fall). The integration of a lean manufacturing competency-based training course into university curriculum. *Online Journal of Workforce Education and Development, IV*(1). Retrieved from http://opensiuc.lib.siu.edu/cgi/viewcontent.cgi?article=1031&context=ojwed

Cooper, J., & DeRuntz, B. (2007). Turning applications: The relationship between the workpiece extension length/diameter ratio and surface roughness. *Journal of Industrial Technology*, *23*(2) 52. Retrieved from http://atmae.org/jit/Articles/cooper031907.pdf