

DISSERTATION

RELATIONSHIPS BETWEEN ORGANIZATIONAL PERFORMANCE AND
CHANGE FACTORS AND MANUFACTURING FIRMS' LEANNESS

Submitted by

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In partial fulfillment of the requirements

For the Degree of Doctor of Philosophy

Colorado State University

Fort Collins, Colorado

Summer 2010

COLORADO STATE UNIVERSITY

May 27, 2010

WE HEREBY RECOMMEND THAT THE DISSERTATION PREPARED UNDER OUR SUPERVISION BY KYLE BRADLEY STONE ENTITLED THE RELATIONSHIPS BETWEEN ORGANIZATIONAL PERFORMANCE AND CHANGE FACTORS AND MANUFACTURING FIRMS' LEANNESS BE ACCEPTED AS FULFILLING IN PART REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY.

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ABSTRACT OF DISSERTATION

RELATIONSHIPS BETWEEN ORGANIZATIONAL PERFORMANCE AND CHANGE FACTORS AND MANUFACTURING FIRMS' LEANNESS

The purpose of this non-experimental research study was to examine relationships between organizational performance and change (OP&C) factors and the perceived leanness and objective performance measures within a medium-sized manufacturing organization engaged in lean transformation. Burke (2008) suggested successful transformational change is often predicated upon an organization's ability to understand dimensions influencing change interventions as outlined in the Burke-Litwin model of OP&C. To better understand why lean interventions succeed in some instances and not in others, it is important to study relationships between OP&C dimensions and their impact on the leanness an organization achieves.

To investigate relationships between lean and the OP&C model, two instruments were used to gather perceptions of leanness and an overall assessment of 14 variables from the OP&C model. The Lean Organization Self Assessment Manufacturing Survey (LOSAMS) was administered to leaders of nine different plants within the same organization to determine a leanness score. The Burke-Litwin Organizational Assessment Survey (OAS) was administered to employees in same nine manufacturing plants gathering perceptions related to 14 factors of OP&C.

While a number of statistical significant findings were found with small effect sizes among the LOSAMS and Burke-Litwin OAS variables, some statistical significant findings with much larger than typical effect sizes between LOSAMS scores and objective financial data were discovered. However, the reliability and validity of the LOSAMS is questionable rendering the implications of the findings weak.

Other practical implications for this research study are many. The conceptual development of a Lean Transformation Model promoted the use of sound organizational development, organizational change, and human resource development principles and practices that could benefit the well intentioned but ill-informed change agent. A systematic literature review explores four decades of scholarly lean literature in an effort to present a reliable history and shared language for future researchers. Reliability and validity of the Burke-Litwin OAS confirmed consistency but the LOSAMS revealed a promising but weak measure of leanness. Conclusions and a research agenda for future studies in lean transformations are offered in the final section.

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ACKNOWLEDGEMENTS

“If I have seen further it is only by standing on the shoulders of giants – Isaac Newton”

To my giants...

- My wife, for being steadfast while I pursued another adventure in our lives requiring sacrifice, patience, and perseverance.
- My parents, for being supportive and consistent in their message of life long learning.
- My professors, who offered insight and guidance to the many questions posed that challenged my paradigms.
- My committee, for suggestions, expertise, and time throughout the dissertation journey.

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CHAPTER 1: INTRODUCTION

Economic turmoil throughout the world in 2008 and 2009 has been reported as the worst since the 1973-75 recession (Meltzer, 2009) with many key indicators suggesting little relief in the near future (Phillips, 2009). One example of the recession is the increasing U.S. unemployment rate to almost 10% and job losses nearing 3.4 million since January 2009 through August 2009, the highest since 1982 (U.S. Department of Labor, 2009). A perfect storm involving the collapse of numerous key economic indicators (U.S. Department of Commerce, 2009) will leave economists searching for answers while others search for blame. Caught in the middle are organizations trying to respond rapidly to changing customer demand in the midst of overwhelming pressure from external environments. Burke and Litwin (1992) declared the catalyst for “organizational change....stems more from environmental impact than from any other factor” (p. 529). Current conditions of the world’s financial and economic turmoil are tantamount to the unfreezing aspect of Kurt Lewin’s notable three-step model of planned change and a shifting status quo (Kippenberger, 1998). Currently, many organizations are experiencing external forces overpowering internal resistance to change resulting in an opportunity for transformational interventions focused on performance improvement to create sustainable, healthy organizations.

An example of transformational change occurring over the last century is manufacturers’ operational strategies and methods of improving business performance (Womack, Jones, & Roos, 1990). One such strategy employed by early manufacturers

was mass production pioneered by Ford Motor Company, which encouraged making large quantities of products in batches relying on forecasts of customer demands and increased equipment efficiencies. As customers became more demanding and their expectations increased, anticipating customers needs became more difficult and manufactures started to realized the importance of producing the right products in optimal quantities while maintaining high quality and delivering on time (Hines, Holwe, & Rich, 2004; Hounshell, 1985). Adopting some attributes of mass production and integrating concepts of high quality from early craft production methods, Toyota Motor Company pioneered a new operational strategy in the mid 1950s and became known as *lean production* in the mid 1980s (Krafcik, 1988b; Liker, 2004; New, 2007; Womack & Jones, 1996b; Womack et al., 1990).

Over the past few decades, lean is increasingly being used in many industries outside of manufacturing as a process improvement method (Baines, Lightfoot, Williams, & Greenough, 2006; Esain, Williams, & Massey, 2008; Paez, Salem, Solomon, & Genaidy, 2005; Ziskovsky & Ziskovsky, 2007). Increased awareness of lean has resulted in a plethora of "how-to do lean" literature and a conundrum of lean definitions, with little emphasis beyond this transactional process and outcome focus. Ample anecdotal and empirical evidence of successful transformations from a mass production operational philosophy to a lean paradigm is readily available in academic literature, as well as in business and industry literature (Holweg, 2007; New, 2007). In light of these success stories, lean succeeds in some instances and not in others; yet, little is known or studied on *why* this range of successes occurs (Bateman, 2005; Hampson, 1999; Scherrer-Rathje, Boyle, & Deflorin, 2009; Seddon & Caulkin, 2007).

Statement of the Research Problem

Successful organizational change is often predicated upon an organization's ability to understand dimensions influencing change interventions as presented in the Lean Transformation Model shown in Figure 1. To better understand why lean interventions succeed in some instances and not in others, it is important to study the relationship between organizational performance and change (OP&C) dimensions and their impact on the leanness an organization achieves.

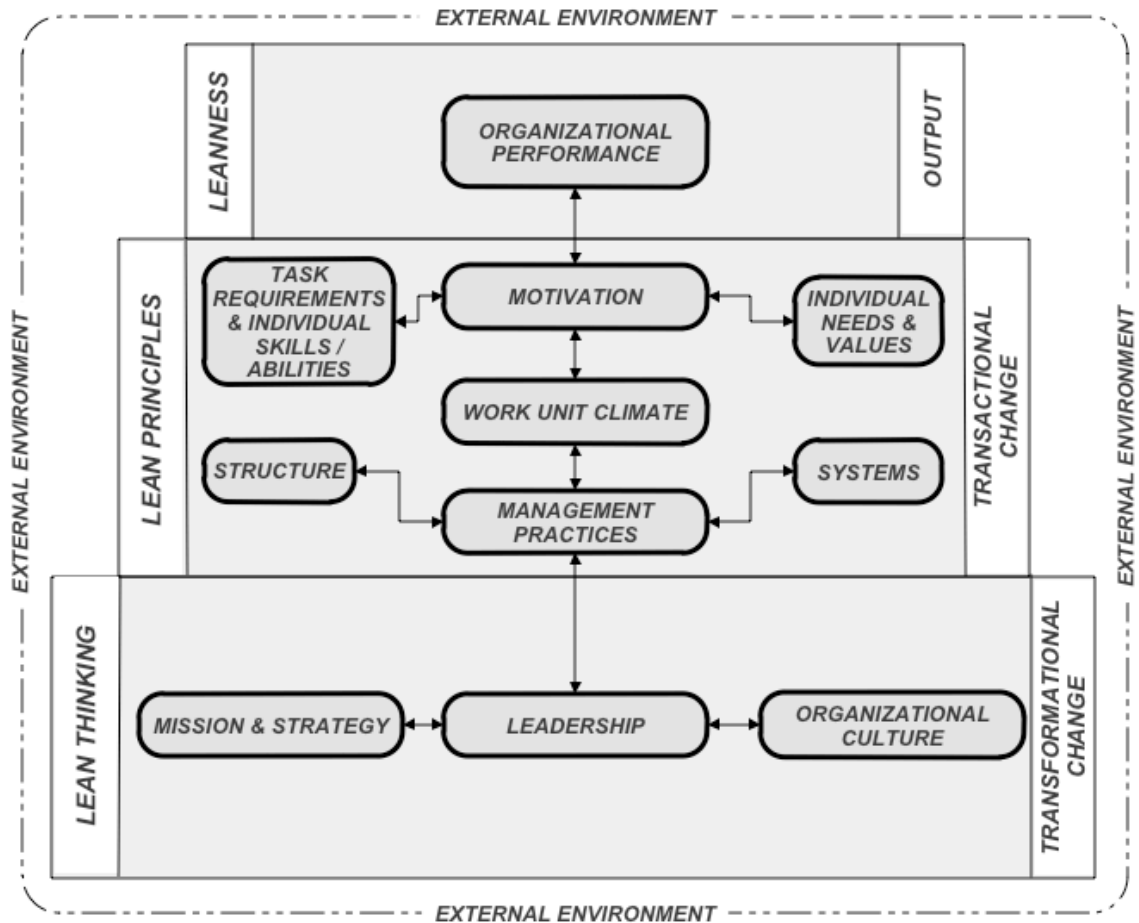


Figure 1. Lean transformation model.

Purpose of the Research

The purpose of this non-experimental research study was to examine relationships between OP&C factors and the perceived leanness and objective performance measures within a medium-sized manufacturing organization engaged in lean transformation. The Burke-Litwin model of Organizational Performance and Change (Burke & Litwin, 1992) will serve as the theoretical framework and delineate 12 attribute independent variables which are external environment, leadership, mission and strategy, organization culture, structure, management practices, systems, work unit climate, motivation, task requirements and individual skills, individual needs and values, and individual and organizational performance. Two additional variables will be determined from aggregated scores of the 12 Burke-Litwin OP&C model attributes and labeled transformational and transactional.

Perceived plant leanness and objective financial data were the dependent variables. Leanness was determined using the Lean Organizational Self Assessment Manufacturing Survey (LOSAMS) designed to elicit perceptions of leanness from leaders. Three financial performance indicators were gross margin variance, inventory turns variance, and warranty variance gathered for each of the plants participating in the study. The findings will contribute to applied lean research, interventions used during lean transformations, and increase our understanding of the relationship between OP&C factors associated with successful organizations.

Research Questions

1. What are the relationships between the 14 dimensions of the Burke-Litwin organizational performance and change model and the perceptual assessment of leanness?
2. What are the relationships between the 14 dimensions of the Burke-Litwin organizational performance and change model and objective financial outcome variables as defined by three measures of plants' performance (gross margin variance, inventory turn variance, and warranty variance)?

Significance of the Study

The majority of extant lean research literature presents case studies highlighting successful implementation and documentation of tools, techniques, and issues associated with human relations during lean transitions. What is not represented in this process focus of lean principles is *why* such interventions result in these related outcomes, suggesting a gap in the literature. To better understand why lean succeeds in some instances and not in others, it is necessary to study and determine factors of organizational change influencing successful outcomes, which ultimately result in improved performance for the organization.

Recognizing lean is one of many operational strategies employed to achieve improved performance, the methods of achieving successful transformation are the underlying foundation of managing change and performance through a systematic process approach and warrants research to assist organizations in their pursuit of success (Burke, 2008). Organizations relying on strategies based on hierarchical structures with inflexible workforces and rigid process may find they are being outperformed by more

agile organizations focused on value-added activities clearly articulated by the customer (Hummels & de Leede, 2000; Senge, 1990). Highly flexible or agile workforces responding rapidly to changing customer demands while maintaining high quality, low cost, and on-time delivery are the “DNA” of successful 21st century operations (Spear & Bowen, 1999, p. 106).

The Burke-Litwin model of Organizational Performance and Change (Burke & Litwin, 1992) is typically used to diagnose and establish baseline information surrounding the transformational and transactional aspects contributing to (or diminishing) successful change interventions. This research uses the Burke-Litwin model as the theoretical foundation for understanding factors associated with an organization engaged in lean transformations allowing the study of causal relationships between factors. The search of lean literature was unsuccessful in locating research employing the Burke-Litwin model, and for that matter, very little research was discovered with the purpose of employing *any* theoretical based models common to organizational change and development interventions (i.e., Weisbord’s Six Box Model, Nadler-Tushman Congruence Model, and Tichy’s TPC Framework). Seddon and Caulkin (2007) noted in an article investigating connections among systems thinking, lean production, and action learning that “it is something of a mystery as to why these disciplines [of systems thinking and action learning] have not been applied more widely” (p. 9). This lack of research employing reliable and validated organizational change models to lean transformations is the catalyst for research contributing to a more systematic approach to lean interventions.

Definitions of Terms

Just-In-Time: “A system for producing and delivery the right items at the right time in the right amounts” (Womack & Jones, 1996b, p. 307).

Kaizen: Japanese word for “continuous incremental improvement” (Womack & Jones, 1996b, p. 307).

Lean thinking: An operational philosophy characterized by the constant pursuit of identifying and eliminating non-value added (*waste*) activities and processes from the *value stream*. The ideal state is achieved when only value added activities and processes are present throughout the value stream.

Lean principles: Accepting *lean thinking* as the operational strategy requires a set of principles that guide activities commonly associated with organizations involved in transforming and sustaining lean. The five principles are value, value stream, flow, pull, and perfection and defined in Table 1.

Table 1

Lean Thinking Principles

Principle	Definition
Value	“A capability provided to a customer at the right time at an appropriate price, as defined in each case by the customer” (Womack & Jones, 1996b, p. 311)
Value Stream	“All the actions (both value added and non-value added) currently required to bring a product through the main flows essential to every product: (1) the production flow from raw material into the arms of the customer, and (2) the design flow from concept to launch” (Rother & Shook, 1999, p. 3)
Flow	“The progressive achievement of tasks along the value stream so that a product proceeds from design to launch, order to delivery, and raw materials into the hands of the customer with no stoppages, scrap, or backflows” (Womack & Jones, 1996b, p. 306)

Table 1 (cont.)	
Principle	Definition
Pull	“A system of cascading production and delivery instructions from downstream to upstream activities in which nothing is produced by the upstream supplier until the downstream customer signals a need” (Womack & Jones, 1996b, p. 309)
Perfection	“The complete eliminations of [waste] so that all activities along the value stream create value” (Womack & Jones, 1996b, p. 308)

Leanness: Used to describe the ‘state’ of the lean transformation by means of assessment.

In the case of this research, the Lean Organization Self-Assessment

Manufacturing Survey (LOSAMS) based on the Lean Enterprise Self-Assessment

Tool (Lean Advancement Initiative, 2001) will be used to determine *leanness*

based on a scale of less lean (1) through more lean (5).

Manufacturing Industry: For the purpose of this research is defined as a company that produces a product from raw materials either chemically, mechanically, or physically and found within the North American Industrial Classification (U.S. Census Bureau, 2009).

Waste: “Any human activity [or process] which absorbs resources but creates no value” (Womack & Jones, 1996b, p. 15). Table 2 defines the most common types of waste and provides examples from manufacturing and office environments.

Table 2

Definitions of Waste

Waste	Definition	Manufacturing Example	Office Example
Overproduction	Products produced prior to their requirements.	Running batches because of equipment utilization, trying to get ahead of schedule, batch assembly.	Using MRP to schedule production demand, early receipt of vendor parts, global e-mails, unclear communication.
Waiting	Any person delayed by an upstream process, materials, or skills in order to complete their task on time.	Parts shortage, watching machine operate, unclear prints or lack of work instruction, broken equipment, traditional supervision.	Computers slow to boot-up, phone on-hold, looking for files on computer, broken equipment.
Motion	Any movement that is a result of non-value added activities.	Walking to retrieve or stock parts, sharing one tool, walking 10 minutes to use restroom.	Distribution of reports, poorly coordinated meetings, excessive paging, incorrect routing of products or materials.
Transportation	Unnecessary movement of products.	Forklifts, conveyors, cart moving parts between buildings.	Logistics of parts from vendors, multiple movements of parts due to poor plant layout, departments disconnected by distance.

Table 2 (cont.)

Waste	Definition	Manufacturing Example	Office Example
Over processing	Excessive resources or material consumed	Oversized equipment, replacing a weld tip or wire spool, machining to an unnecessarily tight tolerance, shipping.	Order entry process takes 20 minutes instead of 5, steps to create a BOM, Steps to issue P.O.
Inventory	Any parts that consume resources	Racks, WIP, off-site storage, castings, steel.	Incorrect forecasting, MRP or Kanban quantities too high (safety stock), Customer orders wrong product, no obsolescence plan.
Defects	Products or processes that result in wasted time to use correctly.	Defective parts, rework of any kind, inspecting and testing for defects.	Incorrect data entry, poor listening skills, shipped product to wrong address.
People's Skills	"Underutilization of people is a result of not placing people where they can (and will) use their knowledge, skills, and abilities to their fullest" (Tapping, 2006, p. 184).	Inflexible workforce due to lack of cross-training; strict job classifications, lack of training and development opportunities for direct labor.	"Project deadlines not being met, workloads not evenly balanced due to lack of cross-training, high absenteeism" (Tapping, 2006, p. 184)

Delimitations

Mauch and Birch (1998) noted “a delimitation ... *is controlled* by the researcher” and may or will affect the study in an important way (p. 103). The following section notes the delimitations of this study with this citation in mind.

1. The literature review was bounded to the term 'lean' and essentially ignored closely associated terms often used synonymously for lean such as TQM, JIT, and Six Sigma. This issue is discussed in detail within the literature review introduction and does have an impact on the breadth of the study.
2. The non-experimental research design and nonprobability sampling methods employed by the researcher do not allow inference beyond the participants. The researcher acknowledges this and has ensured this delimitation is explicitly noted in the discussion section. Efforts to obtain a probability sample were reviewed and decided against due to self-imposed time constraints and access to the host organization.
3. The research is delimited to the manufacturing operations of the host organization that uses at least one type of mechanical assembly, electrical assembly, welding, machining, or industrial painting functions within their facilities. Support services of the manufacturing operations include materials, human resources, engineering, and inside sales. This delimitation is noted due to the number of different 'operations' within the host organization such as outside sales, service, and marketing. While many of these operations are engaged in lean transformations, the purpose of this research is focused on the manufacturing operations only.

4. The selection of a quantitative research strategy delimits the scope of the study to the relationships between variables and limits the illumination of many issues related to the problem statement as perceived by the participants. Employing qualitative or a mixed-method research design may increase the understanding of the problem by highlighting issues from different philosophical viewpoints.

Limitations

Mauch and Birch (1998) also noted “a limitation is a factor that may or will affect the study in an important way, but *is not under the control* of the researcher” (p. 103).

The following section notes the delimitations of this study with this citation in mind.

1. Some of the leadership participants in the LOSAMS may be responsible for operations other than manufacturing, such as marketing and sales, and could skew their perceptions. The researcher will attempt to clarify that responses should be for ‘manufacturing operations’ only but the potential for participants to comment regarding other operations exists.
2. The accessible population is all employees of the nine manufacturing plants within the host organization. However, using the intercompany email system to solicit participants and disseminate the online survey will limit the amount of direct (hourly) employees participating in the Burke-Litwin OAS. Characteristics of the participants reported in Chapter 4 reveal over 80% were indirect (salary) and less than 20% were direct. Therefore, the perceptions of the Burke-Litwin OAS do not represent a diversified sample of the employees at the manufacturing plants.

3. The use of surveys within the host organization to capture employee perceptions is not a normal activity thus the data collection method may encounter some resistance. Typically, organizational change surveys should be linked to a “change agenda” but without this explicit agenda from the host organization, there is potential for participants to question the purpose of the survey (Nadler, 1996, p. 179).

Researcher’s Perspective

Research within organizations is often viewed as the definitive challenge of applied researchers due in part by their highly complex and dynamic environment created when attempting to study people, information flow, power relationships, external influences, and numerous other factors (Swanson & Holton, 2005). Furthermore, organizational research crosses many different academic fields within the social sciences such as psychology, economics, and education all supported by varying theories (Swanson & Holton, 2001). This diversity of academic approaches has resulted in numerous perspectives to study dynamics within organizations.

The academic specialization of this research resides within a combination of human resource development (HRD), organizational development (OD), and organizational change (OC). As noted earlier in this section, the challenge of research within organizations is not limited to one academic field thus resulting in difficulty when attempting to articulate one’s perspective. Definitions selected from literature are offered for each specialization and contributed to the researcher’s perspective.

HRD can be defined as the process of facilitating organizational learning, performance, and change through organized interventions and initiatives and management actions for the purpose of enhancing an organization’s performance

capacity, capability, competitive readiness, and renewal (Gilley & Gilley, 2000, p. 6).

Organizational development is a systemwide application and transfer of behavioral science knowledge to the planned development, improvement, and reinforcement of the strategies, structures, and processes that lead to organizational effectiveness (Cumming & Worley, 2009, pp. 1-2)

[Organizational change is to]...turn the organization in another direction, to fundamentally modify the “way we do things,” to overhaul the structure – the design of the organization for decision making and accountability – and to provide organizational members with a whole new vision for the future (Burke, 2008, p. 11).

The perspective of this researcher is from the postpositivist paradigm employing systems theory as the problem-solving framework with a performance based paradigm of human resource development. Holton (2002) defined the performance paradigm of HRD as one which “holds that the purpose of HRD is to advance the mission of the performance system that sponsors the HRD efforts by improving the capabilities of individuals working in the system and improving the system in which they perform their work” (p. 201).

The final comment surrounding the researcher’s perspective is one of experience and influence on bias. Having spent over eighteen years in various positions ranging from field service engineering, shop floor supervision, materials, manufacturing engineering, plant design, and operations management within industries such as chemical, automotive, pulp and paper, healthcare, utilities, and heavy steel fabrication, a common focus remains the development and deployment of strategies capable of improving individual and system performance within organizations. My career has spanned nearly two decades as a change agent responsible for numerous lean transformations and participation in over 150 kaizen events and currently, I remain active

as an external consultant. Combining the atheoretical practitioner experience with empirical knowledge gathered through research and scholarship affords perspectives not available to others but also presents a challenge of informed bias. I have attempted to balance this bias with an extensive literature review informing the research problem and employing the use of instruments from credible external sources (i.e., Burke-Litwin and MIT)

CHAPTER 2: LITERATURE REVIEW

Defining Lean

When describing ideas and concepts the development of a shared language should be the first step in dissemination. Unfortunately, when communicating ideologies the tendency is to use loosely defined jargon often resulting in confusion for those outside the specific context. Developing a shared language can decrease ambiguity and contribute to increased learning by those less familiar with the specific ideology as described in Figure 2 (S.A. Lynham, personal communication, January 26, 2009).

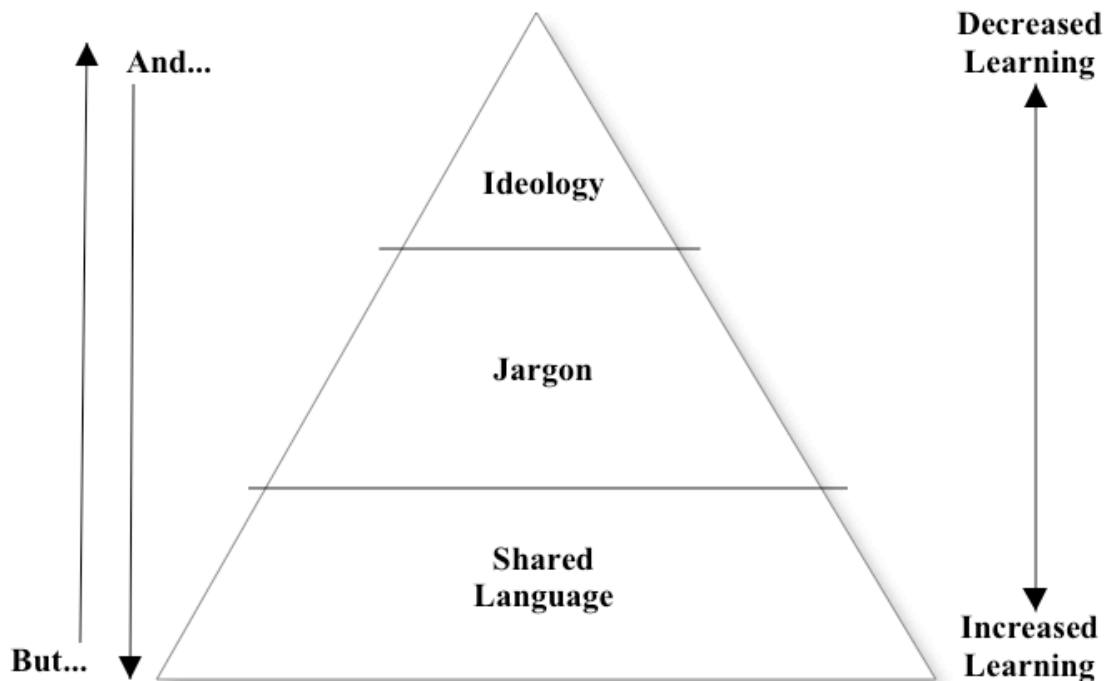


Figure 2. Developing shared language. Source unknown. Adapted from personal communication, Sue Lynham, January 26, 2009.

An example of ill-defined jargon is the term *lean*, which is probably connected for most people to an image of red meat with very little fat or an athlete's trim physique. When the statement 'being lean' within an organizational context is made, the initial thought is often associated to "doing more with less" (Hampson, 1999; Radnor, 2004; Ziskovsky & Ziskovsky, 2007). Merriam-Webster (Lean, 2009) defined lean as "lacking or deficient in flesh; containing little or no fat; lacking richness, sufficiency, or productiveness; deficient in an essential or important quality or ingredient." With this diversity of definitions and visual imagery of *lean*, it is not surprising the term has been diluted and difficult to define when used in the context of process improvement methodologies such as lean thinking, lean principles, and leanness of organizations.

To complicate matters more the term 'lean production' has become somewhat convoluted since initially described by Womack et al. (1990) in *The Machine that Changed the World* which summarized the results of a five year research initiative hosted by Massachusetts Institute of Technology (MIT) called the International Motor Vehicle Program (IMVP) started in 1985. The term 'lean production' was defined in 1990 to describe manufacturing techniques developed over the past 100 years by Toyota Motor Company (Baines et al., 2006; Emiliani, 2006; Holweg, 2007). Internal to Toyota, the same principles and philosophies are known as the Toyota Production System (TPS) and recently re-articulated in an internal Toyota document called "The Toyota Way" (Lander & Liker, 2007; Liker, 2004).

Confusion surrounding exactly *what* lean means has resulted in numerous implementation approaches often starting and ending with misguided efforts initiated by "companies that use only the toolbox without embracing the underlying philosophy [and]

are unlikely to gain more than limited and temporary results” (Seddon & Caulkin, 2007, p. 14). Hallam (2003) noted “...the same term has been used to refer to four aspects of the manufacturing firm, namely the operating philosophy, the tools, the activities, and the state of the manufacturer” (p. 32). Other terms commonly associated with lean are: Just-in-Time (JIT); Continuous Improvement (CI); Total Quality Management (TQM); World Class Manufacturing; Theory of Constraints (TOC); and Six Sigma, to name a few, each process improvement ‘trends’ heavily influenced by lean (Bendell, 2006; Cua, McKone, & Schroeder, 2001; Dahlgaard & Dahlgaard-Park, 2006). Hallam (2003) suggested “...the proper delineation of the terminology should actually contain three terms, one to describe the end state, one to describe the process that achieves the end state, and one to describe the tools used to execute the process” (p. 32). Throughout this paper, the term *lean thinking* will refer to ‘operational philosophy’ of the organization, *lean principles* are associated with the ‘tools used to execute’ lean thinking strategies, and *leanness* to describe the ‘state’ of the organization’s transformation when employing lean thinking and implementing lean principles.

Simply stated, the lean thinking paradigm differentiates between *waste* and *value* within an organization. Womack and Jones (1996b) defined *waste* “as any human activity which absorbs resources but creates no *value*.” (p.15). *Value* is defined as “a capability provided to a customer at the right time at an appropriate price, as defined in each case by the customer” (p. 311). Lean thinking in action is the continuous identification and elimination of waste from an organization’s processes, leaving only value added activities in the value stream (Rother & Shook, 1999). In summary, the act of identifying and eliminating waste are the hallmarks of the lean thinking paradigm.

Four Decades of Lean Literature

The methodology applied to this section was a systematic review of literature as described in Machi and McEvoy (2009). Table 3 presents criteria used during the initial search process. Search terms restricted to the ‘title’ and/or ‘abstract’ were: lean manufacturing, lean production, lean thinking, lean and review, lean and Toyota Production System, lean assessment, lean culture, lean transformation. The databases accessed through EBSCO were: Academic Source Premier, Business Source Premier, ERIC, and PsycINFO.

Table 3

Literature Review Search Criteria

Must Have	Metric
Citations	> 3
Peer Review	Yes, dissertations and theses allowed
Scope	History / Origins / Examples / Assessment
Methodology	Qualitative: Case Study Quantitative: Empirical
Industry	Manufacturing / Production <i>Not:</i> Accounting, Product Development, Services, Healthcare
Page Length	> 4
Year Range	January 1990 – December 2009

The initial search of literature resulted in 234 articles meeting the minimum search criteria after adjustment for duplicates. The first round of article scanning resulted in 169 articles more clearly meeting the criteria and relevant to the problem statement. As a result of the scanning process, an additional 83 articles were added to the EndNote X2 library. Many of these articles were located through the use of databases not

available to the author initially and were heavily referenced as relevant in lean research literature. Additional literature outside of the original date range was included in this review due to their influential role in the early research and definition of lean practices (Krafcik, 1988a; Upadhyhy, 1992). Three additional sources for articles were the Massachusetts of Technology (MIT) 'DSpace' library, Lean Advancement Initiative (LAI) hosted through MIT, and the Lean Enterprise Research Center (LERC) hosted by Cardiff University. Continuing to follow the process promoted in Machi and McEvoy (2009), the second round of the literature review process consisted of skimming each abstract and article identified during the first round of the scan resulting in 193 articles and books being chosen for the final review of literature.

As shown in Table 4, the past four decades of lean research literature has evolved from the initial discovery of “Japanese management” techniques (Drucker, 1971, p. 110) to the current interest in determining performance outcomes (Bayou & de Korvin, 2008) and their impact on lean transformations. Since introducing the term “lean” (Krafcik, 1988b) and “lean production” (Womack et al., 1990), the majority of research literature stems from operations management and industrial engineering disciplines with few from social sciences or applied psychology (see Appendix A for a complete list of journals).

Table 4

Four Decades of Scholarly Lean Literature

Years	1970 – 1990	1991 – 1996	1997 – 2000	2001 – 2005	2006 – 2009
Phase	Discovery	Dissemination	Implementation	Enterprise	Performance
Primary activities	1973 Oil Crisis spurs interest in Japanese methods. Results of MIT's IMVP published.	Lean principles deployed within US manufacturing known as TQM, JIT, etc.	Lean Thinking elevated to strategic implementation.	Value Stream methods expand use beyond manufacturing to service sectors.	Measuring leanness, Toyota Way articulates human resource and culture development aspects.
Number of scholarly 'Lean' publications	11	31	28	56	67
Literature examples	(Drucker, 1971; Krafcik, 1988a, 1988b; Schonberger, 1986; Shingo & Dillon, 1989; Sugimori, Kusunoki, Cho, & Uchikawa, 1977; Womack et al., 1990)	(Berkley, 1992; Green, 1994; Shadur, Rodwell, & Bamber, 1995; Upadhyhy, 1992; Warnecke & Huser, 1995; Womack & Jones, 1994, 1996b)	(Cappelli & Rogovsky, 1998; Kippenberger, 1997; MacDuffie & Helper, 1997; Spear & Bowen, 1999; Yingling, Detty, & Sottile, 2000)	(Doolen & Hacker, 2005; Emiliani & Stec, 2005; Fairris & Tohyama, 2002; Gough & Fastenau, 2004; Hines et al., 2004; Liker, 2004; Nightingale & Mize, 2002; Paez et al., 2005; Sawhney & Chason, 2005)	(Baines et al., 2006; Bayou & de Korvin, 2008; Conti, Angelis, Cooper, Faragher, & Gill, 2006; Emiliani, 2006; Graff, 2007; Liker & Morgan, 2006; Mehri, 2006; Saurin & Ferreira, 2009; Takeuchi, Osono, & Shimizu, 2008; Wan & Chen, 2008)

Note: Books included were either seminal works or considered instrumental in scholarly literature.

Discovery phase: 1970 – 1990.

Drucker (1971) noted many “Japanese management” practices such as: decisions by consensus, action orientated problem solving, workforce generalization and flexibility, and a focus on constant change and process improvement. He compared and contrasted differences between Western and Japanese management practices common to the lean thinking paradigm and described later in the Toyota Way (Liker, 2004). Although not explicitly stated, Drucker’s (1971) article is one of the earliest documenting the Japanese influence on what later became known as lean (New, 2007). Another influential article contributing to the discovery of lean in the United States is Sugimori et al. (1977), the first English article describing the Toyota Production System (TPS) and its sub-component called Kanban, a system of ‘just-in-time’ production control. John Krafcik, a member of the Massachusetts Institute of Technology’s (MIT) International Motor Vehicle Program, published his masters thesis (Krafcik, 1988a) and an article in *Sloan Management Review* (Krafcik, 1988b) being the first to use the term ‘lean’ in scholarly literature.

A number of books published during this discovery phase typically described the concepts around the TPS. Shingo and Bodek (1988) and Shingo and Dillon (1989) captured the working principles directly from Toyota while Womack et al.’s (1990) book titled *The Machine that Changed the World* summarized the results of a five year research initiative hosted by MIT’s International Motor Vehicle Program (IMVP) started in 1985. The IMVP was the continuation of MIT research focused on differences between automotive manufacturing around the world after the oil crisis in the mid-1970s. Holweg (2007) stated the IMVP “research remit was to not only describe the gap between

the Western World and Japan, but also to measure the size of the gap” (p. 425). The term ‘lean production’ first coined by Womack et al. (1990) was used to describe manufacturing techniques developed by the founders of Toyota Motor Company originating in the late 1800s (Baines et al., 2006; Emiliani, 2006; Holweg, 2007).

Dissemination phase: 1991 – 1996.

After the publication of Womack et al. (1990), and the addition from other Japanese seminal works describing TPS (Monden, 1983; Ohno, 1988; Shingo & Dillon, 1989), discovery themes continued with a notable increase of articles associated with dissemination of the concepts from the TPS. Scholars began deciphering techniques described in Sugimori et al. (1977) and Womack et al. (1990) such as Kanban, JIT, and quality circles. The predominate industry adopting lean principles was automotive and its suppliers contributing to literature associated with labor relations specifically targeting threats to rigid unionized organizations by more flexible non-unionized Japanese manufacturers (Babson, 1993; Camuffo & Volpato, 1995; MacDuffie, 1994; Schonberger, 1994; Shadur et al., 1995; Taira, 1996; Yanarella & Green, 1994). Interestingly, the few scholarly articles found during this literature review from Dr. James Womack, one of the seminal researchers of lean, is a rebuttal to Taira’s (1996) article describing the transition from mass production to lean production as “controversial and traumatic” (p. 97). In his response, Womack (1996) restated the objectives of lean production and stressed the importance of continued research to better understand the psychology underlying worker satisfaction and motivation. In addition to Womack’s (1996) rebuttal, others contributed to the debate stirred by Taira (1996) as well (Antoni, 1996; Wakabayashi, 1996)

The dissemination of lean concepts and the transition from ideology to jargon was starting to become apparent in the literature language. Some referred to lean as the MIT Model (Babson, 1993) while others used World Class Manufacturing (Oliver, Delbridge, Jones, & Lowe, 1994) and Total Quality Management (TQM) along with Agile Manufacturing and Just-in-Time (JIT) synonymously with lean (Boyer, 1996; Kidd, 1994; Rago, 1996). Articles began to state ‘lean production’ as ‘lean management’ (Warnecke & Huser, 1995) and noted benefits of applying lean principles to ‘lean product development’ (Kosonen & Buhanist, 1995). Internationally, lean was being noted within scholarly literature and contributed much to the dissemination of concepts outlined in seminal works of the 1980s and early 1990s (Forza, 1996; Karlsson & Ahlstrom, 1996; Katayama & Bennett, 1996; Niepce & Molleman, 1996; Oliver, Delbridge, & Lowe, 1996; Sohal, 1996).

The dissemination phase of lean was quickly followed by an intense implementation phase spurred by the early successes of lean transformation within notable organizations. Another influential book published by Womack and Jones (1996b) highlighted a few of these transformations such as: Lantech, Wiremold, Pratt and Whitney, and Porsche. *Lean Thinking* (Womack & Jones, 1996b) articulated the tenets of lean, provided examples from industry, and suggested lean principles as the framework for organizations interested in transforming from traditional mass production techniques.

Implementation phase: 1997 – 2000.

Womack and Jones (1996a) captured the challenges echoed in lean literature from the 1990s stating “managers are struggling to combine lean techniques into a coherent system” (p. 140). *Lean Thinking* (Womack & Jones, 1996b) was noted in many articles

spanning the late 1990s as influential and helping organizations understand the strategic approach of planned change throughout the organization and enterprise (Detty & Yingling, 2000; Hines & Taylor, 2000; Kippenberger, 1997; Lewis, 2000; Storch & Lim, 1999; Yingling et al., 2000). In addition to implementation of lean, numerous articles continued to explore resistive forces and critiques of implementation, primarily regarding labor relations of organized workforces and worker stress created by the ambiguity of less structured job design typical of lean environments (Cappelli & Rogovsky, 1998; Conti & Gill, 1998; Hummels & de Leede, 2000; Kochan & Lansbury, 1997; Landsbergis, Cahill, & Schnall, 1999; Mersha & Merrick, 1997; Niepce & Molleman, 1998; P. Stewart, 1998; Storey & Harrison, 1999).

During this phase, empirical studies started to emerge from the literature employing quantitative and qualitative research methods contributing to the much needed knowledge base of lean thinking (Bamber & Dale, 2000; Brown, 1998; Hines, 1998; Lewis, 2000; Perez & Sanchez, 2000). While most of the extant literature from this decade (1990 – 2000) remained conceptual and descriptive of lean thinking and lean principles, the amount of empirical research specific to lean was still minimal. Niepce and Molleman (1998) and Hummels and de Leede (2000) contributed to theory building by connecting aspects of lean to well-known organizational theory, such as sociotechnical systems.

Enterprise phase: 2001 – 2005.

At the dawn of the 21st century, lean literature continued to be of interest within scholarly research primarily from operations management and engineering disciplines with a small contingent emerging from other disciplines such as economics and human

resource development (see Appendix A for a complete distribution of journal articles). Womack and Jones (1996b) inspired many organizations to expand lean interventions from shop floor activities to the boardroom and beyond, including the enterprise. Rother and Shook (1999) published *Learning to see: Value stream mapping to create value and eliminate muda* providing a roadmap for organizations to connect their enterprise in a manner similar to Rummler and Brache's (1995) successful relationship mapping methodology. The focus during the late 1990s and early 2000s was shifting from implementing lean exclusively on the manufacturing shop floor (Carnes & Hedin, 2005; May, 2005; Paez et al., 2005) to other areas of the enterprise such as: product development, marketing, sales, service, accounting, and other white collar jobs (Brandenburg & Ellinger, 2003; Comm & Mathaisel, 2005; Crute, Ward, Brown, & Graves, 2003; E. Holton, 2003; Holweg & Pil, 2001; Hyer & Weemerlov, 2002; Mann, 2002; Salaheldin, 2003; Scaffede, 2002; Seitz, 2003).

One of the few examples of a literature review specific to lean can be found in Hines et al. (2004) addressing origins and phases of lean in a somewhat systematic manner based on books with few mentions of peer-reviewed journal articles. Critiques and issues of lean continued to emerge as a testament to the veracity of the implementation of lean thinking within industry (Bruno & Jordan, 2002; Parker, 2003; Seppala & Klemola, 2004; Yong-Sook, 2003). An article by Spithoven (2001) even suggested lean production in Dutch organizations has contributed to an increase in "mental disorders" caused by worker stress (p. 725). Articles published on topics closely related to human resource development (HRD) began to surface as well highlighting the importance in organizational change and performance transformations (Brandenburg &

Ellinger, 2003; Genaidy & Karwowski, 2003; Harter, Asplund, & Fleming, 2004; E. Holton, 2003; LaScola et al., 2002; Sawhney & Chason, 2005).

An increase of articles across disciplines and healthy debates are good indicators of the development and advancement of successful ideologies. Through the enterprise phase, the diversity and depth of research demonstrated a growing interest as opposed to a weakening discussion. Nightingale and Mize's (2002) research centered around determining measures of leanness along with Doolen and Hacker (2005); Hallam (2003); Paxton (2004); Pavnaskar, Gershenson, and Jambekar (2003); and Seitz (2003). Research focused on the assessment of lean transformations helped to established the agenda for the next phase of research in lean performance outcomes.

Performance phase: 2006 – 2009.

The decision to split the fourth decade into two phases was primarily influenced by an increase in the quantity of published lean articles in 2006 which numbered 26 journal articles. Prior years, the most published was 2004 with 15 articles, 2003 with 14 articles and 1996 with 13 articles (Table 5).

Table 5

Lean Journal Articles Published Over Three Decades

Year	Quantity	Year	Quantity	Year	Quantity
2009	3	1999	7	1989	0
2008	19	1998	7	1988	2
2007	16	1997	6	1987	0
2006	26	1996	13	1986	0
2005	12	1995	6	1985	1
2004	15	1994	6	1984	0
2003	14	1993	2	1983	0
2002	8	1992	2	1982	0
2001	5	1991	0	1981	0
2000	5	1990	0	1980	0
Total	123	Total	49	Total	3

Note: 2009 data includes articles through May.

The increase in literature during 2006 is likely attributed to the rise of Toyota Motor Company as the leading automotive manufacturer in the world displacing General Motors (New, 2007; Takeuchi et al., 2008; Towill, 2006). A number of Toyota executives and consultants intimately familiar with their organizational structure published numerous books allowing unprecedented exposure to the inner-workings and insights into Toyota's management practices, human resource development, and the production system known as TPS (Liker, 2004, 2007; Liker & Hoseus, 2008; Osono, 2008; Shimokawa & Fujimoto, 2009). Journal articles supplemented the books allowing further exploration of research within lean organizations all trying to capture and

duplicate the success demonstrated by Toyota (Bendell, 2006; Black, 2007; Bonavia & Marin, 2006; Dahlgard & Dahlgard-Park, 2006; Jang, Rim, & Park, 2006; Lander & Liker, 2007; Liker & Morgan, 2006; Ndahi, 2006; Roth, 2006; Sakai & Amasaka, 2006; T. Stewart & Raman, 2007).

Developing performance outputs of lean transformations dominated the literature attempting to increase the credibility of traditional measures of lean performance typically expressed in forms associated with quality, cost, delivery, and safety (Bayou & de Korvin, 2008; Cumbo, Kline, & Bumgardner, 2006; Doolen, Traxler, & McBride, 2006; Kennedy & Widener, 2008; Meade, Kumar, & Houshyar, 2006; Shah & Ward, 2007; Shan, 2008; Taj, 2008; Wan & Chen, 2008). MIT's research continued to establish a foundation in the area of measuring 'leanness' of organizations by using their Lean Enterprise Self-Assessment Tool (LESAT) (Lean Advancement Initiative, 2001). Utah State University offers a managed-assessment system called the Shingo Prize for Operational Excellence to measure lean performance (Utah State University, 2009).

Literature reviews of lean have become common to most current articles published with a general consensus regarding the contributions from many within Toyota, Henry Ford, and the influence of W. Edwards Deming in the early stages of TPS development. Baines et al. (2006), Emiliani (2006), and Holweg (2007) offer historical perspectives of lean further developing the depth of knowledge supporting the lean paradigm. Shimokawa and Fujimoto (2009) provide transcripts of interviews with key contributors to the development of the Toyota Production System continuing to bring clarity to the genealogy and historical context in the *Birth of Lean*. Critiques of lean continue with more studies based on sound research practices (Conti et al., 2006;

Schonberger, 2007; Treville & Antonakis, 2006; Vidal, 2007) and less on personal opinion (Mehri, 2006). Human resource and organizational development research continues the connection between existing theory and lean thinking (Balle, Beauvallet, Smalley, & Sobek, 2006; Graff, 2007; Roth, 2006; Worley & Doolen, 2006) with Seddon and Caulkin's (2007) article establishing logical links to systems thinking and action research methods.

Core Knowledge From Lean Literature

From the early mention of 'Japanese management' practices (Drucker, 1971) to the discovery and dissemination of the Toyota Production System (TPS) into the lean paradigm (Womack et al., 1990), it became clear the mass production methods proven successful since the early 1900s were being outperformed by the more modern and flexible aspects of lean production. While lean is not void of issues and controversy, the benefits appear to outweigh the investment required to transform from traditional mass production operational methods to a lean thinking paradigm. The literature reviewed revealed the following 'knowledge' about lean:

- Lean thinking has evolved from the manufacturing environment to be applicable throughout an organization and in industries outside manufacturing.
- The term 'lean' and its association with 'Japanese management' techniques has caused confusion and difficulty when addressing the topic outside of the manufacturing context.
- Interest in research and implementation of lean continues to increase and is heavily influenced by Toyota Motor Company.

- Employing lean principles have dominated the “how-to-do” lean literature.
- The majority of research has historically been from engineering and operations management disciplines with a recent increase of interest from disciplines associated with human resource and organizational development.
- Lean transformations appear to be more successful when strategically aligned throughout the enterprise.

Knowledge Voids Within Lean Literature

The most apparent void within the body of knowledge eschewing from lean literature was the lack of theoretical connections often associated with planned organizational change and HRD interventions. Seddon and Caulkin (2007) noted the importance of systems thinking and its applicability to lean, while certain studies connected the sociotechnical aspects (Hummels & de Leede, 2000), human performance (Genaidy & Karwowski, 2003), and motivating job characteristics (Treville & Antonakis, 2006) to lean transformations. While these articles, along with a few others, opened dialog around aspects important to lean transformations, a majority of the nearly 200 articles reviewed centered on “how-to-do” lean principles and critiques of the consequences.

Another void surrounds the aspects of planned organizational change absent from lean literature and well articulated in Kippenberger’s (1998) article which highlighted the legacy of Kurt Lewin’s research. Kippenberger reiterated the foundation of change and the ideology around shifting the ‘status quo’ through force field organizational diagnostics. In addition, Burke (2008) unpacked many concepts around different types of organizational change such as: revolutionary versus evolutionary, discontinuous versus

continuous, episodic versus continuous flow, transformational versus transactional, strategic versus operational, and total system versus local option (p. 21). Burke stated “95% of organizational changes are evolutionary...consist[ing] of improvements, incremental steps to fix a problem or change a part of the larger system. Most organizational change in Japan, for example, is referred to as *kaizen*, meaning continual improvement” (p. 69). This acknowledgement by Burke of one of the many lean principles (*kaizen*) associated with a type of organizational change (evolutionary) is one possible connection between theory and the lean thinking paradigm that could be further explored in lean research.

The final void within lean literature was the ‘human’ factor, a common theme amid some articles. However, most were critiques associated with human resource management or labor relation issues. Using Swanson and Holton’s (2001) definition of HRD, “a process for developing and unleashing human expertise through organization development and personnel training and development for the purpose of improved performance” (p. 4), revealed scant research within lean literature. Brandenburg and Ellinger (2003) offered suggestions for improving the ‘just-in-time’ nature of HRD interventions while Holton (2003) challenged the HRD profession and its processes to become more cognizant of cycle time, a common theme echoed in lean thinking. Nevertheless, much of the connections between HRD and lean remain outside scholarly literature suggesting an opportunity for additional collaboration between practitioners and scholars (Harris & Harris, 2007; Liker, 2007; Liker & Hoseus, 2008; Mann, 2005).

Contribution to HRD/OPC Knowledge and Literature

Organizational performance and change along with human resource development are applied disciplines relying on practical theory to diagnose, develop, implement, and evaluate process and performance improvement often encountered during organization and human resource development interventions. As noted in this literature review, lean has been practiced for over four decades however it appears to be founded on “incomplete espoused theories” (Lynham, 2000, p. 159) and could benefit greatly from theory building: “the ongoing process of producing, confirming, applying and adapting theory” (Lynham, 2002, p. 222).

To apply theory, it must first be developed. Lynham (2002) presented the general method of theory-building research in applied disciplines model (Figure 3) as a guide for researchers and practitioners to blend their knowledge, expertise, and experience toward outcomes conducive to sound practices built on solid theoretical foundations. The first phase of theory building is conceptual development providing an “initial understanding and explanation of the ... issue, problem, or phenomenon” (p. 231). Typical outputs of this phase are conceptual models informed by current understandings and explanations based on literature reviews and research testing the proposed theories.

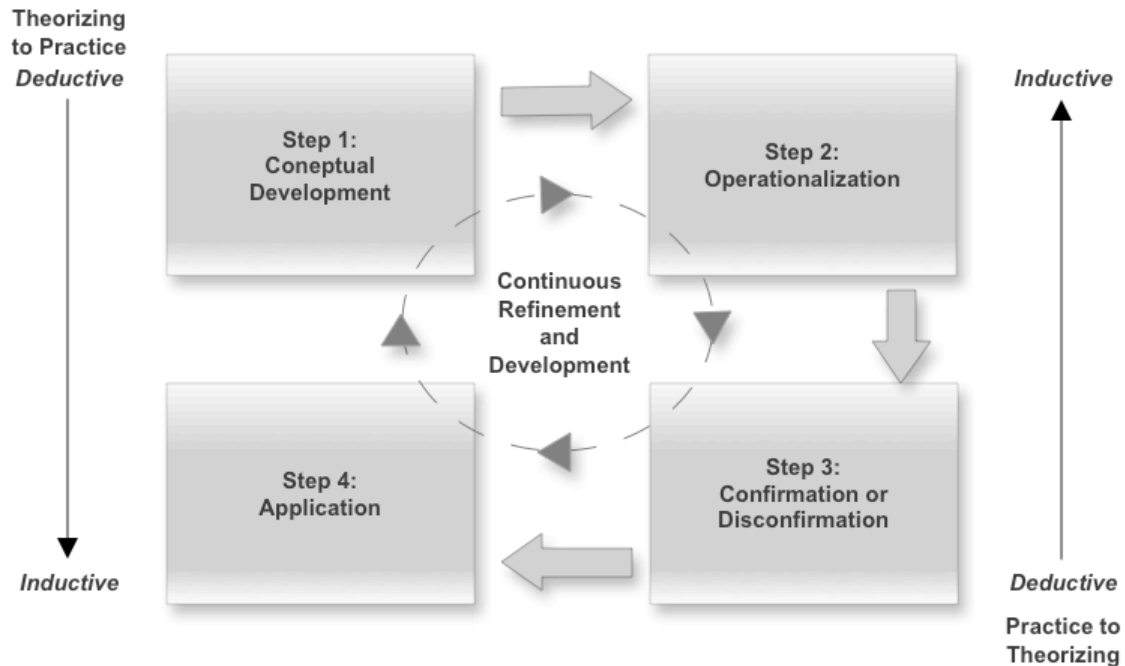


Figure 3. The general method of theory-building research in applied disciplines (Lynham, 2002).

The review of four decades of lean literature was to inform and substantiate the creation of a conceptual lean transformation model (see Figure 1) in order to study *why* lean succeeds in some instances and not in others. This literature review has synthesized and categorized scholarly literature along with influential books from credible researchers and practitioners of lean in an effort to decipher the lean thinking paradigm from jargon to a commonly shared language. In doing so, definitions of lean thinking, lean principles, and leanness were articulated along with phases of lean from the 1970s to current literature of early 2009. Knowledge from lean literature was identified along with the most obvious voids between theoretical foundations of organizational change and human resource development that could prove to benefit lean transformations. All of these aspects of discovery, definition, and synthesis of lean will contribute to the knowledge

base reinforcing the creation and dissemination of practical theory for use by change agents and HRD professionals engaged in lean transformations.

Conceptual Framework Development

The foundational theory of my conceptual framework is based on Burke and Litwin's (1992) causal model of Organizational Performance and Change (see Figure 4). Burke and Litwin hypothesize that organizations engaged in planned change and performance improvement interventions need to recognize transformational change predicates transactional change and often, organizations mired in details overlook the importance leadership, mission and strategy, and culture have on successful outcomes. Burke (2008) purported the predictive relationships between OP&C factors common to organizations engaged in change and offered a process, "how to bring about change..." in addition to content, "what needs to change...", approach lacking in other organizational change models (p. 165). This concept of transformational and transactional activities during change initiatives seems appropriate for lean transformations as well.

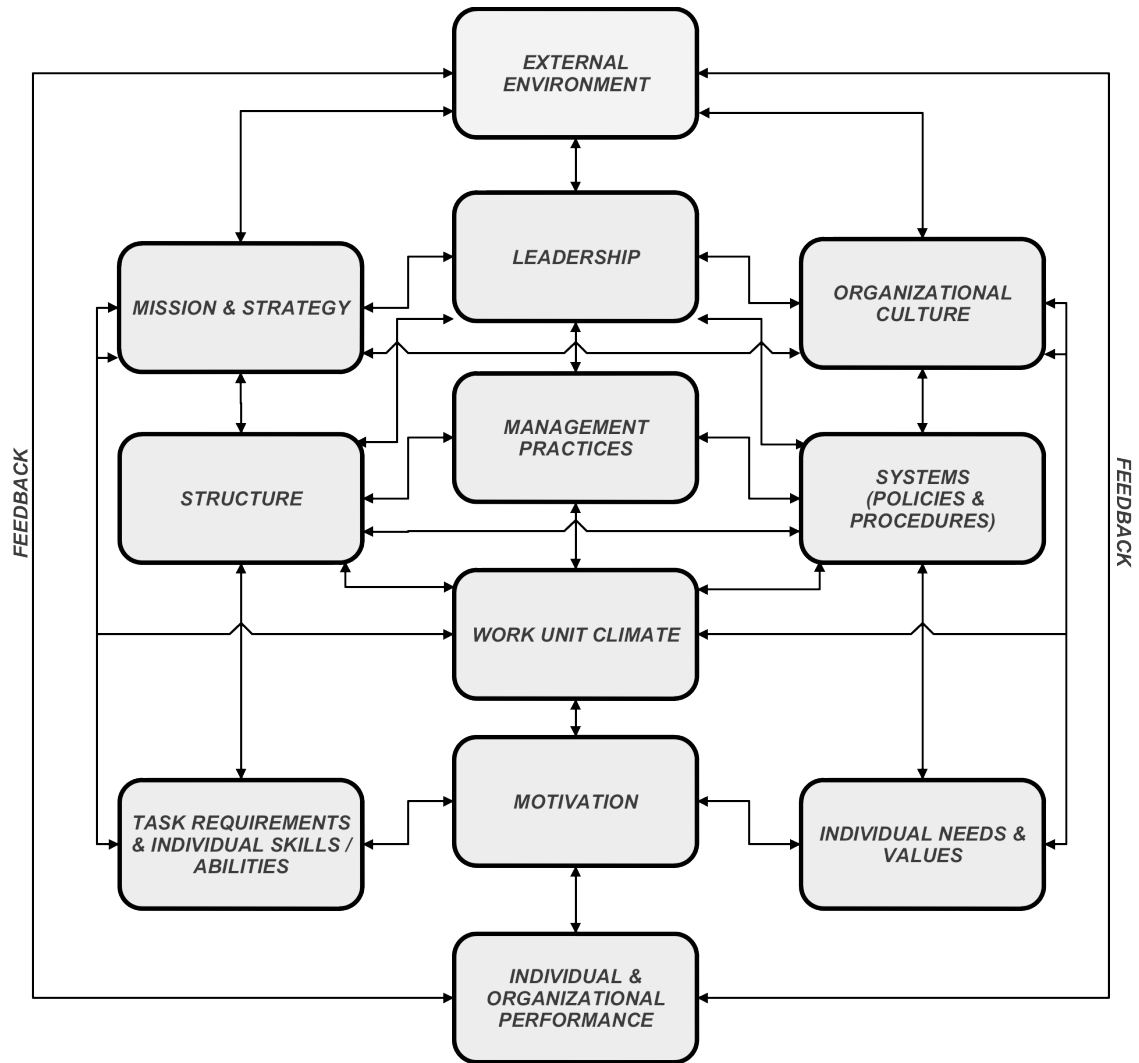


Figure 4. Burke-Litwin organizational performance & change model (Burke & Litwin, 1992, p. 528)

The transformational and transactional dimensions of the Burke-Litwin model were adopted from Zaleznik's (1977) and Burns' (1978) research on transformational and transactional leadership styles. Burke (1986) aligned these two styles within the OP&C model hypothesizing "that each leader (transformational) or manager (transactional) could empower others effectively, but the behaviors would differ when one was acting as leader and when as manager" (Burke, 2008, p. 190). Drawing on this, Burke concluded

“transformational change is more closely linked with leadership and transactional change is more closely associated with management” (p.190). Within the Burke-Litwin OP&C model the transformational factors are: external environment, leadership, mission and strategy, organizational culture, and individual and organizational performance. The transactional factors are: management practices, structure, systems, work unit climate, motivation, tasks and skills, and individual needs and values. A definition of each variable follows (Burke, 2008; Burke & Litwin, 1992; W. Warner Burke Associates, n.d., p. 3):

- External Environment: Outside conditions or situations that influence performance of an organization (e.g., government policy, competition, customers).
- Mission and Strategy: Overall purpose of an organization, what it wants to achieve. Strategy is the means by which the organization intends to achieve the mission.
- Leadership: Most senior level executives in an organization.
- Culture: ‘Way things are done around here’; includes values, beliefs, and norms that drive people's actions.
- Individual and Organizational Performance: Outcomes, results, and indicators of individual and organizational achievement.
- Structure: How an organization is designed (levels, roles, responsibilities, etc.) to achieve its mission.
- Management Practices: Behavior that managers exhibit in the normal course of events on a daily basis.

- Systems: Standardized policies, procedures, rewards, and information systems that facilitate and reinforce people's work.
- Work Group Climate: Collective impressions, expectations, and feelings members of work groups have that affect their relationships with each other.
- Task Requirements and Individual Skills / Abilities: Specific skills and abilities that people need to do their work and how well these skills match the requirements of their jobs.
- Motivation: People's desire to achieve both their own work goals and the goals of the organization.
- Individual Needs and Values: What people believe to be important, good versus bad, and what should guide daily behavior in the organization.

Another important aspect contributing to my conceptual framework is the integration of lean terminology and alignment with factors of the Burke-Litwin model to advance a conceptual model of lean transformation. Hallam's (2003) dissertation provided the inspiration for further clarification of lean terms as he surmised:

Since first being coined, the term "lean" has been promulgated more loosely by consultants, academia, and industry to refer to manufacturing businesses that utilize an underlying set of manufacturing principles and practices that are assumed to lead to a leaner state. In effect, the same term has been used to refer to four aspects of the manufacturing firm, namely the operating philosophy, the tools, the activities, and the state of the manufacturer. (p. 32)

Drawing from Hallam's (2003) definitions, three lean terms are used to align the Burke-Litwin model with key concepts of lean transformations. The first term *lean thinking* refers to 'operational philosophy' of the organization. Second term *lean principles* are associated with the 'tools used to execute' lean thinking strategies, and the

last term *leanness* is used to describe the ‘state’ of the organizations transformation when employing lean thinking and implementing lean principles.

Hallam (2003) was not the first to define these terms as all have been noted in lean literature over the past four decades. As noted previously, Womack and Jones (1996b) were one of the first to coin the term and offer evidence of this operational philosophy. Although not explicitly called ‘lean principles’, Monden’s (1983) book became the foundation many organizations used to learn and apply what is now commonly referred to as ‘lean principles’ (Hines et al., 2004; Holweg, 2007; Karlsson & Ahlstrom, 1996; New, 2007). The leanness of organizations is a relatively new term evolving in lean literature since around 2001 when the Lean Advancement Initiative of Massachusetts Institute of Technology (MIT) began sponsoring numerous research projects assessing levels of leanness within organizations. The development of the Lean Enterprise Self Assessment Tool (Lean Advancement Initiative, 2001) has contributed much to the literature defining ‘leanness’ (Hallam, 2003; Paxton, 2004; Seitz, 2003; Shan, 2008).

Drawing heavily from the Burke-Litwin Organizational Performance and Change model (Figure 4) and adopting Hallam’s (2003) three dimensions of lean transformations, a conceptual model was developed aligning factors of OP&C to the different tiers of lean implementations. The conceptual framework encompassing this research is shown in Figure 5 followed by a description of supporting logic.

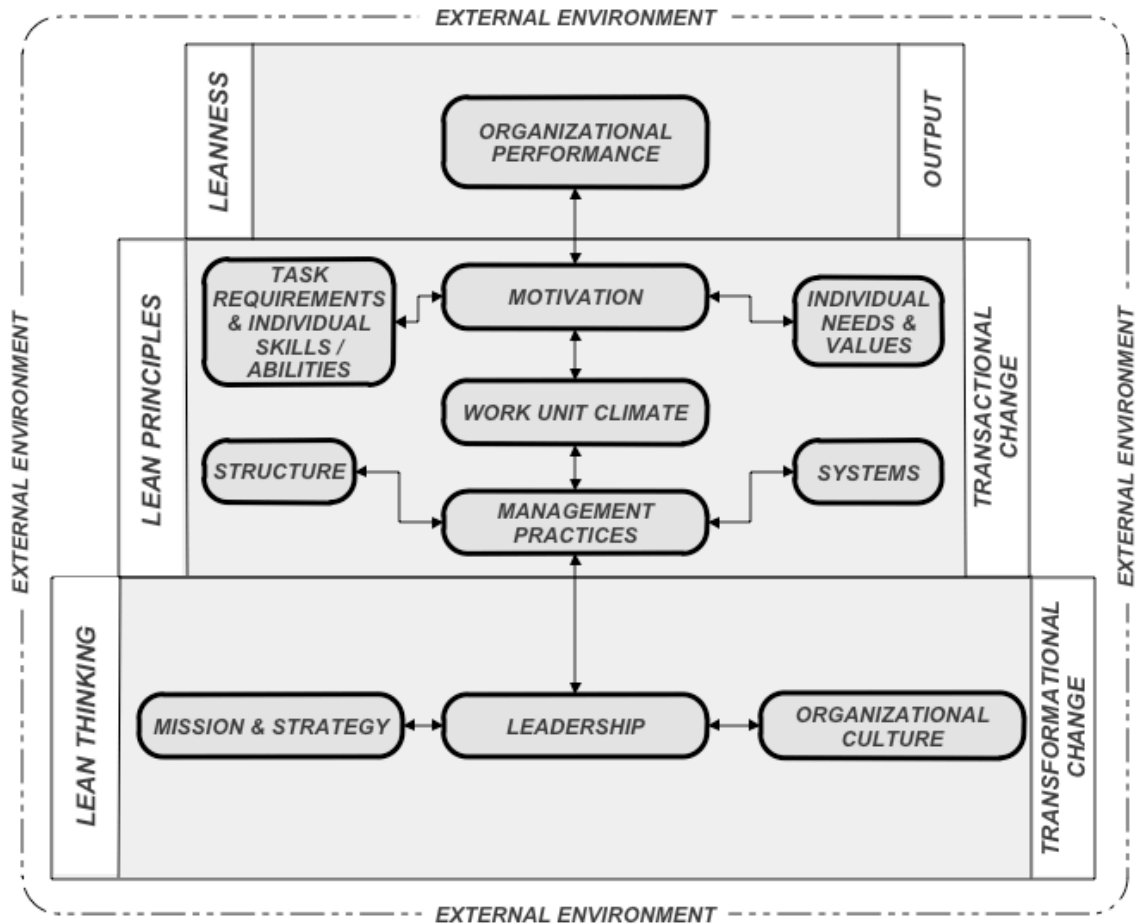


Figure 5. Lean transformation model

The Lean Transformation Model is divided into three tiers with lean thinking being the foundation requiring a transformational approach to change. The second tier utilizes the transactional aspects known as lean principles and the third tier, supported by the other tiers, represents the output as leanness. The external environment encompasses the entire model as Burke and Litwin (1992) stressed the importance of “organizational change...stems more from environmental impact than any other factor” (p. 529).

Leadership, mission and strategy, and organizational culture are considered foundational as well as transformational aligning logically with the operational

philosophy underpinning lean thinking. Hines et al. (2004) addressed the evolution of lean thinking and reinforced the importance of leadership, mission and strategy, and culture to lean transformations. Nightingale and Mize (2002) development of the LESAT (Lean Advancement Initiative, 2001) stressed “leadership plays a critical role in the success of lean change initiatives” and “leadership is a key precedent to every other lean practice” (p. 24). Liker and Hoseus (2008) decipher the “DNA” of Toyota and stressed the need to move beyond lean principles and focus more on developing a “culture that guides our business every day...through successful implementation of human resource philosophies that create the buy in and engagement of the people necessary to run such a simple but intricate system” (pp. xxi-xxii).

The second tier of the lean transformation model incorporates transactional factors associated with lean principles. The primary OP&C factors most influential are management practices, work unit climate, and motivation. Subordinate factors are structure, systems, task requirements and individual skills / abilities, and individual needs and values. The primary tier two OP&C factors are mostly associated with management, process and job/performer level activities common to kaizen events employing lean principles (Brunet & New, 2003; Burke, 2008; Rummler & Brache, 1995).

Leanness, the third tier, represents the output generated by applying lean thinking based on lean principles. Burke (2008) stated output “refers to the outcomes and results of all the throughput activities that in turn are responses to the external environment (input)” (p. 195). For the purposes of this research, the output variable of leanness will be determined using the Lean Organizational Self-Assessment Manufacturing Survey

(LOSAMS), which is specific to the organizational level of change, not individual and group level.

In summary, the lean transformation model presents a graphic representation, the conceptual framework for my research. The tiered nature of the model insinuates one tier is built upon or supports the other and the overlay of the Burke-Litwin OP&C factors aligns lean dimensions with associated content (*what* to change) and process (*how* to change) perspectives. Burke (2008) noted “more than 95% of organizational changes are evolutionary” (p. 69) which supports the logic that 70% of OP&C factors align well with the incremental, transactional nature of lean principles.

CHAPTER 3: METHODOLOGY

This chapter discusses the research methodology employed for this study. After restating the research problem, purpose statement, and research questions the design and rationale are explored and connected to the philosophical framework. Next, the host organization is described along with the participants and sampling procedures. Finally, the data collection instrumentation reliability and validity are reviewed. An overview of the data analysis methods concludes this chapter.

Statement of the Research Problem

Successful organizational change is often predicated upon an organization's ability to understand dimensions influencing change interventions as presented in the Lean Transformation Model. To better understand why lean interventions succeed in some instances and not in others, it is important to study the relationship between organizational performance and change (OP&C) dimensions and their impact on the leanness an organization achieves.

Purpose of the Research

The purpose of this non-experimental research study was to examine relationships between OP&C factors and the perceived leanness and objective performance measures within a medium-sized manufacturing organization engaged in lean transformation. The Burke-Litwin model of OP&C (Burke & Litwin, 1992) serves as the theoretical framework and delineates 12 attribute independent variables which are external

environment, leadership, mission and strategy, organization culture, structure, management practices, systems, work unit climate, motivation, task requirements and individual skills, individual needs and values, and individual and organizational performance. Two additional variables will be determined from aggregated scores of the 12 Burke-Litwin OP&C model attributes and labeled transformational and transactional.

Perceived plant leanness and objective financial data were the dependent variables. Leanness was determined using the Lean Organizational Self Assessment Manufacturing Survey (LOSAMS) designed to elicit perceptions of leanness from leaders. Three financial performance indicators were gross margin variance, inventory turns variance, and warranty variance and gathered for each of the plants participating in the study. The findings will contribute to applied lean research, interventions used during lean transformations, and increase our understanding of the relationship between OP&C factors associated with successful organizations.

Research Questions

1. What are the relationships between the 14 dimensions of the Burke-Litwin organizational performance and change model and the perceptual assessment of leanness?
2. What are the relationships between the 14 dimensions of the Burke-Litwin organizational performance and change model and objective financial outcome variables as defined by three measures of plants' performance (gross margin variance, inventory turn variance, and warranty variance)?

Research Design and Rational

The non-experimental research approach (Gliner, Morgan, & Leech, 2009) is used to explain relationships between transformational and transactional factors suggested to be influential to successful performance and change interventions (Burke, 2008) and the leanness of an organization as presented in the conceptual model of lean transformations (see Figure 5). Also known as correlational research, Creswell (2005) stated this method is preferred when “relating two or more variables to see if they influence each other” (p. 325) and is helpful when relating outcomes within organizations “without necessarily inferring causality” (Swanson & Holton, 2005, p. 33).

Bounded by the non-experimental general approach; associational and comparative were selected as the specific approaches to answer the research questions based on criteria outlined by Gliner et al. (2009) from five different quantitative designs: “descriptive, associational, comparative, quasi-experimental, and randomized experimental” (p. 90). Since no interventions or treatments were administered during this study, the non-experimental approach will be used to focus on the attribute variables (a.k.a., predictor, explanatory, independent), which are “characteristics [or perceptions] that the participants bring with them to the study and are not controlled by the researchers” (Gliner et al., 2009, p. 89). The comparative approach was used to determine differences between the plants perceived leanness scores and the associational approach was used to investigate the strength, if any, between the Burke-Litwin OAS factors and perceived leanness scores and firms’ objective financial data.

Data Collection

The sampling process entails selecting participants from an organization with the intent of generalizing from the sample to the overall organization. To make these generalizations, the sample needs to be as representative of the organization as possible (Gliner et al., 2009). In contrast, a study with no restrictions of resources (time, money, access, etc.) might survey the entire organization thus no inference would be required and statements could be made more accurately regarding the perceptions of employees and their organization. However, in the reality of research within organizations, decisions must be made that ultimately result in the need for inference and generalizations. The following section details these decisions and the sampling process used for this research as shown in Figure 6.

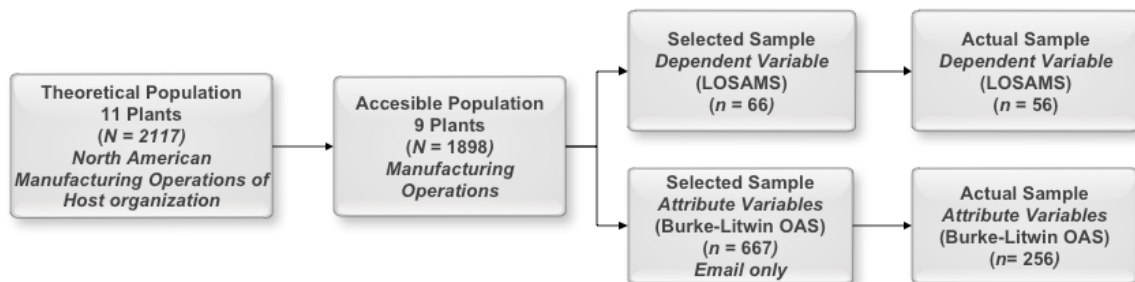


Figure 6. Diagram of sampling process

Site.

This study was conducted within a North American based, medium-sized manufacturing organization operating 11 manufacturing plants and 20 service centers throughout the United States and Canada. The focus of this research is within the 11 manufacturing operations, not service centers. To protect the anonymity of the host

organization, no reference will be made to the geographic locations of each manufacturing operations or any indicators that could be used to determine the source of the research site.

Participants.

The theoretical population of participants includes all employees ($N = 2117$) of the host organization engaged in activities associated with 11 manufacturing operations located in North America. Jobs classified as indirect represent 23% ($N = 496$) of the total workforce while direct represents the remaining 77% ($N = 1621$). The host organization provided year 2010 headcounts for direct and indirect labor to determine the final list of accessible population plants.

The accessible population of participants is limited to employees of nine manufacturing operations that have company-assigned email addresses ($N = 407$). The selection of facilities was based on discussions with the host organization and the researchers criteria of geographic diversity, minimum requirement of 50 employees within a site, a mix of newer and older facilities, and a mix of union and non-union facilities.

Sampling Plan – Burke-Litwin OAS.

The selected sample of participants for the attribute variables were obtained from the accessible population using nonprobability convenience sampling primarily due to limited resources of the researcher and to ease the burden on the host organization in coordinating a probability sample. While the researcher acknowledges the benefits of probability sampling and the impact on overall validity (Creswell, 2005; Gliner et al.,

2009; Swanson & Holton, 2005), the non-experimental nature of the study limits the generalizability of the outcomes to the host organization thus a randomized sample would have limited impact. Gliner et al. (2009) reluctantly acknowledge most theses and dissertations often use convenience sampling and offered two ways of determining if a sample is considered convenient. First, “whenever the *accessible population* is not representative of the *theoretical population*...” and second, “if the participants are volunteers or selected from the population in a nonprobability manner”(p. 125). It is unclear in Gliner et al.’s (2009) explanation if both conditions or just one must be met. Since the theoretical and accessible populations within this research study are somewhat the same size (N = 2117: 1898), the first criterion seems not to apply. The second criterion applies as all of the participants will be volunteers participating via intercompany email.

The following Table 6 displays the Burke-Litwin OAS sample plan and response rates. It was determined during the data collection planning phase with the host organization to only request participation from employees with an intercompany email address realizing the participants would primarily be indirect employees. This choice is discussed in more detail within the limitations section.

Table 6

Burke-Litwin OAS Sampling plan With Response Rates.

	Accessible Population (N)	Selected Sample (n)	Actual Sample (n)	Response Rate
Plant #	Total Employees	Email Address	Participants	%
1	83	30	16	53
2	329	115	44	38
3	307	107	38	36
4	213	75	27	36
5	409	143	23	16
6	88	31	18	58
7	97	34	26	76
8	173	61	14	23
9	199	71	20	28
Total	1898	667	256	38

Determining the selected sample size (*n*) through *power* analysis is a recommended practice increasing robustness of the research (Gliner et al., 2009; Thiemann & Kraemer, 1987). The higher the *power* (0 - .99 range) the more confident the researcher can be in accepting the alternative hypothesis (*beta* error) while rejecting the null hypotheses (*alpha* error). When *alpha* (α) is established at either .05 or .01, the

power can be determined using sample size (n) and effect size (d) through referencing “Power Tables” common to inferential statistics textbooks (see Gliner et al., 2009, p. 239). An outcome of statistical significant with a power value of .99 would indicate a 99% likelihood of being able to reject the null hypotheses is false. While this might be what all researchers would aspire to determine, the practicality of achieving this outcome is out of reach for most. Thiemann and Kraemer (1987) suggested a .70 to .90 range is typical while Gliner et al. (2009) split the difference by recommending an ideal power value of .80.

To determine if the selected sample size is appropriate for this research, power tables were used (Gliner et al., 2009, p. 239) for two-tailed t test with an $\alpha = .05$. Since the number of participants at nine plants varies, the average of the selected sample was calculated ($n = 75$). To determine the appropriate estimated effect size (d), “the strength of the relationship between the independent and dependent variables” (p. 238), researchers often draw from previous research or estimations by the researchers knowledge of the subject (Gliner et al., 2009; Thiemann & Kraemer, 1987). After reviewing research employing the use of the Burke-Litwin OAS (Anderson-Rudolf, 1996; Falletta, 1999) and the LESAT (Hallam, 2003; Nightingale & Mize, 2002; Shan, 2008), it was difficult to determine an appropriate estimated effect size therefore a “medium or typical” “ d ” family effect size of .50 was chosen (Gliner et al., 2009, p. 252). Using the aforementioned data ($\alpha = .05$, $d = .50$, $n = 75$) the power is close to .80 and within the recommended power, ranging from .70 to .90, ensuring the appropriate selected sample size.

Administration of Burke-Litwin OAS survey.

After institutional review board (IRB) approval (Appendix B) a preliminary email (Appendix B) was sent to the survey sample through the host organizations intercompany email system introducing the research and requesting their participation on February 15, 2010. At the bottom of the email, there was a URL link routing the participant to the survey website where they were informed of the risk associated with the survey (or lack thereof) and asked to continue, providing informed consent (Appendix B). The survey was administered using an online electronic questionnaire website called Question Pro (www.QuestionPro.com). Participants confidentiality was maintained throughout the data collection process by the automatic assignment of a response ID generated by the Question Pro online survey system. Participants were asked to complete the survey by February 28, 2010 with the first reminder email (Appendix B) sent four days (February 19, 2010) after the initial notification. A second reminder email (Appendix B) was sent three days (February 25, 2010) prior to the close of the survey. The survey was closed on March 6, 2010.

Sampling Plan – LOSAMS.

The Lean Organization Self Assessment Manufacturing Survey (LOSAMS) was used to determine the perceptions of leanness and “is intended to highlight the key integrative practices at the uppermost levels of an enterprise” (MIT, 2001, p. 3). The goal of the LOSAMS assessment for this research study was to determine level of leanness based on maturity matrices in two areas: Section I enterprise transformation / leadership and Section III enabling infrastructure processes. With the high-level aspect of the instrument in mind, the selected sample of participants for the dependent variable will be

obtained from the accessible population using nonprobability convenience sampling of the leadership from each of the nine plants listed in Table 7. Leadership teams typical of this organization consist of a director, general manager, operations manager, plant manager, quality manager, engineering manager, materials manager, and human resource manager. The director of each plant participating was contacted by the researcher and asked to participate in the study via an online survey and to recruit the rest of their leadership team.

Table 7

LOSAMS Sampling Plan With Response Rates.

	Accessible Population (N)	Selected Sample (n)	Actual Sample (n)	Response Rate
Plant #	Total Employees	Leadership	Participants	%
1	83	5	3	60
2	329	11	10	91
3	307	12	12	100
4	213	5	1	20
5	409	10	5	50
6	88	8	6	75
7	97	7	5	71
8	173	12	10	83
9	199	8	4	50
Total	1898	78	56	72

Administration of LOSAMS survey.

Once institutional review board approval was received (Appendix B), a teleconference was coordinated with the nine participating plants to introduce the study and review the LOSAMS. A follow-up email (see Appendix C) was sent to the survey sample through the host organizations intercompany email system introducing the research and requesting their participation on February 1, 2010. At the bottom of the email, a URL link routed the participant to the survey website where they were informed of the risk associated with the survey (or lack thereof) and asked to continue, providing informed consent (Appendix C). The survey was administered using an online electronic questionnaire website called Question Pro (www.QuestionPro.com). Participants confidentiality was maintained throughout the data collection process by the automatic assignment of a response ID generated by the Question Pro online survey system. Participants were asked to complete the survey by February 14, 2010 with the first reminder email (Appendix C) sent 15 days (February 15, 2010) after the initial notification. The survey was closed on February 28, 2010.

Instruments

Two instruments were used to collect data via online survey delivery method. The attribute variables used the Burke-Litwin Organizational Assessment Survey (OAS) (W. Warner Burke Associates, n.d.) and the dependent variables used a modified version of the LESAT (Lean Advancement Initiative, 2001) named the LOSAMS. Both instruments utilize self-report measures employing a Likert-type scale. The 'paper' versions were converted to 'online' format modified to conform to QuestionPro's (QuestionPro.com) electronic protocol. Demographic data were modified on both

instruments to ask questions pertinent to this research such as plant location, direct, and indirect job position (see Appendix D and E for complete surveys).

Burke-Litwin Organizational Assessment Survey.

I was first introduced to the Burke-Litwin OP&C model during EDOD 769: Theory and Practice of Change and Burke's (2008) textbook *Organization change: Theory and practice*. The Burke-Litwin OAS aligns well with the Burke-Litwin OP&C model and the overall theme of the Organizational Performance and Change doctoral program. Other models of organizational assessment and diagnosis were reviewed such as: Weisbord's Six-Box organizational model, Nadler-Tushman Congruence model, and Tichy's framework in addition to a search of literature encompassing assessment within organizations (Dunham & Smith, 1979; Kraut, 2006; Levinson, 2002; Smith, 2003). A review of dissertations using the Burke-Litwin OAS for research (Anderson-Rudolf, 1996; Falletta, 1999; Fox, 1990) lead to correspondence with Dr. Burke and approval to use the instrument for research and educational purposes granted (see Appendix F).

The survey includes 90 questions based on a 5-point Likert-type rating scale with each item ranging (1) through (5). There were no reverse ordered response items and participants were allowed to choose 'don't know' on any question. The anchor labels for many of the questions varied with the majority being "to a very small extent" = 1 and "to a very great extent" = 5. The only modifications to the original survey were the deletion of open-ended questions, 'background information' changed to 'participant information' with questions pertinent to this specific research, and the definitions of each construct were restated at the beginning of each section instead of just at the beginning of the

original survey. Each question was recreated verbatim for the online survey, as were the anchor labels.

Reliability and validity.

Gliner et al. (2009) suggested the instrument manual and/or previous research published in scholarly literature as good sources for reliability measures. Through correspondence (see Appendix F), Dr. Burke indicated neither an instrument manual existed for the Burke-Litwin OAS nor has the reliability data been compiled. A review of literature revealed three dissertations and one journal article reporting reliability measures of the Burke-Litwin OAS and reported in Table 8.

Table 8

Internal Consistency of the Burke-Litwin OAS Constructs

		Cronbach's α			
		Fox (1990)	Anderson- Rudolf (1996)	Falletta (1999)	Di Pofi (2002)
	<i>n</i> =	260	4,644 / 10,078	268	188
Survey Construct	Items				
External Environment	1–4	n/a	n/a	.59	.58
Mission & Strategy	5–15	n/a	n/a	.86	.88
Leadership	16–22	.97	.84/.83	.90	.93
Culture	23–34	.95	.83/.78	.85	.88
Structure	35–38	n/a	n/a	.68	.74
Management Practices	39–51	.92	.97/.98	.93	.94
Systems	52–59	n/a	n/a	.84	.86

Table 8 (Cont.)					
Survey Construct	Items	Cronbach's α			
		Fox (1990)	Anderson- Rudolf (1996)	Falletta (1999)	Di Pofi (2002)
Work Unit Climate	60–67	.85	.86/.81	.88	.91
Task Requirements / Individual Skills	68–71	n/a	n/a	.88	.76
Motivation	72–75	n/a	n/a	.81	.90
Individual Needs & Values	76–80	n/a	n/a	.76	.71
Performance	81–90	.84	.83/.84	.87	.90

Validity measures of an early version of the Burke-Litwin OP&C model were tested using factor analysis by Fox (1990) and directional causality among organizational culture to leadership, management practices, work unit climate, and individual and organizational performance were presented. Anderson-Rudolf (1996) expanded on Fox's research by employing the Burke-Litwin OP&C model in a longitudinal study and analyzing validity with principle component analysis. The research reported 13 factors in the first time study and 12 factors in the second time study resulting in the 12 factors used in the current Burke-Litwin OP&C model. Validity measures were not reported in Falletta (1999) and (Di Pofi (2002).

Lean Organization Self-Assessment Manufacturing Survey.

The LOSAMS was developed based on the LESAT designed to measure the dependent variable after a review of literature supported the evolution of the development of instruments determining the 'level of leanness' within organizations engaged in lean

transformation (Hallam, 2003; Nightingale & Mize, 2002; Seitz, 2003). Through correspondence with the Lean Advancement Institute (LAI) director, Mr. Tom Shields, I expressed interest in learning more about the LESAT instrument and possible use for my dissertation. Consequently, an invitation to Massachusetts Institute of Technology (MIT) for a Knowledge Exchange Event (KEE) followed and in May 2009, I attended the event consisting of training on administering the instrument in addition to discussions with one of the original developers, Dr. Deborah Nightingale.

The LESAT development started in 2000 by members of the Lean Aerospace Initiative consortium (currently known as the ‘Lean Advancement Initiative’) consisting of industry, government, and academia personnel focused on sharing best practices and creating a more systematic approach to connecting the entire aerospace enterprise as they pursue lean transformation. The initial outcome of LAI’s efforts was the Lean Enterprise Model (LEM) in 1996 which “provides a taxonomy of lean principles and practices which collectively constitute the *what’s* of lean, but does not address the *how’s* of implementation” (Nightingale & Mize, 2002, p. 16). The second major product developed and launched by the LAI consortium was the Transition-To-Lean (TTL) Enterprise Roadmap (see Figure 7), which presents a conceptual framework for “transitioning an enterprise from a mass-production mentality to a lean enterprise mentality” (p. 16). The TTL framework allows leaders to create a mental model of the process associated with lean transformations and guides practitioners through the journey.

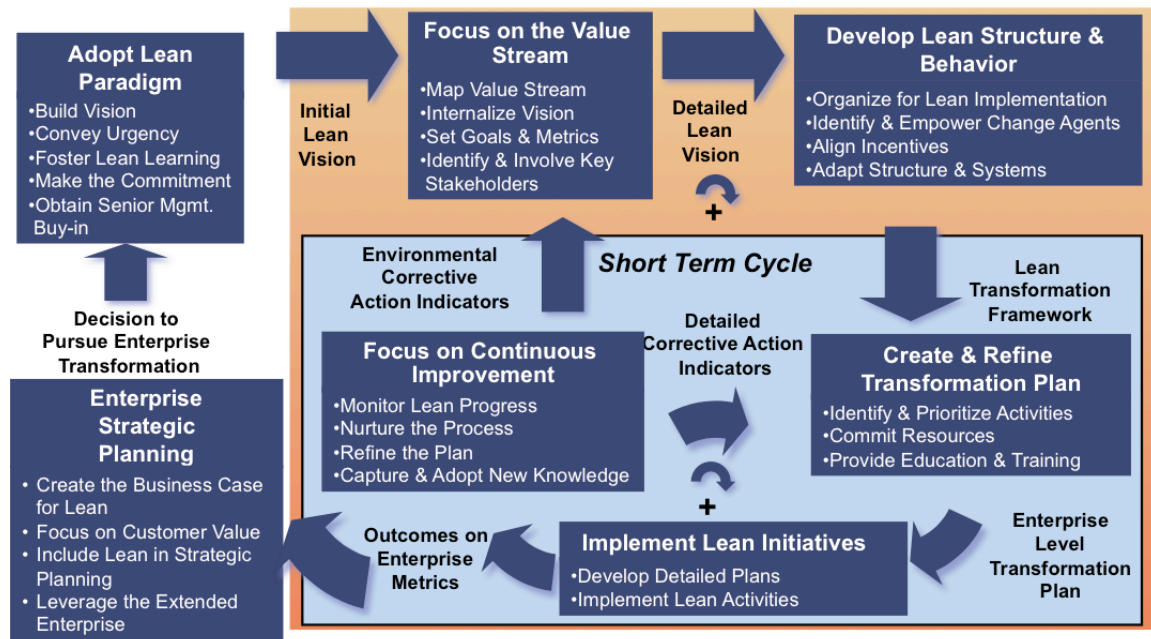


Figure 7. Transition to lean (TTL) enterprise roadmap (Lean Advancement Initiative, 2001)

The third and most recent outcome of the LAI initiative is the LESAT designed by the consortium as a standardized method of assessing progress through the TTL enterprise roadmap. Drawing from currently established assessment programs such as the Malcolm Baldrige National Quality Award, ISO 9000, and the European Quality Award, the LESAT emerged focusing “on assessing the degree of maturity of an enterprise in its use of *lean* principles and practices to achieve the best value for the enterprise and its stakeholders” (Nightingale & Mize, 2002, p. 18). The LESAT is structured into three sections with a total of 54 questions and 15 factors as shown in Table 9.

Table 9

LESAT Structure

Section	Factor	# of Items
Section I: Lean Transformation / Leadership	Enterprise strategic planning	3
	Adopt lean paradigm	4
	Focus on the value stream	4
	Develop lean structure and behavior	7
	Create and refine transformation plan	3
	Implement lean initiatives	2
	Focus on continuous improvement	5
Section II: Life-Cycle Processes	Business acquisition and program management	4
	Requirements definition	2
	Develop product and process	3
	Manage supply chain	3
	Produce product	2
	Distribute and service product	4
Section III: Enabling Infrastructure Processes	Lean organizational enablers	5
	Lean process enablers	3

Source: (Lean Advancement Initiative, 2001)

Figure 8 illustrates the connection among all three products created by the LAI initiative designed to assist with lean transformations.

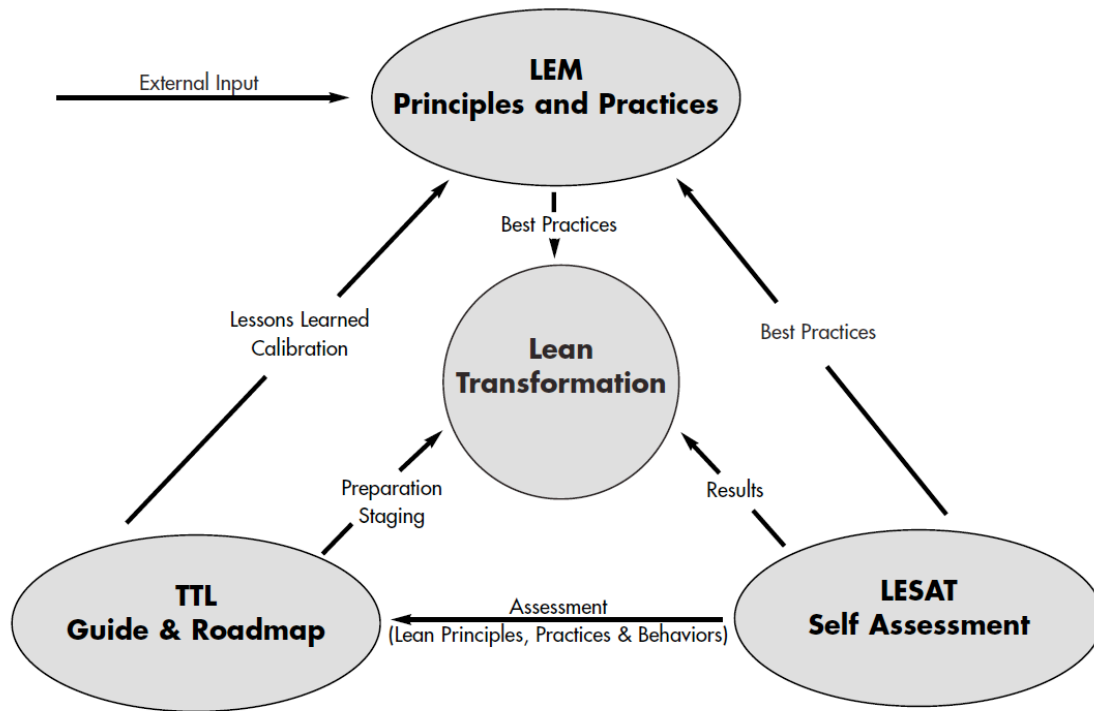


Figure 8. Relationship of LEM, TTL, and LESAT to lean transformation (MIT, 2001, p. 29).

Modifications.

After receiving training on the LESAT and attending Knowledge Exchange Events sponsored by the LAI and consortium members, it became clear the language within the LESAT was very specific to the aerospace industry and their suppliers. A modified version of the LESAT was created with the intent to make it more ‘organizational’ with language specific to manufacturing industry. This modified version is called the LOSAMS.

One of the major issues with using the existing LESAT for my research was the amount of time required as outlined in the facilitator’s guide and conversation with current users. The typical time for the 54 question LESAT “is around 5 – 8 hours” (MIT, 2001, p. 140). To reduce the overall time, the open-ended responses for ‘evidence’ and

‘opportunities’ were eliminated along with Section II – Life Cycle-process consisting of 18 questions. Pilot testing with the online version of the LOSAMS indicated the average time was 42 minutes.

Another concern with the existing LESAT was the language of many questions and the use of ‘enterprise’ to describe the entire value stream from suppliers, manufacturer, to the end-user. While this might be a common term in the aerospace industry, pilot testing within a small sample ($n = 5$) of the host manufacturer indicated confusion surrounding this and many other terms and meanings.

Reliability and validity.

The search for LESAT reliability measures consisted of examining the facilitators guide (MIT, 2001), literature review of seminal and current works involving the LESAT (Hallam, 2003; Nightingale & Mize, 2002; Paxton, 2004; Seitz, 2003; Shan, 2008), and correspondence with leaders of the Lean Advancement Initiative. None were able to confirm if reliability documentation existed for the LESAT.

LESAT validity measures were outlined in Nightingale and Mize’s (2002) account of the development team consisting of 25 industry, 13 government, and two labor union members in addition to numerous MIT researchers, faculty, and students. A needs assessment was conducted documenting the aerospace enterprise lean assessment requirements generating a weighted list of constructs. These constructs were aligned and linked with the Lean Enterprise Model (LEM) and Transition-To-Lean (TTL) roadmap generating 54 questions within three major sections (as shown in Table 9).

The prototype alpha version of the LESAT was reviewed and tested through 10 LAI consortium member companies with a follow-up review session at MIT producing

another Beta field-test version. Twenty companies from both the U.S. and U.K. participated in the Beta testing including a “feedback form...to determine LESAT’s usefulness, ease of use and alignment with other business practices” (Nightingale & Mize, 2002, p. 21). Incorporating the findings from the Beta field-test, the current version 1.0 was released to the public in August 2001. According to Gliner et al. (2009), this is an example of the instrument’s evidence based on content validity.

The literature review and correspondence with the LAI to review evidence based validity on internal structure (i.e., EFAs; CFAs) did not yield any information for the LESAT.

Pilot Testing

The LESAT instrument was pilot tested with a small convenience sample ($n = 5$) of participants from the host organization in November 2009. The primary purpose of the pilot was to test the online delivery system (Questionpro.com), gather feedback on the language used in the LESAT, and estimate overall time to complete the survey. Informal conversations with the participants after completion indicated confusion surrounding the use of terms such as ‘enterprise’ and various other terms associated with aerospace jargon. The average time to complete the LESAT was 55 minutes. Online delivery worked well, but the participants requested the ability to save their answers and return later to complete the survey. The conclusion of this pilot test resulted in the development of the LOSAMS more specific to manufacturing industry, removal of section II questions to reduce time, and addition of the feature to Questionpro.com that allows participants to save their answers and return.

The Burke-Litwin OAS instrument was pilot tested within an organization other than the host site with a convenience sample ($n = 35$) in October 2009. The primary purpose of the pilot was to test the online delivery system (Questionpro.com), determine the average time to complete the 90 Likert question survey with 19 open-ended questions, and work with the data to experiment with analysis methods. The online delivery worked well and data was easily extracted for use in PASW Statistical software. The average time to complete was 47 minutes. As a result of the pilot testing, the open-ended questions were removed to reduce the overall time of completion. Descriptive analysis was completed for the pilot test organization and a final report submitted for their review (see Appendix G).

Data Analysis

Inferential statistical tests were used to examine the research questions for this study using PASW Statistics version 18. First, an exploratory data analysis was conducted for the purposes of understanding the descriptive nature of the data, checking for errors, and reviewing statistical assumptions (Morgan, Leech, Gloeckner, & Barrett, 2007). With the exception of demographic data, the scores from the Burke-Litwin OAS and LOSAMS were considered *approximately normal* measurement variables and the objective financial data were considered *ordinal* as used within comparative and associational research questions (Morgan et al., 2007). Pearson product moment correlation coefficients (r) were used to measure the degree of association between the attribute variables and the criterion dependent variable while determining the level of multicollinearity with the results presented in Chapter 4.

Next, exploratory factor analysis (EFA) using principal axis factor analysis with varimax rotation were conducted to assess the underlying structure for both the Burke-Litwin OAS and LOSAMS with results presented in Appendix H and I and discussed in Chapter 4.

Cronbach alpha (α) coefficients were used to measure the internal consistency reliability of the Burke-Litwin OAS and LOSAMS with results reported in Tables 16 and 17. Next, A one-way analysis of variance (ANOVA) compared means between plants' scores for 14 variables of the Burke-Litwin OAS and tested for statistically significant differences. Illumination of these differences allows inference for the purpose of understanding the homogeneous and heterogeneous aspect between plants. Findings are detailed in Chapter 4 and will be used to answer research question (1).

Finally, Spearman's rho (r_s) bivariate correlation were used to investigate relationships between *transformational*, *transactional* and *leanness* in addition to *inventory variance*, *GM variance*, *warranty variance* and *leanness* to answer research questions 1. and 2.

CHAPTER 4: FINDINGS

The purpose of this non-experimental research study was to examine relationships between organizational performance and change (OP&C) factors and the perceived leanness and objective performance measures within a medium-sized manufacturing organization engaged in lean transformation. Successful transformational change is often predicated upon an organization's ability to understand dimensions influencing change interventions as outlined in the Lean Transformation Model. To better understand why lean interventions succeed in some instances and not in others, it is important to study the relationship between OP&C dimensions and their impact on the leanness an organization achieves.

Chapter 4 presents the findings of this study designed to address three primary research questions:

1. What are the relationships between the 14 dimensions of the Burke-Litwin organizational performance and change model and the perceptual assessment of leanness?
2. What are the relationships between the 14 dimensions of the Burke-Litwin organizational performance and change model and objective financial outcome variables as defined by three measures of plants' performance (gross margin variance, inventory turn variance, and warranty variance).

To answer research questions (1) and (2), two different surveys were administered in nine plants of the same manufacturing organization. The first survey (LOSAMS) was

deployed to leaders within each of the nine plants asking a series of questions designed to determine perceived leanness of their perspective plants. A second survey (Burke-Litwin OAS) was administered, to all employees of the nine plants with intercompany email addresses, to determine their scores on 12 factors associated with perceived organizational performance and change.

This chapter presents the findings of these surveys and results of data analysis. First, the characteristics of the participants will be reviewed followed by an examination of research questions (1) and (2) and associated analysis.

Descriptive Characteristics of Respondents

This section describes the characteristics of both surveys administered starting with the LOSAMS and ending with the Burke-Litwin OAS.

Descriptive characteristics of the LOSAMS.

From a total of 66 surveys 60 complete surveys were received at the end of the two week data collection phase from plant leadership. After completing an “exploratory data analysis” (Morgan et al., 2007, p. 53), two surveys were removed because ‘other’ plant could not be reconciled with plants participating in the research. Two surveys were deleted due to extreme outliers skewing plant #8 resulting in a total of 56 LOSAMS included in the data analysis. In descending order, the percentages of respondents by plant are; 21.4% (n = 12) from plant #3, 17.9% (n = 10) for each plant #2 and plant #8, 10.7% (n = 6) for plant # 6, 8.9% (n = 5) for each plant #7 and plant #5, 7.1% (n = 4) for plant #9, 5.4% (n = 3) for plant #1, and 1.8% (n = 1) for plant #4 (Table 10). Since the

selected sample for the LOSAMS was restricted to the leadership of each plant, no other descriptive data were gathered.

Table 10

Frequencies and Percentages for LOSAMS Participants by Plant (n = 56)

Plant #	Frequency	%	Response Rate%
1	3	5.4	60
2	10	17.9	91
3	12	21.4	100
4	1	1.8	20
5	5	8.9	50
6	6	10.7	75
7	5	8.9	71
8	10	17.9	83
9	4	7.1	50
Total	56	100	72

Descriptive characteristics of the Burke-Litwin OAS.

A total of 362 surveys were distributed with 275 complete surveys at the end of the two week data collection phase. After completing an “exploratory data analysis” (Morgan et al., 2007, p. 53), 19 surveys were removed because ‘other’ was selected for either ‘plant location’ or ‘current function’ and could not be reconciled with plants or positions participating in the research. The deletions resulted in 256 Burke-Litwin OASs

included in the data analysis. In descending order, the percentages of respondents by plant from highest to lowest are; 20.7% (n = 53) from plant #5, 17.2% (n = 44) for plant #2, 14.8% (n = 38) for plant # 3, 10.5% (n = 27) for plant #4, 10.2% (n = 26) for plant #7, 7.8% (n = 20) for plant #9, 7.0% (n = 18) for plant #6, 6.3% (n = 16) for plant #1, and 5.6% (n = 14) for plant #8 (Table 11).

Table 11

Frequencies and Percentages for Burke-Litwin OAS Participants by Plant (n = 256)

Plant #	Frequency	%	Response Rate %
1	16	6.3	53
2	44	17.2	38
3	38	14.8	36
4	27	10.5	36
5	53	20.7	16
6	18	7.0	58
7	26	10.2	76
8	14	5.6	23
9	20	7.8	28
Total	256	100	38

The current function/department was gathered to ensure participants were members of the manufacturing operations within the host organization. Collecting this data was necessary because the intercompany email used to solicit participants contained

employees of functions outside of the manufacturing operations such as sales and field service technicians. The overall distribution of the participants was 36.3% (n = 93) from engineering, 19.5% (n = 50) from management, 16% (n = 41) from materials, 8.2% from quality, and 6.6% (n = 17) from manufacturing, administrative, and other (Table 12).

Table 12

Frequencies and Percentages for Burke-Litwin OAS Participants by Function / Department (n = 256)

Function / Department	Frequency	%
Engineering	93	36.3
Management	50	19.5
Materials	41	16.0
Quality	21	8.2
Manufacturing	17	6.6
Administrative	17	6.6
Other	17	6.6

Information on direct (hourly) and indirect (salary) labor classification was gathered for each participant of the manufacturing operations and shown in Table 13. This information becomes important for understanding perspectives of participants and is discussed in more detail within the limitations section.

Table 13

Frequencies and Percentages for Burke-Litwin OAS Participants by Labor Classification (n = 256)

Labor Classification	Frequency	%
Indirect (Salary)	209	81.6
Direct (Hourly)	47	18.4

The last participant characteristic gathered for the Burke-Litwin OAS was the tenure within the host organization as shown in Table 14.

Table 14

Frequencies and Percentages for Burke-Litwin OAS Participants by Tenure

Tenure (years)	Frequency	%
0 – 2	54	21.1
3 – 5	97	37.9
6 – 8	20	7.8
9 – 12	32	12.5
13 – 20	22	8.6
20+	31	12.1

Overview of LOSAMS, Burke-Litwin OAS Scores and Financial Data

Prior to presenting the findings related to research questions 1. and 2., an aggregated summary of all the data is provided and reviewed (Table 15). The objective financial data are variances based on the percentage above (positive) or below (negative) the financial target and in all cases, a positive variance is better than a negative one. Gross margin variance was calculated based on an average of 26 months data from each of the plants participating in the study. Inventory turns variance was calculated based on an average of 36 months data from each of the plants and warranty variance was based on an average of 14 months data.

The LOSAMS aggregated scores were based on an average of the nine factors for each participating plant as noted in Table 10. No weighting of the individual questions or factors were used to determine the overall LOSAMS score in order to maintain consistency with the original LESAT design.

The Burke-Litwin OAS aggregated scores are average scores based on the appropriate questions as listed in Table 16. Transformational scores were determined by averaging the scores for external environment, mission and strategy, leadership, culture, and organizational performance. Transactional scores were determined by averaging the scores for structure, management practices, systems, work group climate, task and skills, motivation, and needs and values.

Table 15

Overview of Data Collection and Variables Used for Analysis

	Plant #																	
Variables	1		2		3		4		5		6		7		8		9	
Gross Margin	4.00		15.50		13.50		(13.00)		52.00		14.00		(86.50)		8.00		(362.00)	
Variance																		
Inventory Turns	(17.80)		1.50		(23.00)		(48.00)		(4.10)		13.20		0.80		(13.80)		18.70	
Variance																		
Warranty Variance	(29.00)		(47.00)		(52.00)		(47.00)		(50.00)		67.00		(70.00)		(9.00)		(33.00)	
	LOSAMS																	
n =	3		11		12		1		6		6		5		12		4	
	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
	3.04	0.38	2.97	0.46	2.40	0.55	2.79	0.00	3.52	0.71	3.41	0.49	3.05	0.62	2.85	0.59	2.49	0.64
	Burke- Litwin OAS																	
n =	16		51		41		28		59		20		28		16		23	
	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
Transformational	2.82	0.76	3.59	0.65	3.29	0.65	3.55	0.52	3.52	0.45	3.69	0.46	3.79	0.53	2.97	0.59	3.42	0.65
External	3.08	0.64	3.83	0.64	3.59	0.59	3.88	0.68	3.81	0.50	4.09	0.46	3.96	0.51	3.52	0.61	4.00	0.45
Mission	2.79	0.69	3.67	0.72	3.48	0.74	3.57	0.67	3.48	0.55	3.69	0.47	3.78	0.64	3.00	0.66	3.42	0.56
Leadership	2.73	1.35	3.66	0.94	3.14	1.01	3.64	0.74	3.66	0.74	3.86	0.73	4.00	0.68	2.90	1.03	3.44	0.96
Culture	2.68	0.70	3.37	0.70	3.07	0.63	3.46	0.58	3.41	0.52	3.45	0.65	3.69	0.54	2.69	0.68	3.25	0.85
Org. Performance	3.01	0.77	3.61	0.81	3.35	0.77	3.50	0.64	3.56	0.61	3.59	0.57	3.72	0.62	3.10	0.68	3.25	0.83
Transactional	3.07	0.85	3.58	0.67	3.34	0.81	3.36	0.62	3.55	0.50	3.79	0.54	3.75	0.61	3.37	0.67	3.48	0.75
Structure	2.72	0.88	3.43	0.73	3.20	0.67	3.05	0.81	3.24	0.50	3.42	0.85	3.79	0.58	3.15	0.74	3.10	0.91
Mgt. Practices	3.24	1.08	3.85	0.80	3.53	1.01	3.75	0.75	3.86	0.62	4.31	0.55	3.87	0.69	3.71	0.77	3.72	0.76
Systems	2.74	0.86	3.28	0.76	3.02	0.75	2.96	0.62	3.13	0.63	3.14	0.70	3.44	0.92	2.83	0.81	3.29	0.89
Climate	3.09	0.83	3.58	0.82	3.33	0.99	3.40	0.72	3.56	0.64	3.65	0.88	3.75	0.74	3.41	0.74	3.49	1.00
Task / Skill	3.13	0.92	3.46	0.94	3.39	0.85	3.18	0.83	3.50	0.67	3.79	0.64	3.70	0.77	3.35	0.80	3.45	0.87
Motivation	2.83	1.20	3.33	1.08	3.09	1.03	3.16	0.87	3.50	0.69	3.69	0.85	3.85	0.68	3.23	0.96	3.33	0.94
Needs / Values	3.57	1.11	3.79	0.85	3.66	0.81	3.59	0.83	3.95	0.69	4.03	0.76	4.00	0.62	3.62	0.64	3.55	0.79

Measurement Reliability and Validity

The following section reports the findings of reliability and validity measures for both instruments (Burke-Litwin OAS; LOSAMS) based on data collected during this research study. Further discussion regarding these findings occur in Chapter 5.

Burke-Litwin OAS reliability.

As noted in Table 16, Cronbach's α were determined for each construct based on research data collected for this study. The instrument constructs have good internal consistency reliability (.70 and above) according to Morgan et al. (2007, p. 129) with the exception of external environment ($\alpha = .55$), which also demonstrated a less than desirable Cronbach's α as in previous studies as referenced in Chapter 3, Table 8.

Table 16

Internal Consistency of the Burke-Litwin OAS Constructs (n = 256)

Survey Construct	Items	Cronbach's α
External Environment	1–4	.55
Mission & Strategy	5–15	.90
Leadership	16–22	.93
Culture	23–34	.89
Structure	35–38	.72
Management Practices	39–51	.94
Systems	52–59	.85
Work Unit Climate	60–67	.91
Task Requirements / Individual Skills	68–71	.69
Motivation	72–75	.89
Individual Needs & Values	76–80	.76
Performance	81–90	.87

Burke-Litwin OAS validity.

To review validity, exploratory factor analysis (EFA) using principal axis analysis with varimax rotation was conducted to assess the underlying structure for the Burke-Litwin OAS. Twelve factors were requested based on the original constructs which were: external environment; leadership; mission and strategy; organization culture; structure; management practices; systems; work unit climate; motivation; task requirements and individual skills; individual needs and values; and individual and organizational performance. After rotation, the highest loaded factor accounted for 11.79% of the variance, the second factor accounted for 9.80%, and the third factor accounted for 7.79%. The communalities for all but one question were relatively high ($h^2 > .80$) indicating the reliability of the loading factors is strong. The lowest communality was Q1 external environment ($h^2 = .736$). Appendix H displays the items and factor loadings for all 12 factors, with loadings less than .30 omitted to improve clarity.

LOSAMS reliability.

As noted in Table 17, the LOSAMS instrument demonstrated good internal consistency reliability (.70 and above) according to Morgan et al. (2007, p. 129) with the exception of strategic planning ($\alpha = .68$).

Table 17

Internal Consistency of the LOSAMS (n = 56)

Survey Construct	Items	Cronbach's α
Strategic Planning	1 - 3	.68
Adopt Lean Thinking Paradigm	4 - 7	.85
Focus on the Value Stream	8 - 9	.81
Develop Lean Structure and Behavior	12 - 18	.87
Create and Refine Transformation Plan	19 - 21	.70
Implement Lean Initiatives	22 - 23	.70
Focus on Continuous Improvement	24 - 28	.88
Lean Organizational Enablers	29 - 33	.75
Lean Process Enablers	34 - 38	.78

LOSAMS validity.

An EFA using principal axis analysis with varimax rotation was conducted to assess the underlying structure of the LOSAMS. Nine factors were requested based on the original constructs which were: strategic planning, adopt lean thinking paradigm, focus on the value stream, develop lean structure and behavior, create and refine transformation plan, implement lean initiatives, focus on continuous improvement, lean organizational enablers, lean process enablers. After rotation, the highest loaded factor accounted for 13.9% of the variance, the second factor accounted for 13.11%, and the third factor accounted for 8.18%. The communalities for all of the questions were acceptable ($h^2 > .69$) indicating the reliability of the loading factors is strong. Appendix I

displays the items and factor loadings for nine of the factors, with loadings less than .30 omitted to improve clarity.

Research Question (1) Analysis

- 1. What are the relationships between the 14 dimensions of the Burke-Litwin organizational performance and change model and the perceptual assessment of leanness?*

Correlations between Burke-Litwin OP&C factors and LOSAMS.

To investigate associations between the Burke-Litwin OP&C factors and the perceived level of leanness determined by the LOSAMS, correlations were computed. All variables from the Burke-Litwin OAS and LOSAMS were normally distributed and assumptions of linearity were not noticeably violated therefore, Pearson (r) correlations were computed to examine the intercorrelations of the variables. Table 18 reveals seven of the 14 Burke-Litwin OP&C factors were significantly correlated with LOSAMS scores however, the effect sizes are considered small to medium according to Cohen (Morgan et al., 2007, p. 94). All correlations were positive with the strongest between LOSAMS and leadership, $r(252) = .19, p < .002$ indicating plants with higher LOSAMS scores were likely to have high leadership scores. The next highest correlations were between LOSAMS and two OP&C variables of culture and individual needs and values, $r(252) = .16, p < .020; p < .011$. Three other OP&C variables with significant correlations to LOSAMS were management practices, motivation, and transformational factors, $r(252) = .15, p < .020; p < .019; p < .021$, respectively. The final correlation was with transactional, $r(252) = .13, p < .04$.

Table 18

Intercorrelations for Burke-Litwin OP&C Factors and LOSAMS (listwise N = 254)

	LOSAMS	1	2	3	4	5	6	7	8	9	10	11	12	13	14
LOSAMS	--	.088	.054	.190	.162	.122	.075	.146	.031	.087	.092	.147	.159	.145	.129
1. External		<i>.162</i>	<i>.393</i>	<i>.002</i>	<i>.010</i>	<i>.052</i>	<i>.236</i>	<i>.020</i>	<i>.626</i>	<i>.168</i>	<i>.144</i>	<i>.019</i>	<i>.011</i>	<i>.021</i>	<i>.040</i>
2. Mission & Strategy			<i>.507</i>	<i>.535</i>	<i>.505</i>	<i>.467</i>	<i>.416</i>	<i>.396</i>	<i>.448</i>	<i>.348</i>	<i>.373</i>	<i>.441</i>	<i>.321</i>	<i>.625</i>	<i>.471</i>
3. Leadership			--	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>
4. Culture				<i>.662</i>	<i>.693</i>	<i>.677</i>	<i>.585</i>	<i>.495</i>	<i>.561</i>	<i>.549</i>	<i>.489</i>	<i>.602</i>	<i>.462</i>	<i>.856</i>	<i>.634</i>
5. Organizational Performance					<i>.781</i>	<i>.718</i>	<i>.661</i>	<i>.645</i>	<i>.638</i>	<i>.611</i>	<i>.609</i>	<i>.713</i>	<i>.577</i>	<i>.885</i>	<i>.761</i>
6. Structure					--	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>
7. Management Practices						<i>.767</i>	<i>.711</i>	<i>.619</i>	<i>.707</i>	<i>.683</i>	<i>.591</i>	<i>.715</i>	<i>.563</i>	<i>.915</i>	<i>.781</i>
8. Systems						<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>
9. Work Group Climate							<i>.672</i>	<i>.661</i>	<i>.693</i>	<i>.675</i>	<i>.658</i>	<i>.777</i>	<i>.703</i>	<i>.881</i>	<i>.820</i>
10. Task Req. / Indv. Skills							--	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>
11. Motivation								<i>.526</i>	<i>.626</i>	<i>.648</i>	<i>.585</i>	<i>.641</i>	<i>.519</i>	<i>.739</i>	<i>.737</i>
12. Individual Needs and Values								--	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>
13. Transformational									<i>.630</i>	<i>.628</i>	<i>.611</i>	<i>.708</i>	<i>.577</i>	<i>.678</i>	<i>.869</i>
14. Transactional									--	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>
										<i>.691</i>	<i>.650</i>	<i>.701</i>	<i>.600</i>	<i>.734</i>	<i>.845</i>
									--	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>
											<i>.590</i>	<i>.703</i>	<i>.588</i>	<i>.705</i>	<i>.845</i>
										--	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>
												<i>.745</i>	<i>.703</i>	<i>.659</i>	<i>.799</i>
												--	<i>.000</i>	<i>.000</i>	<i>.000</i>
													<i>.748</i>	<i>.787</i>	<i>.883</i>
													--	<i>.000</i>	<i>.000</i>
														<i>.642</i>	<i>.780</i>
														--	<i>.000</i>
															<i>.841</i>
															<i>.000</i>
															--

Note: Significant correlation among the LOSAMS and Burke-Litwin OAS factors are in bold; Significance is *italicized*.

Burke-Litwin OAS ANOVA's.

While not directly related to answering research question 1, it was decided to further investigate significant differences between plants scores using a one-way analysis of variance (ANOVA) to compare nine plants on each of the 14 dependent variables of the Burke-Litwin OAS mean scores for significant differences. As noted in Table 19, 11 of the 14 Burke-Litwin OAS mean scores indicated significant differences among the nine plants. These were external environment, $F(8,247) = 5.139, p = < .001$, mission and strategy, $F(8,247) = 5.251, p = < .001$, leadership, $F(8,247) = 5.208, p = < .001$, culture, $F(8,247) = 6.406, p = < .001$, organizational performance, $F(8,245) = 2.511, p = .012$, structure, $F(8,247) = 4.329, p = < .001$, management practices, $F(8,247) = 2.654, p = .008$, systems, $F(8,247) = 2.025, p = .044$, motivation, $F(8,247) = 2.658, p = .008$, transformational, $F(8,245) = 6.163, p = < .001$, transactional, $F(8,247) = 2.469, p = .014$.

Table 19

One-Way Analysis of Variance (ANOVA) Summary Table Comparing Plants to the Burke-Litwin OAS Factors

Source	<i>df</i>	SS	MS	<i>F</i>	<i>p</i>
External Environment					
Between Groups	8	13.455	1.682	5.139	< .001
Within Groups	247	80.840	.327		
Total	255	94.295			
Mission and Strategy					
Between Groups	8	17.132	2.141	5.251	< .001
Within Groups	247	100.737	.408		
Total	255	117.869			
Leadership					
Between Groups	8	33.480	4.185	5.208	< .001
Within Groups	247	198.483	.804		
Total	255	231.963			
Culture					
Between Groups	8	20.754	2.594	6.406	< .001
Within Groups	247	100.024	.405		
Total	255	120.779			
Organizational Performance					
Between Groups	8	9.938	1.242	2.511	.012
Within Groups	245	121.185	.495		
Total	253	131.123			

Table 19 (Cont.)

Source	<i>df</i>	SS	MS	<i>F</i>	<i>p</i>
Structure					
Between Groups	8	17.291	2.161	4.329	< .001
Within Groups	247	123.321	.499		
Total	255	140.612			
Management Practices					
Between Groups	8	13.153	1.644	2.654	.008
Within Groups	247	152.989	.619		
Total	255	166.142			
Systems					
Between Groups	8	9.280	1.160	2.025	.044
Within Groups	247	141.485	.573		
Total	255	150.765			
Climate					
Between Groups	8	6.693	.837	1.265	.262
Within Groups	245	163.340	.661		
Total	253	170.033			
Task and Skills					
Between Groups	8	7.859	.982	1.489	.162
Within Groups	247	162.966	.660		
Total	255	170.824			

Table 19 (Cont.)

Source	<i>df</i>	SS	MS	<i>F</i>	<i>p</i>
Motivation					
Between Groups	8	2.243	2.243	2.658	.008
Within Groups	247	208.404	.844		
Total	255	226.347			
Needs and Values					
Between Groups	8	7.565	.946	1.526	.149
Within Groups	247	153.067	.620		
Total	255	160.632			
Transformational					
Between Groups	8	16.849	2.106	6.163	< .001
Within Groups	245	84.408	.342		
Total	253	101.257			
Transactional					
Between Groups	8	8.641	1.080	2.469	.014
Within Groups	247	108.075	.438		
Total	255	116.716			

Note: significance $p < .05$

Burke-Litwin OAS post hoc multiple comparison test results.

Factors demonstrating significant differences ($p < .05$) from the ANOVA (Table 19) were subjected to the appropriate post hoc multiple comparison tests to determine which plants' LOSAMS's mean scores differed. Based on the homogeneity of variance

Levene test outcomes, Tukey HSD post hoc tests were conducted when the assumption of equal variances was not significant ($p > .05$) and Games-Howell post hoc tests used when the Levene test was significant ($p < .05$). The strength of the variances were calculated and effect sizes (d) reported. Each individual post hoc test is then presented with Table 20 detailing the means, standard deviations, and significant differences between each variable.

External environment.

The ANOVA indicate a significant difference for external environment, $F(8,247) = 5.139, p = .000$. Post hoc Tukey HSD tests indicate that plant #1 ($M = 3.083$) differed significantly from plant #2 ($M = 3.830, d = 1.16$), plant #3 ($M = 3.594, d = .83$), plant #4 ($M = 3.878, d = 1.20$), plant #5 ($M = 3.808, d = 1.26$), plant #6 ($M = 4.092, d = 1.83$), plant #7 ($M = 3.958, d = 1.51$), and plant #9 ($M = 3.996, d = 1.66$).

Mission and strategy.

The ANOVA indicate a significant difference for mission and strategy, $F(8,247) = 5.251, p = .000$. Post hoc Tukey HSD tests indicate plant #1 (2.673) differed significantly from plant #2 ($M = 3.673, d = 1.25$), plant #3 ($M = 3.476, d = .96$), plant #4 ($M = 3.571, d = 1.15$), plant #5 ($M = 3.480, d = 1.10$), plant #6 ($M = 3.686, d = 1.52$), and plant #7 ($M = 3.777, d = 1.48$); plant #2 (3.673) differed significantly from plant #8 ($M = 3.000, d = .97$); plant #7 (3.777) differed significantly from plant #8 ($M = 3.000, d = 1.20$).

Leadership.

The ANOVA indicate a significant difference for leadership, $F(8,247) = 5.208, p = .000$. Games-Howell post hoc tests indicate plant #1 ($M = 2.733$) differed significantly from plant #7 ($M = 4.000, d = 1.19$); plant #3 ($M = 3.144$) differed significantly from plant #7 ($M = 4.000, d = .99$); plant #7 ($M = 4.000$) different significantly from plant #8 ($M = 2.901, d = 1.26$).

Culture.

The ANOVA indicate a significant difference for leadership, $F(8,247) = 6.406, p = .000$. Tukey HSD post hoc tests indicate plant #1 ($M = 2.675$) differed significantly from plant #2 ($M = 3.369, d = .99$), plant #4 ($M = 3.456, d = 1.21$), plant #5 ($M = 3.412, d = 1.19$), plant #6 ($M = 3.448, d = 1.17$), plant #7 ($M = 3.693, d = 1.63$); plant #2 ($M = 3.369$) differed significantly from plant #8 ($M = 2.689, d = .99$); plant #3 ($M = 3.074$) differed significantly from plant #7 ($M = 3.693, d = 1.05$); plant #4 ($M = 3.456$) differed significantly from plant #7 ($M = 3.693, d = 1.05$), and plant #8 ($M = 2.689, d = 1.21$); plant #5 ($M = 3.412$) differed significantly from plant #8 ($M = 2.689, d = 1.20$); plant #6 ($M = 3.448$) differed significantly from plant #8 ($M = 2.689, d = .42$); plant #7 ($M = 3.693$) differed significantly from plant #8 ($M = 2.689, d = 1.64$).

Organizational / individual performance.

The ANOVA indicate a significant difference for organizational and individual performance, $F(8,245) = 2.511, p = .012$. Tukey HSD post hoc tests indicate plant #1 ($M = 3.009$) differed significantly from plant #7 ($M = 3.716, d = 1.01$).

Structure.

The ANOVA indicate a significant difference for structure, $F(8,247) = 4.329, p = .000$. Tukey HSD post hoc tests indicate plant #1 (2.719) differed significantly from plant #2 ($M = 3.431, d = .88$), and plant #7 ($M = 3.792, d = 1.44$); plant #3 ($M = 3.200$) differed significantly from plant #7 ($M = 3.792, d = .95$); plant #4 ($M = 3.048$) differed significantly from plant #7 ($M = 3.792, d = 1.06$); plant #5 ($M = 3.243$) differed significantly from plant #7 ($M = 3.792, d = 1.02$); plant #7 ($M = 3.792$) differed significantly from plant #9 ($M = 3.104, d = .91$).

Management practices.

The ANOVA indicate a significant difference for management practices, $F(8,247) = 2.654, p = .008$. Tukey HSD post hoc tests indicate plant #1 (3.240) differed significantly from plant #6 ($M = 4.313, d = 1.25$); plant #3 ($M = 3.527$) differed significantly from plant #6 ($M = 4.313, d = .96$).

Systems.

The ANOVA indicate a significant difference for systems, $F(8,247) = 2.025, p = .044$ however the Games-Howell post hoc tests did not indicate any significant variances ($p < .05$) between means thus indicating the variances are not statistically significant.

Motivation.

The ANOVA indicate a significant difference for motivation, $F(8,247) = 2.658, p = .008$. Tukey HSD post hoc tests indicate plant #1 (2.828) differed significantly from plant #7 ($M = 3.849, d = 1.05$); plant #3 ($M = 3.088$) differed significantly from plant #7 ($M = 3.849, d = .87$).

Transformation.

The ANOVA indicate a significant difference for transformation, $F(8,247) = 6.163, p = .000$. Games-Howell post hoc tests indicate plant #1 ($M=2.820$) differed significantly from plant #2 ($M=3.628, d = 1.13$), plant #4 ($M=3.590, d = 1.19$), plant #5 ($M=3.562, d = 1.18$), plant #6 ($M=3.671, d = 1.35$), and plant #7 ($M = 3.801, d = 1.48$); plant #3 ($M = 3.301$) differed significantly from plant #7 ($M = 3.801, d = .83$); plant #7 ($M = 3.301$) differed significantly from plant #8 ($M = 2.300, d = 2.55$).

Transactional.

The ANOVA indicate a significant difference for transactional, $F(8,247) = 2.469, p = .014$ however the Games-Howell post hoc tests did not indicate any significant variances ($p < .05$) between means.

Table 20

Means, Standard Deviations, and Significant Differences Between Plants and Burke-Litwin OAS Factors

Factor	Plant #1 (<i>n</i> = 16)		Plant #2 (<i>n</i> = 44)		Plant #3 (<i>n</i> = 38)		Plant #4 (<i>n</i> = 27)		Plant #5 (<i>n</i> = 53)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
External Environment	3.083 ₁	.639	3.830 ₁	.644	3.594 ₁	.594	3.878 ₁	.681	3.808 ₁	.502
Mission & Strategy	2.673 ₁	.692	3.673 _{1,2}	.724	3.476 ₁	.738	3.571 ₁	.670	3.480 ₁	.553
Leadership	2.733 ₁	1.348	3.659	.943	3.144 ₂	1.013	3.644	.740	3.661	.738
Culture	2.675 ₁	.702	3.369 _{1,2}	.699	3.074 ₃	.633	3.456 _{1,3}	.583	3.412 _{1,5}	.520
Performance	3.009 ₁	.771	3.612	.805	3.350	.768	3.503	.637	3.557	.605
Structure	2.719 ₁	.884	3.431 ₁	.728	3.200 ₃	.666	3.048 ₄	.809	3.243 ₅	.501
Management Practices	3.240 ₁	1.079	3.846	.801	3.527 ₃	1.013	3.752	.752	3.860	.617
Systems	2.737	.856	3.282	.755	3.016	.752	2.955	.615	3.134	.630
Climate	3.086	.826	3.578	.822	3.328	.992	3.398	.716	3.560	.641
Task / Skills	3.125	.917	3.464	.940	3.386	.847	3.180	.834	3.505	.670
Motivation	2.828 ₁	1.200	3.326	1.078	3.088 ₃	1.034	3.157	.875	3.495	.689
Needs and Values	3.569	1.109	3.789	.849	3.663	.806	3.585	.832	3.947	.692
Transformational	2.820 ₁	.762	3.628 ₁	.658	3.301 ₃	.650	3.590 ₁	.500	3.562 ₁	.447
Transactional	3.068	.852	3.580	.683	3.339	.807	3.392	.601	3.576	.487

Note. Common subscripts in each row indicate plant # with significant differences between means, $p < .05$ using Tukey HSD and Games Howell post hoc. All effect sizes (d) of significant differences were much larger than typical according to Cohen (Morgan et al., 2007, p. 94).

Table 20 (Cont.)

Factor	Plant #6 (<i>n</i> = 18)		Plant #7 (<i>n</i> = 26)		Plant #8 (<i>n</i> = 14)		Plant #9 (<i>n</i> = 20)		Total (<i>n</i> = 256)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
External Environment	4.092 ₁	.457	3.958 ₁	.511	3.521	.611	3.996 ₁	.446	3.801	.608
Mission & Strategy	3.686 ₁	.468	3.777 _{1,7}	.640	3.000 _{2,7}	.657	3.419	.563	3.521	.681
Leadership	3.862	.730	4.000 _{1,3,7}	.677	2.901 ₇	1.030	3.442	.964	3.533	.954
Culture	3.448 _{1,6}	.621	3.693 _{1,3,7}	.538	2.689 _{2,4,5,6,7}	.678	3.246	.846	3.306	.688
Performance	3.587	.566	3.716 ₁	.616	3.101	.685	3.245	.828	3.465	.720
Structure	3.421	.846	3.792 _{1,3,4,5,7}	.576	3.149	.744	3.104 ₇	.907	3.285	.743
Management Practices	4.313 _{1,3}	.551	3.869	.685	3.707	.770	3.718	.756	3.777	.807
Systems	3.144	.698	3.453	.952	2.831	.807	3.288	.892	3.127	.769
Climate	3.653	.876	3.745	.739	3.410	.742	3.494	1.003	3.494	.817
Task / Skills	3.793	.637	3.699	.768	3.345	.802	3.450	.868	3.449	.818
Motivation	3.694	.847	3.849 _{1,3}	.684	3.232	.963	3.325	.939	3.350	.942
Needs and Values	4.033	.765	4.000	.625	3.621	.638	3.550	.786	3.779	.794
Transformational	3.671 _a	.462	3.801 _{1,3,7}	.549	2.300 _c	.626	3.353	.663	3.476	.630
Transactional	3.791	.536	3.778	.627	3.371	.674	3.477	.751	3.507	.677

Note. Common subscripts in each row indicate plant # with significant differences between means, $p < .05$ using Tukey HSD and Games Howell post hoc. All effect sizes (d) of significant differences were much larger than typical according to Cohen (Morgan et al., 2007, p. 94).

Research Question (2) Analysis

2. *What are the relationships between the 14 dimensions of the Burke-Litwin organizational performance and change model and objective financial outcome variables as defined by three measures of plants' performance (gross margin variance, inventory turn variance, and warranty variance).*

Correlations between Burke-Litwin OP&C and objective financial data.

To investigate associations between the Burke-Litwin OP&C factors and the plants' objective financial data, three separate bivariate correlations were computed and presented in the following sections. All variables from the Burke-Litwin OAS were normally distributed and assumptions of linearity were not noticeably violated however, since the firms' objective financial data are ordinal, Spearman' rho (r_s) correlations were computed to examine relationships.

Gross margin variance correlations.

Table 21 does not reveal any statistically significant correlations between the Burke-Litwin OP&C factors and gross margin variance. This finding indicates a lack of positive or negative relationships among the OP&C factors and gross margin variance.

Table 21

Intercorrelations for Burke-Litwin OP&C Factors and Gross Margin Variance (listwise N = 254)

	GM Variance	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Gross Margin Variance	--	.015	.056	.057	.053	.090	-.047	.060	-.016	.016	.038	.014	.097	.066	.031
		.810	.372	.364	.400	.151	.459	.342	.795	.804	.550	.824	.122	.295	.623
1. External		--	.461	.480	.464	.422	.379	.351	.421	.330	.353	.389	.308	.569	.433
			.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
2. Mission & Strategy				.624	.665	.632	.566	.433	.541	.527	.473	.554	.443	.824	.584
			--	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
3. Leadership					.765	.673	.610	.608	.641	.607	.590	.684	.562	.864	.735
				--	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
4. Culture						.751	.686	.572	.705	.653	.588	.697	.560	.914	.758
					--	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
5. Organizational Performance							.638	.636	.696	.667	.664	.746	.683	.866	.802
						--	.000	.000	.000	.000	.000	.000	.000	.000	.000
6. Structure								.509	.637	.647	.574	.611	.498	.714	.734
							--	.000	.000	.000	.000	.000	.000	.000	.000
7. Management Practices									.639	.585	.645	.687	.577	.634	.850
								--	.000	.000	.000	.000	.000	.000	.000
8. Systems										.696	.665	.705	.629	.739	.865
									--	.000	.000	.000	.000	.000	.000
9. Work Group Climate											.586	.690	.553	.693	.824
										--	.000	.000	.000	.000	.000
10. Task Req. / Indv. Skills												.755	.720	.653	.819
											--	.000	.000	.000	.000
11. Motivation													.734	.758	.871
												--	.000	.000	.000
12. Individual Needs and Values														.631	.776
													--	.000	.000
13. Transformational															.816
														--	.000
14. Transactional															--

Note: Significant correlation among the gross margin variance and the Burke-Litwin OAS factors are in bold; Significance is *italicized*.

Inventory turns variance correlations.

Table 22 reveals 12 of the 14 Burke-Litwin OP&C factors were significantly correlated with inventory turns variance however, the effect sizes are considered smaller than typical according to Cohen (Morgan et al., 2007, p. 94). All significant correlations were positive with the strongest between inventory turns variance and structure, $r_s(252) = .19, p < .002$; systems, $r_s(252) = .19, p < .003$; and transactional, $r_s(252) = .19, p < .003$. The other significant correlations were external environment, $r_s(252) = .18, p < .004$; motivation, $r_s(252) = .18, p < .005$; leadership, $r_s(252) = .17, p < .025$; transformational, $r_s(252) = .16, p < .010$; work group climate, $r_s(252) = .15, p < .018$; task requirement and individual skills, $r_s(252) = .15, p < .015$; culture, $r_s(252) = .14, p < .025$; management practices, $r_s(252) = .14, p < .029$; and mission and strategy, $r_s(252) = .13, p < .037$. Each of these significant correlations indicates plants with a higher positive inventory variance were likely to have higher scores in the associated significant OP&C factor. However, with small effect sizes, the r^2 indicates that approximately 2.5% to 3.5% of the OP&C factor variance can be explained from the plant inventory turns variance.

Table 22

Intercorrelations for Burke-Litwin OP&C Factors and Inventory Turns Variance (listwise N = 254)

	IT Variance	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Inventory Turns Variance	--	.182	.131	.168	.141	.093	.190	.137	.188	.149	.153	.176	.095	.161	.186
1. External		<i>.004</i>	<i>.037</i>	<i>.007</i>	<i>.025</i>	<i>.141</i>	<i>.002</i>	<i>.029</i>	<i>.003</i>	<i>.018</i>	<i>.015</i>	<i>.005</i>	<i>.132</i>	<i>.010</i>	<i>.003</i>
2. Mission & Strategy			<i>.461</i>	<i>.480</i>	<i>.464</i>	<i>.422</i>	<i>.379</i>	<i>.351</i>	<i>.421</i>	<i>.330</i>	<i>.353</i>	<i>.389</i>	<i>.308</i>	<i>.569</i>	<i>.433</i>
3. Leadership			<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>
4. Culture				<i>.624</i>	<i>.665</i>	<i>.632</i>	<i>.566</i>	<i>.433</i>	<i>.541</i>	<i>.527</i>	<i>.473</i>	<i>.554</i>	<i>.443</i>	<i>.824</i>	<i>.584</i>
5. Organizational Performance				<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>
6. Structure					<i>.765</i>	<i>.673</i>	<i>.610</i>	<i>.608</i>	<i>.641</i>	<i>.607</i>	<i>.590</i>	<i>.684</i>	<i>.562</i>	<i>.864</i>	<i>.735</i>
7. Management Practices					<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>
8. Systems						<i>.751</i>	<i>.686</i>	<i>.572</i>	<i>.705</i>	<i>.653</i>	<i>.588</i>	<i>.697</i>	<i>.560</i>	<i>.914</i>	<i>.758</i>
9. Work Group Climate						<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>
10. Task Req. / Indv. Skills							<i>.638</i>	<i>.636</i>	<i>.696</i>	<i>.667</i>	<i>.664</i>	<i>.746</i>	<i>.683</i>	<i>.866</i>	<i>.802</i>
11. Motivation							<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>
12. Individual Needs and Values								<i>.509</i>	<i>.637</i>	<i>.647</i>	<i>.574</i>	<i>.611</i>	<i>.498</i>	<i>.714</i>	<i>.734</i>
13. Transformational								<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>
14. Transactional									<i>.639</i>	<i>.585</i>	<i>.645</i>	<i>.687</i>	<i>.577</i>	<i>.634</i>	<i>.850</i>
									<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>
										<i>.696</i>	<i>.665</i>	<i>.705</i>	<i>.629</i>	<i>.739</i>	<i>.865</i>
										<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>
											<i>.586</i>	<i>.690</i>	<i>.553</i>	<i>.693</i>	<i>.824</i>
											<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>
												<i>.755</i>	<i>.720</i>	<i>.653</i>	<i>.819</i>
												<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>
													<i>.734</i>	<i>.758</i>	<i>.871</i>
													<i>.000</i>	<i>.000</i>	<i>.000</i>
														<i>.631</i>	<i>.776</i>
														<i>.000</i>	<i>.000</i>
															<i>.816</i>
															<i>.000</i>
															--
															--

Note: Significant correlation among the inventory turns variance and Burke-Litwin OAS factors are in bold; Significance is *italicized*.

Warranty variance correlations.

Table 23 reveals four of the 14 Burke-Litwin OP&C factors were significantly correlated with warranty variance however, the effect sizes are considered smaller than typical according to Cohen (Morgan et al., 2007). All significant correlations were positive with the strongest between warranty variance and culture, $r_s(252) = .16, p < .013$. The other significant correlations were mission and strategy, $r_s(252) = .15, p < .020$; structure, $r_s(252) = .13, p < .040$; and transformational, $r_s(252) = .13, p < .044$. Each of these significant correlations indicates plants with a higher positive warranty variance were likely to have higher scores in the associated significant OP&C factor. However, with small effect sizes, the r^2 indicates that approximately 2.5% of the OP&C factor variance can be explained from the plant warranty variance.

Table 23

Intercorrelations for Burke-Litwin OP&C Factors and Warranty Variance (listwise N = 254)

	Warranty	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Warranty variance		.009	.145	.068	.156	.116	.129	-.052	.089	.046	.031	.065	.049	.127	.049
	--	.890	.020	.277	.013	.065	.040	.409	.158	.465	.618	.300	.435	.044	.432
1. External			.461	.480	.464	.422	.379	.351	.421	.330	.353	.389	.308	.569	.433
	--		.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
2. Mission & Strategy				.624	.665	.632	.566	.433	.541	.527	.473	.554	.443	.824	.584
			--	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
3. Leadership					.765	.673	.610	.608	.641	.607	.590	.684	.562	.864	.735
				--	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
4. Culture						.751	.686	.572	.705	.653	.588	.697	.560	.914	.758
					--	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
5. Organizational Performance							.638	.636	.696	.667	.664	.746	.683	.866	.802
						--	.000	.000	.000	.000	.000	.000	.000	.000	.000
6. Structure								.509	.637	.647	.574	.611	.498	.714	.734
							--	.000	.000	.000	.000	.000	.000	.000	.000
7. Management Practices									.639	.585	.645	.687	.577	.634	.850
								--	.000	.000	.000	.000	.000	.000	.000
8. Systems										.696	.665	.705	.629	.739	.865
									--	.000	.000	.000	.000	.000	.000
9. Work Group Climate											.586	.690	.553	.693	.824
										--	.000	.000	.000	.000	.000
10. Task Req. / Indv. Skills												.755	.720	.653	.819
											--	.000	.000	.000	.000
11. Motivation													.734	.758	.871
												--	.000	.000	.000
12. Individual Needs and Values														.631	.776
													--	.000	.000
13. Transformational															.816
														--	.000
14. Transactional															--

Note: Significant correlation among the warranty variance and Burke-Litwin OAS factors are in bold; Significance is *italicized*.

Correlations between LOSAMS and objective financial data.

A final correlation investigated relationships between the overall LOSAMS scores and the plants' objective financial data. Table 24 reveals three significant correlations: LOSAMS and gross margin variance, $r_s(252) = .56, p < .001$; LOSAMS and inventory turns variance, $r_s(252) = .31, p < .001$; and between warranty variance and inventory variance, $r_s(252) = .30, p < .001$. The first two significant correlations indicate plants with higher positive LOSAMS scores were associated with positive gross margin variances and positive inventory turns variances. The correlation also indicated a significant relationship between higher positive warranty variance and positive inventory turn variances. According to Cohen's guidelines on effect sizes the relationship between LOSAMS and inventory variance is much larger than typical with the r^2 accounting for 31% of the variance. The other significant relationships are typical and account for approximately 10% of the variance in each LOSAMS's relationship with inventory variance and warranty variance's relationship with inventory variance.

Table 24

Intercorrelations for LOSAMS and Objective Financial Data (listwise N = 254)

	LOSAMS	Gross margin variance	Warranty variance	Inventory turns variance
LOSAMS		.558	-.018	.310
	--	<i>.000</i>	<i>.773</i>	<i>.000</i>
Gross margin variance			-.086	.068
		--	<i>.168</i>	<i>.281</i>
Warranty variance				.304
			--	<i>.000</i>
Inventory turns variance				
				--

Note: Significant correlations are in bold; Significance is *italicized*.

CHAPTER 5: DISCUSSION

This chapter will discuss the findings presented in Chapter 4 and draw conclusions based on data gathered during the research project. Instrument reliability and validity are reviewed followed by a summary, future research, and implications.

Summary of the study

The purpose of this non-experimental research study was to examine relationships between OP&C factors and the perceived leanness and objective performance measures within a medium-sized manufacturing organization engaged in lean transformation. Burke (2008) suggested successful transformational change is often predicated upon an organization's ability to understand dimensions influencing change interventions as outlined in the Burke-Litwin model of OP&C. To better understand why lean interventions succeed in some instances and not in others, it is important to study relationships between OP&C dimensions and their impact on the leanness an organization achieves.

To illustrate possible connections between lean and the OP&C model, the conceptual lean transformation model (Figure 9) was developed with the first tier implying lean thinking's similarities to transformational variables described by Burke (2008) as "more closely linked with leadership" activities (p. 190). The second tier promotes lean principles similar to transactional activities within the Burke-Litwin model of OP&C and "more closely associated with management" activities (p. 190). The final

tier of the lean transformation model is associated with leanness and similar to the output variable organizational performance within the Burke-Litwin model of OP&C.

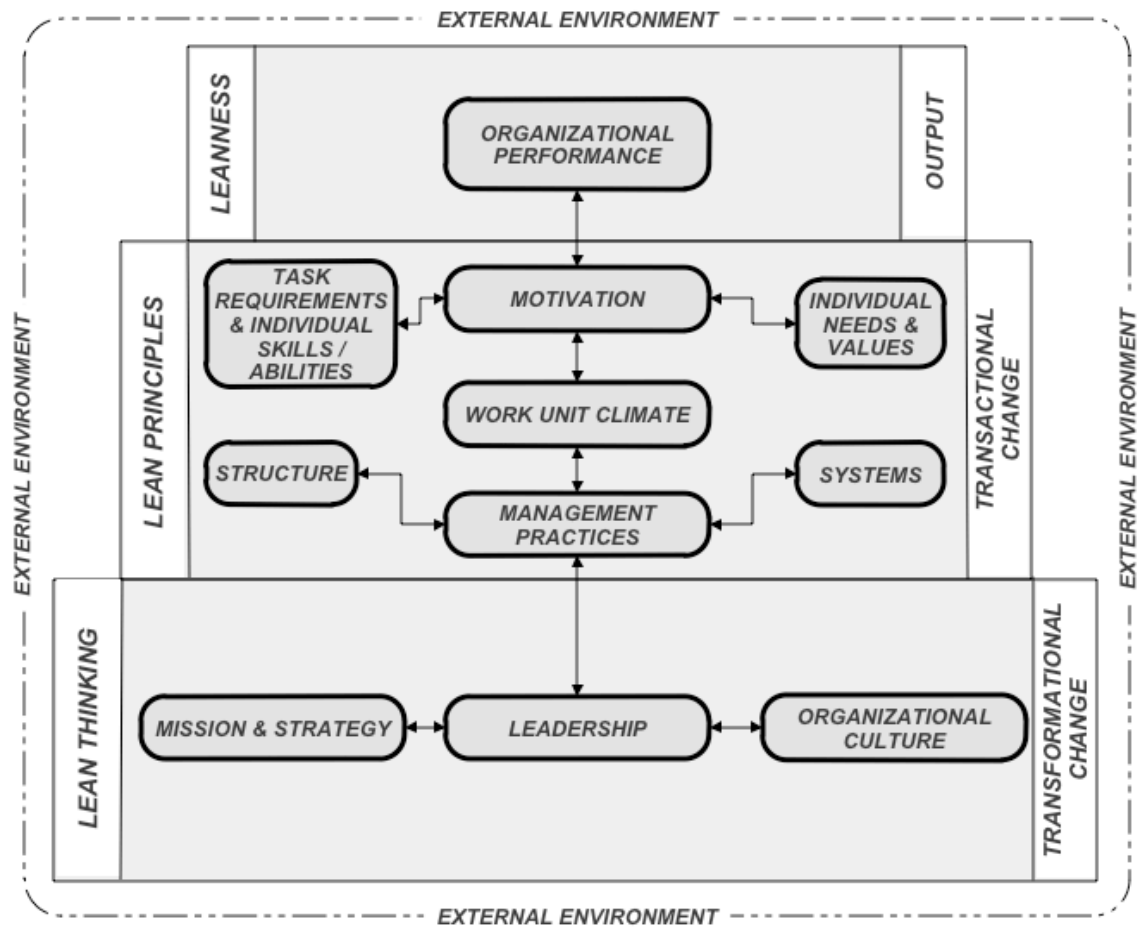


Figure 9. Lean transformation model

Research questions for this study were designed to investigate these connections within the host organization and determine if any statistically significant relationships exist.

1. What are the relationships between the 14 dimensions of the Burke-Litwin organizational performance and change model and the perceptual assessment of leanness?

2. What are the relationships between the 14 dimensions of the Burke-Litwin organizational performance and change model and objective financial outcome variables as defined by three measures of plants' performance (gross margin variance, inventory turn variance, and warranty variance)?

Using the LOSAMS the perceived leanness of nine manufacturing plants were determined along with the perceived scores relating to each of the 14 variables from the Burke-Litwin OAS. Data analysis included ANOVAs and bivariate correlations with the results presented in Chapter 4.

Conclusions

Research question (1).

What are the relationships between the 14 dimensions of the Burke-Litwin organizational performance and change model and the perceptual assessment of leanness?

As reported in the literature (Anderson-Rudolf, 1996; Burke & Litwin, 1992; Di Pofi, 2002; Falletta, 1999; Fox, 1990) the internal relationships among the 12 factors within the Burke-Litwin OAS were highly correlated and shown in Tables 18, 21, 22 and 23. While these confirm the relationships Burke suggested, to answer the first research question one must look beyond the internal relationships and examine connections between perceived leanness of the manufacturing plants and 14 attribute variables of Burke-Litwin OAS scores. Table 25 presents the plants in ranked order from 'most' lean to 'least' lean with plant #5 ($M = 3.52$) being the leanest and plant #3 ($M = 2.40$) being the least lean.

Table 25

Overview of Attribute Variables by Plant Leanness Ranking

Factor	Plant #								
	5	6	7	1	2	8	4	9	3
Leanness (LOSAMS)	3.52	3.41	3.05	3.04	2.97	2.85	2.79	2.49	2.40
<i>Transformational</i>	3.52	3.69	3.79	2.82	3.59	2.97	3.55	3.42	3.29
External Environment	3.81	4.09	3.96	3.08	3.83	3.52	3.88	4.00	3.59
Mission & Strategy	3.48	3.69	3.78	2.79	3.67	3.00	3.57	3.42	3.48
Leadership	3.66	3.86	4.00	2.73	3.66	2.90	3.64	3.44	3.14
Culture	3.41	3.45	3.69	2.68	3.37	2.69	3.46	3.25	3.07
Performance	3.56	3.59	3.72	3.01	3.61	3.10	3.50	3.25	3.35
<i>Transactional</i>	3.55	3.79	3.75	3.07	3.58	3.37	3.36	3.48	3.34
Structure	3.24	3.42	3.79	2.72	3.43	3.15	3.05	3.10	3.20
Management Practices	3.86	4.31	3.87	3.24	3.85	3.71	3.75	3.72	3.53
Systems	3.13	3.14	3.44	2.74	3.28	2.83	2.96	3.29	3.02
Climate	3.56	3.65	3.75	3.09	3.58	3.41	3.40	3.49	3.33
Task / Skills	3.50	3.79	3.70	3.13	3.46	3.35	3.18	3.45	3.39
Motivation	3.50	3.69	3.85	2.83	3.33	3.23	3.16	3.33	3.09
Needs and Values	3.95	4.03	4.00	3.57	3.79	3.62	3.59	3.55	3.66

Note.

While seven of the 14 attribute variables indicated significant correlations with the leanness of a plant: leadership ($r = .19$), culture ($r = .16$), management practices ($r = .15$), motivation ($r = .15$), individual needs and values ($r = .16$), transformational ($r = .16$), and transactional ($r = .13$), the effect sizes (d) were smaller than typical according to Cohen's values (Morgan et al., 2007) rendering the findings of little practical significance. In addition to bivariate correlations, hierarchical linear modeling was investigated however, very small interclass correlations among the leanness of plants and

the attribute variables indicated insufficient correlations to examine and the effort was abandoned. The lack of practical significance among the OP&C variables and the leanness of the manufacturing plants does not allow one to draw any conclusions that leanness has a positive or negative relationship between the OP&C variables.

Shifting away from the associational approach to a comparative approach, one-way ANOVAs were completed comparing each of the nine plant scores from the Burke-Litwin OAS to one another for significant differences. One-way ANOVAs and post hoc test were not computed for the LOSAMS leanness score because plant #4 has less than two cases and the skewness violated the normal distribution assumption for all of the nine plants, most likely due to the small sample size. As noted in Table 26 (and detailed in Table 19), eight of the nine plants indicated significant differences within the transformational variable, and associated sub-set variables had a much higher frequency of differences (with the exception of performance) when compared to the transactional variable. Structure, a sub-set of transactional, was the only variable to indicate a higher frequency of significant differences between seven of the nine plants. Transactional, systems, climate, and needs and values did not indicate any significant differences among plants suggesting a more homogeneous connection.

Table 26

Overview of Significant Differences and Non-Significant Differences Between Plants

Factor	Plant #								
	1	2	3	4	5	6	7	8	9
<i>Transformational</i>	SD ₁	SD ₁	SD ₃	SD ₁	SD ₁	SD ₁	SD _{1,3,7}	SD ₇	--
External Environment	SD ₁	SD ₁	SD ₁	SD ₁	SD ₁	SD ₁	SD ₁	--	SD ₁
Mission & Strategy	SD ₁	SD _{1,2}	SD ₁	SD	SD	SD ₁	SD _{1,7}	SD _{2,7}	--
Leadership	SD ₁	--	SD ₃	--	--	--	SD _{1,3,7}	SD ₇	--
Culture	SD ₁	SD _{1,2}	SD ₃	SD _{1,4}	SD _{1,5}	SD _{1,6}	SD _{1,3,7}	SD _{2,4,5,6,7}	--
Performance	SD ₁	--	--	--	--	--	SD ₁	--	--
<i>Transactional</i>	--	--	--	--	--	--	--	--	--
Structure	SD ₁	SD ₁	SD ₃	SD ₄	SD ₅	--	SD _{1,3,4,5,7}	--	SD ₇
Management Practices	SD ₁	--	SD ₃	--	--	SD _{1,3}	--	--	--
Systems	--	--	--	--	--	--	--	--	--
Climate	--	--	--	--	--	--	--	--	--
Task / Skills	--	--	--	--	--	--	--	--	--
Motivation	SD ₁	--	SD ₃	--	--	--	SD _{1,3}	--	--
Needs and Values	--	--	--	--	--	--	--	--	--

Note. (SD) = significant differences; (--) = non-significant differences; common subscripts in each row indicate plant #.

This finding of transformational variables being more diverse among plants than transactional variables is of interest when one returns to the Burke-Litwin OP&C model and the supporting theory suggesting organizations focused more on transformational activities tend to perform better than those focused on transactional. Seven of the nine plants are geographically separated by at least hundreds of miles (plants #4 and #5 in

addition to plants #6 and #7 are located on the same sites) however, their similarities (no significant differences) indicate cohesiveness among the transactional variable and differences among the transformational variables. While this finding does not allow one to suggest relationships between transformational and transactional attributes, it does demonstrate grouping of variables as promoted by Burke and Litwin (1992).

Plant variances between means was highest for culture which is often defined as “the way we do things around here” (Deal & Kennedy, 1982, p. 4). Burke (2008) expanded the “way” as the norms, both implicit and explicit rules, adopted by members within the organization. It is not surprising that culture has high variances since each plant is essentially led by its own plant level leaders and culture is strongly influenced by the leaders within the organization. Mission and strategy within this organization are established at the corporate level then disseminated and implemented at the plant level possibly explaining why mission and strategy are more consistent than culture when connected to leadership functions.

To summarize the conclusion for research question (1), the relationships among the 14 dimensions of the OP&C model and the perceived leanness of manufacturing plants did yield a number of statistical significant findings with small effect sizes indicating possible correlations but uncertain practical significance.

Research question (2).

What are the relationships between the 14 dimensions of the Burke-Litwin organizational performance and change model and objective financial outcome variables as defined by three measures of plants’ performance (gross margin variance, inventory turn variance, and warranty variance)?

Bivariate correlations were computed to determine intercorrelations among the 14 variables of the Burke-Litwin OAS and three objective financial outcome variables based on gross margin variance, inventory turn variance, and warranty variance of the nine plants. No significant correlations were found among the gross margin variable and each of the 14 Burke-Litwin OAS variables. Four statistically significant warranty variance correlations were discovered between mission and strategy ($r = .15$), culture ($r = .16$), structure ($r = .13$), and transformational ($r = .13$), however, the effect sizes (d) were smaller than typical suggesting limited practical significance of the findings. Inventory turns variance revealed 12 of the 14 Burke-Litwin OAS variables, (external environment ($r = .18$), mission and strategy ($r = .13$), leadership ($r = .17$), culture ($r = .14$), structure ($r = .19$), management practices ($r = .14$), systems ($r = .19$), work group climate ($r = .15$), task and skills ($r = .15$), motivation ($r = .18$), transformational ($r = .16$), and transactional ($r = .19$), had significant correlations however, the effect sizes (d) were smaller than typical offering little insight into the relationships between these variables.

Additional bivariate correlations were investigated between the aggregated LOSAMS scores, gross margin variance, warranty variance, and inventory turns variance resulting in statistical and practical significant correlations. LOSAMS demonstrated significant correlations with gross margin variance ($r = .56$) indicating plants with higher positive LOSAMS scores were associated with positive gross margin variances. LOSAMS was also significantly correlated with inventory turns variance ($r = .31$). The other significant correlation was among warranty variance and inventory turns variance ($r = .30$) indicating an association between positive warranty variance and positive inventory turns variance.

To summarize the conclusion for research question (2), the relationships among the 14 dimensions of the OP&C model and the objective financial variables of manufacturing plants yielded a number of statistical significant findings, but with small effect sizes rendering the findings practical significance questionable. There was evidence of statistical significant associations with larger than typical effect sizes between the aggregated LOSAMS leanness score and two of the objective measures indicating a possible link between that could prove beneficial for future development of measuring relationships between leanness and financial performance.

Instrument reliability and validity.

The Burke-Litwin OAS indicated reliability measures consistent with previous literature (Anderson-Rudolf, 1996; Di Pofi, 2002; Falletta, 1999; Fox, 1990) and performed as expected. To investigate validity, an exploratory factor analysis (EFA) was performed and reported in Chapter 4 with results indicating loadings consistent to the original design by Burke and Litwin (1982) and reported in Anderson- Rudolf (1996). The measurement reliability and validity for the Burke-Litwin OAS have met the standard for consistency (reliability) and accuracy (validity) as suggested by Gliner et al. (2009).

The LOSAMS is lacking confirmed reliability and validity as is the original LESAT instrument within research literature. From the conception of the LESAT instrument (MIT, 2001; Nightingale & Mize, 2002) to current research (Hallam, 2003; Jones, 2006; Seitz, 2003; Shan, 2008) traditional measurement reliability (Cronbach's α) and validity (exploratory and/or confirmatory factor analysis) have yet to be confirmed. This lack of information renders the results of the LOSAMS and LESAT skeptical and inconclusive (Gliner et al., 2009). During this research study, an effort to improve the

quality of the LOSAMS measurement reliability and validity were made by determining the Cronbach's alphas and subjecting the scores to an EFA. The results indicated favorable reliability measures on the nine factors however, the EFA loadings did not represent consistency with the original factors presented in the LESAT instrument. The small sample size ($n = 56$) has likely contributed to the incongruence but further studies are necessary to validate this instrument before declaring usefulness results.

Summary

The overall purpose of this study was to examine relationships between OP&C factors and the perceived leanness and objective performance measures within an organization engaged in lean transformation. The Lean Transformation Model (Figure 9) conceptualizes possible connections between the Burke-Litwin OP&C dimensions and three tiers of lean thinking, lean principles, and leanness. Based on the findings and conclusions, relationships between the first two tiers was not obvious however, a relationship might appear to exist between tier three (leanness) and the objective financial data.

Originally, I hypothesized lean thinking and transformational change along with lean principles and transactional change should have some relational value to each other. Literature supported lean thinking as being more associated with leadership activities similar to the transformational aspects of the Burke-Litwin OP&C model. Also supported was the connection between lean principles and transactional activities aligned with management. However, the lack of significant relationships from the study indicates otherwise and raises additional questions about *how* to assess leanness of an organization while providing a more systematic approach to lean transformations.

The significant findings between leanness and objective financial data lend some credence to existing research and the development of more practical measures that capture connections between lean and improved financial performance (Bayou & de Korvin, 2008; Meade et al., 2006; Srinivasaraghavan & Allada, 2006). The LESAT was originally developed to assist leaders of lean implementations and not intended to be used as the sole measure of leanness outcomes (Nightingale & Mize, 2002). The relationships between the perceived scores of leanness and objective financial data are similar to Hallam's (2003) research suggesting a combination between "lagging financial indicators" and "leading indicators of performance" as a more realistic measure of leanness.

Future Research

As became apparent during this research study, using the LOSAMS to gather perceptions about leanness at the plants was problematic. The small sample size in addition to the lack of measurement validity resulted in suspect data and a violation of numerous statistical assumptions limiting possible analysis. A single instrument needs to be developed that is capable of measuring 'leanness' as the output variable. A suggestion would be to add or revise the 'individual and organizational performance' variable in the Burke-Litwin OAS instrument to be more specific to outcomes measured in the LOSAMS.

Another suggestion for future research is a longitudinal study using the Burke-Litwin OAS pre and post lean interventions. This study employed the Burke-Litwin OAS to measure the perceptions of participants and to establish a benchmark for future analysis but was not part of a larger change initiative. To further develop the Lean

Transformation Model, repeated studies are necessary to determine if the OP&C variables align with the three tiers of lean as suggested.

Connecting objective financial performance indicators to lean transformations continues to be of interest within management literature and industry. Many of the lean assessment tools currently available (i.e., The Shingo Prize, LESAT, Malcolm Baldrige) suggest leanness correlates to improved financial performance however, little empirical research supports this statement. This research study stumbled across significant findings between leanness and a few financial indicators that could indicate possible relationships worth exploring. It is unclear if these relationships were attributed to variance or another latent variable. A study comparing financial performance and lean activities could yield interesting findings and help substantiate or discredit the impact lean transformations have on the 'bottom line' within organizations.

Implications

While this research study did not reveal many statistically significant relationships between OP&C factors and different tiers of lean, the practical implications are many. Chapter 1 and the conceptual development section promoted the use of sound OD, OC, and HRD principles and practices that could benefit the well intentioned but ill-informed change agent. Chapter 2 offers what appears to be the first systematic review of scholarly lean literature published in an effort to provide a reliable history and shared language for future researchers. Chapter 3 detailed the reliability and validity of a robust OD instrument (Burke-Litwin OAS) and revealed opportunities for a promising but weak measure of leanness (LOSAMS). Chapter 5 offers conclusions and a research agenda for future studies in lean transformations.

In closing, research within organizations is dynamic and challenging and often relies on the perceptions of individuals to determine associations between behaviors and performance. While this research did not reveal many statistically significant findings, the process of using organizational surveys combined with the development of a conceptual model of lean transformations based on sound OD/OC/HRD theories and practices has provided a foundation for building future applied research. Many organizations referenced in this research study have encountered enormous change since mid-2009 (i.e., Toyota quality issues, General Motors bankrupt) and are experiencing external environmental forces like never before. If Burke's theory is correct, the catalyst for shifting the status quo has arrived for these organizations and there is much to be learned through observing, inquiring, questioning, analyzing, and synthesizing. The opportunity for scholars and practitioners to combine resources and develop practical interventions designed to improve performance based on solid theoretical frameworks is now...let's not miss the opportunity.

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APPENDIX A:
FOUR DECADES OF LEAN LITERATURE

Lean Literature Published in Scholarly Journals Over Four Decades

Journal Name	1970 – 1990	1991 – 1996	1997 – 2000	2001 – 2005	2006 – 2009
<i>Academy of Management Executive</i>				1	
<i>Academy of Management Perspectives</i>					2
<i>Action Learning: Research and Practice</i>					1
<i>Advances in Developing Human Resources</i>				1	
<i>Antidote (The)</i>			1		
<i>Applied Psychology: An International Review</i>		4			
<i>British Journal of Management</i>		2			
<i>Business Horizons</i>					1
<i>California Management Review</i>		1	1		
<i>Canadian Journal of Civil Engineering</i>					1
<i>Critical Sociology</i>					1
<i>Economic & Industrial Democracy</i>			2	2	
<i>Economic Geography</i>				1	
<i>Employee Relations</i>			2		
<i>Engineering Management Journal</i>				1	2
<i>Environmental Quality Management</i>				1	
<i>Forest Products Journal</i>				2	2
<i>Harvard Business Review</i>	1		1	1	2
<i>Human Factors and Ergonomics in Manufacturing</i>				4	
<i>Human Relations</i>		1	1		

Lean Literature Published in Scholarly Journals Over Four Decades (Cont.)

Journal Name	1970 – 1990	1991 – 1996	1997 – 2000	2001 – 2005	2006 – 2009
<i>Human Resource Development Review</i>					
<i>IIE Solutions</i>			2	1	
<i>Industrial & Labor Relations Review</i>			1		
<i>Industrial Management</i>				1	
<i>Industrial Management & Data Systems</i>				1	
<i>Information Knowledge Systems Management</i>			1	1	
<i>International Journal of Advanced Manufacturing Technology</i>					1
<i>International Journal of Employment Studies</i>			1	1	
<i>International Journal of Human Resource Management</i>		1			
<i>International Journal of Industrial Ergonomics</i>					1
<i>International Journal of Logistics: Research & Applications</i>				1	
<i>International Journal of Operations & Production Management</i>		9	2	4	2
<i>International Journal of Production Economics</i>		2			1
<i>International Journal of Production Research</i>	1		1	2	8
<i>International Journal of Productivity & Performance Management</i>					1
<i>International Journal of Social Economics</i>				1	
<i>International Journal of Sustainability in Higher Education</i>				1	
<i>International Journal of Technology Management</i>					1

<i>Lean Literature Published in Scholarly Journals Over Four Decades (Cont.)</i>					
Journal Name	1970 – 1990	1991 – 1996	1997 – 2000	2001 – 2005	2006 – 2009
<i>Journal of Advanced Manufacturing Systems</i>					2
<i>Journal of Applied Psychology</i>				1	
<i>Journal of Business Ethics</i>			1		
<i>Journal of Engineering and Technology Management</i>					1
<i>Journal of Management History</i>					1
<i>Journal of Management in Engineering</i>					1
<i>Journal of Manufacturing Systems</i>				1	1
<i>Journal of Manufacturing Technology Management</i>					1
<i>Journal of Marketing Management</i>			1		
<i>Journal of Occupational Health Psychology</i>			2		
<i>Journal of Operations Management</i>	1			1	5
<i>Journal of Organizational Excellence</i>				4	
<i>Labor Law Journal</i>		1			
<i>Labor Studies Journal</i>		2			
<i>Leadership & Organization Development Journal</i>				1	
<i>Management Accounting Quarterly</i>				1	
<i>Management Accounting Research</i>					1
<i>Management Decision</i>				1	1
<i>Management Services</i>				1	1
<i>Manufacturing Engineer</i>					2
<i>Materials & Manufacturing Processes</i>					1
<i>Mineral Resources Engineering</i>			1		

<i>Lean Literature Published in Scholarly Journals Over Four Decades (Cont.)</i>					
Journal Name	1970 – 1990	1991 – 1996	1997 – 2000	2001 – 2005	2006 – 2009
<i>Performance Improvement Quarterly</i>				1	
<i>Personnel Review</i>					1
<i>Production & Inventory Management Journal</i>			1		
<i>Production and Operations Management</i>		1			
<i>Production Planning & Control</i>			2		
<i>Progress in Human Geography</i>				1	
<i>Psychology and Education: An Interdisciplinary Journal</i>					1
<i>Public Administration Review</i>		1			
<i>Public Money & Management</i>					2
<i>Quality Progress</i>				1	
<i>Reflections</i>					2
<i>Robotics & Computer-Integrated Manufacturing</i>					1
<i>Sloan Management Review</i>	1				1
<i>Sloan School of Management</i>	1			3	3
<i>Strategic Direction</i>					1
<i>Studies in Continuing Education</i>				1	
<i>Technology Teacher</i>					1
<i>Technovation</i>			1	2	
<i>TQM Magazine</i>					2
<i>Work Employment Society</i>			1		
<i>WorkingUSA</i>				1	
TOTALS	5	25	26	49	57

APPENDIX B:
BURKE-LITWIN OAS ADMINISTRATION DOCUMENTS

NOTICE OF APPROVAL FOR HUMAN RESEARCH

DATE: January 29, 2010
TO: Chermack, Thomas, 1588 School of Education
DeVoe, Dale, 1501 Dean Applied Hum Sci, Stone, Kyle, 1588 School of Education
FROM: Barker, Janell, CSU IRB 2
PROTOCOL TITLE: Organizational Performance and Change factors associated with Lean Transformations
FUNDING SOURCE: NONE
PROTOCOL NUMBER: 09-1585H
APPROVAL PERIOD: Approval Date: January 28, 2010 Expiration Date: January 27, 2011

The CSU Institutional Review Board (IRB) for the protection of human subjects has reviewed the protocol entitled: Organizational Performance and Change factors associated with Lean Transformations. The project has been approved for the procedures and subjects described in the protocol. This protocol must be reviewed for renewal on a yearly basis for as long as the research remains active. Should the protocol not be renewed before expiration, all activities must cease until the protocol has been re-reviewed.

If approval did not accompany a proposal when it was submitted to a sponsor, it is the PI's responsibility to provide the sponsor with the approval notice.

This approval is issued under Colorado State University's Federal Wide Assurance 00000647 with the Office for Human Research Protections (OHRP). If you have any questions regarding your obligations under CSU's Assurance, please do not hesitate to contact us.

Please direct any questions about the IRB's actions on this project to:

Janell Barker, Senior IRB Coordinator - (970) 491-1655 Janell.Barker@Research.Colostate.edu
Evelyn Swiss, IRB Coordinator - (970) 491-1381 Evelyn.Swiss@Research.Colostate.edu



Barker, Janell

Includes:

Approval is for 400 participants. Because of the nature of this research, it will not be necessary to obtain a signed consent form. However, all subjects must be consented with the approved electronic cover letter. The requirement of



Knowledge to Go Places

Research Integrity & Compliance Review Office
Office of the Vice President for Research
321 General Services Building - Campus Delivery 2011
Fort Collins, CO
TEL: (970) 491-1553
FAX: (970) 491-2293

documentation of a consent form is waived under § __.117(c)(2).

Approval Period:	January 28,2010 through January 27,2011
Review Type:	EXPEDITED
IRB Number:	00000202

e-protocol

Preliminary email sent February 15, 2010

Hello, my name is Kyle Stone and [REDACTED] and currently an instructor and a Ph.D candidate at Colorado State University in the Organizational Performance and Change program. [REDACTED]

[REDACTED] In an effort to better understand how organizations achieve and sustain performance through lean transformations, I am conducting research as part of my doctoral program designed to identify different aspects of performance and change within organizations engaged in lean business practices.

My advisor, Thomas Chermack, Ph.D., School of Education, is the Principal Investigator for this study, and I am the Co-Principal Investigator. The title of the project is: "Organizational Performance and Change Factors Associated with Lean Transformations."

Nine different manufacturing plants within [REDACTED] have agreed to contribute to the research and I would like you to participate by taking an on-line Organizational Assessment Survey. Participation in this research is voluntary and your confidentiality will be maintained throughout the research project. At the completion of the research study (May 2010) the findings will be presented to [REDACTED] and available to all participants.

The link listed at the end of this e-mail will direct you to an on-line survey designed to capture perceptions of your organization in relation to 12 different factors associated with performance and change. They are: external environment, mission & strategy, leadership, culture, structure, management practices, systems, work group climate, task requirements, motivation, and individual needs. The survey consist of 90 questions and participation will take approximately 30 to 40 minutes completed during work hours or anytime with a computer connected to the internet.

The survey will be open for two weeks starting **February 15, 2010** and will close **February 28, 2010**. It is preferable to complete the survey in one session however, if you cannot complete the survey in one session, there is an option to save your answers and return prior to the close of the survey on February 28, 2010.

Should you have any questions or require additional information, please feel free to contact me via e-mail or phone. If you have any questions about your rights as a volunteer in this research, contact Janell Barker, Human Research Administrator at [REDACTED]. Thanks again for your participation and providing your perceptions of your organization.

CLICK HERE >>>> [http://\[REDACTED\].questionpro.com](http://[REDACTED].questionpro.com) <<<<<<**CLICK HERE**

Sincerely,

Kyle B. Stone, Ph.D.c

Colorado State University
Organizational Performance & Change
25 Education Bldg
Ft. Collins, Colorado 80523-1588
Phone / Cell [REDACTED]
e-mail: kbstone@cahs.colostate.edu

Thomas Chermack, Ph.D.

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Informed consent at the beginning of the online survey:

Thank you for following the link to the on-line Organizational Assessment Survey. As mentioned in the previous e-mail, the survey consists of 90 questions and participation will take approximately 30-45 minutes completed during work hours or anytime with a computer connected to the internet.

Your participation in this research is voluntary and your confidentiality will be maintained throughout the research project. At anytime during the survey you decide to not participate in the study, you may stop participation by exiting the survey with no consequences.

The survey will be open for two weeks starting February 15, 2010 and will close February 28, 2010. It is preferable to complete the survey in one session however, if you cannot, there is an option to save your answers and return prior to the close of the survey on February 28, 2010.

While there are no direct personal benefits to you for participating, our intent is to gain more knowledge about factors influencing performance and change within your organization. All data will be analyzed and scored then summarized for your organization in a final report. Your participation will be confidential ensuring the researchers and your employer will not be able to link individual participants with their perceptions.

It is not possible to identify all potential risks in research procedures, but the researchers have taken reasonable safeguards to minimize any known and potential, but unknown, risks. If you agree to participate in this study, please proceed by clicking the "I AGREE" button at the end of this page.

If you have any questions or technical issues with the on-line survey, please contact Kyle Stone via e-mail or phone. If you have any questions about your rights as a volunteer in this research, contact Janell Barker, Colorado State University – Human Research Administrator, at 970-491-1655.

Sincerely,

Kyle B. Stone
Colorado State University
Organizational Performance & Change
25 Education Bldg
Ft. Collins, Colorado 80523-1588
Phone / Cell (970) 488-0057
e-mail: kbstone@cahs.colostate.edu

☐ I AGREE

1st Reminder email sent February 19, 2010:

This email is a reminder to request your participation in the Lean Research being conducted at [REDACTED] various manufacturing plants. If you have already taken the on-line Organizational Assessment Survey, thank you for your participation. If you have yet to take the survey, there's still plenty of time as the survey will be remain open until **February 28, 2010**.

The average time to take the survey is around 30 minutes and there is an option to 'save and continue' and the end of each page. If you choose to save and continue, you will be prompted for an email address and a link will be sent so you can re-enter the survey where you left off.

The following is a list of manufacturing plants participating and the current number of participants along with the goal of each plant.

- [REDACTED] = 5 completed / goal = 15
- [REDACTED] = 19 completed / goal = 50
- [REDACTED] = 22 completed / goal = 50
- [REDACTED] = 8 completed / goal = 50
- [REDACTED] = 16 completed / goal = 60
- [REDACTED] = 5 completed / goal = 25
- [REDACTED] = 5 completed / goal = 20
- [REDACTED] = 3 completed / goal = 40
- [REDACTED] = 4 completed / goal = 40
- Other = 14 completed

The survey is designed for all hourly and salaried associates. We realize many of the hourly associates do not have [REDACTED] emails so those having direct contact (especially supervisors) with hourly associates, please feel free to ask them to participate on a shop floor computer or other designated computer.

To enter the on-line survey, please click on the following link:

CLICK HERE >>>> [http://\[REDACTED\].questionpro.com](http://[REDACTED].questionpro.com) **<<<<CLICK HERE**

Should you have any questions or require additional information, please feel free to call or e-mail.

Regards,

Kyle B. Stone, Ph.D.c
Colorado State University
Organizational Performance & Change
25 Education Bldg
Ft. Collins, Colorado 80523-1588
Phone / Cell ([REDACTED])
e-mail: kbstone@cahs.colostate.edu

2nd Reminder email sent February 25, 2010:

First, we would like to thank everyone who has participated in the Organizational Assessment Survey for your time and interest in the research project over the past few weeks.

If you would still like to participate in the survey please complete it by this Sunday (**February 28, 2010**).

If you started the survey and planned on completing the survey at a later time, please do so prior to Sunday (**February 28, 2010**).

The following is a list of manufacturing plants participating and the current number of participants along with the goal of each plant. Due to limited internet access of the survey for hourly associates, many of the plants will more than likely not be able to achieve each goal as stated. However, the data collected will still yield highly generalizable results and your participation is very much appreciated. The final results of the research project will be made available in the upcoming months.

- [REDACTED] = 16 completed / goal = 15
- [REDACTED] = 37 completed / goal = 50
- [REDACTED] = 36 completed / goal = 50
- [REDACTED] = 22 completed / goal = 50
- [REDACTED] = 36 completed / goal = 60
- [REDACTED] = 17 completed / goal = 25
- [REDACTED] = 23 completed / goal = 20
- [REDACTED] = 10 completed / goal = 40
- [REDACTED] = 16 completed / goal = 40
- Other = 30 completed

To enter the on-line survey, please click on the following link:

CLICK HERE >>>> [http://\[REDACTED\]questionpro.com](http://[REDACTED]questionpro.com) **<<<<<CLICK HERE**

Should you have any questions or require additional information, please feel free to call or e-mail.

Regards,

Kyle B. Stone, Ph.D.c
Colorado State University
Organizational Performance & Change
25 Education Bldg
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Phone / Cell [REDACTED]
e-mail: kbstone@cahs.colostate.edu

APPENDIX C:
LOSAMS ADMINISTRATION DOCUMENTS

A few weeks ago during the Operations teleconference I introduced the research project I am conducting for my PhD in Organizational Performance and Change at Colorado State University. I have attached the executive summary for your reference that gives a brief overview of the project and the surveys for collecting data.

The Lean Organizational Self-Assessment Manufacturing Survey (LOSAMS) is taken by the "leaders" or "management" team within the organization being assessed. If you could please **forward this e-mail to potential participants** that are in "leadership roles" within your division, it would be greatly appreciated. The LOSAMS survey will be open until **February 14, 2010**.

Kyle Stone

Thomas Chermack, Ph.D.
Colorado State University
Organizational Performance & Change
223 Education Bldg
Fort Collins, CO 80523-1588
Phone: [REDACTED]
email: Thomas.Chermack@colostate.edu

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Informed consent at the beginning of the online survey:

Thank you for following the link to the on-line Lean Organization Self-Assessment Manufacturing Survey (LOSAMS). As mentioned in the previous e-mail, the survey consists of 38 questions and participation will take approximately 15 - 20 minutes.

Your participation in this research is voluntary and your confidentiality will be maintained throughout the research project. At anytime during the survey you decide to not participate in the study, you may stop participation by exiting the survey with no consequences.

The survey will be open for two weeks starting February 1, 2010 and will close February 14, 2010. It is preferable to complete the survey in one session however, if you cannot complete the survey in one session, there is an option to save your answers and return prior to the close of the survey on February 14, 2010.

While there are no direct benefits to you personally, our intent is to gain more knowledge on factors influencing performance and change within organizations related to Lean transformations. All data will be analyzed and scored then summarized for your organization in a final report. Your participation will be confidential ensuring the researchers and your employer will not be able to link individual participants with their perceptions.

It is not possible to identify all potential risks in research procedures, but the researchers have taken reasonable safeguards to minimize any known and potential, but unknown, risks. If you agree to participate in this study, please proceed by clicking the "I AGREE" button at the end of this page.

If you have any questions or technical issues with the on-line survey, please contact Kyle Stone via e-mail or phone. If you have any questions about your rights as a volunteer in this research, contact Janell Barker, Colorado State University - Human Research Administrator, at 970-491-1655.

Sincerely,

Kyle B. Stone, Ph.D.c
Colorado State University
Organizational Performance & Change
25 Education Bldg
Ft. Collins, Colorado 80523-1588
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email: Thomas.Chermack@colostate.edu

By clicking on the following "AGREE" you are consenting to participate in the study.

☐ I AGREE

Reminder email sent February 15, 2010:

Two weeks ago we launched the Lean Organizational Self-Assessment Manufacturing Survey (LOSAMS) throughout nine plants within [REDACTED]. The following is a summary of completed surveys by location:

- [REDACTED] = 3 completed / goal = 5
- [REDACTED] = 10 completed / goal = 10
- [REDACTED] = 14 completed / goal = 8
- [REDACTED] = 0 completed / goal = 5
- [REDACTED] = 5 completed / goal = 10
- [REDACTED] = 6 completed / goal = 8
- [REDACTED] = 5 completed / goal = 7
- [REDACTED] = 12 completed / goal = 10
- [REDACTED] = 3 completed / goal = 8

I would like to leave the survey open for another week (**February 26**) to encourage a few more participants within the plants highlighted in bold. There are 9 surveys that have been started but not completed so it may be that many are in the process of completing them.

Then next phase of the research will start today with the launch of the Burke-Litwin Organizational Assessment Survey. This will be sent to the nine plants via their campus email and will not require any redistribution. Everyone is encouraged to participate (even those who took the LOSAMS) as this survey attempts to measure broader aspects of an organization not necessarily specific to "Lean".

Once again, I appreciate everyone's support and participation and look forward to evaluating the results and providing feedback.

Should you have any questions, please feel free to call or email.

Regards,

Kyle B. Stone
[REDACTED]

APPENDIX D:
LOSAMS ONLINE SURVEY

Thank you for following the link to the on-line Lean Organization Self-Assessment Manufacturing Survey (LOSAMS). As mentioned in the previous e-mail, the survey consists of 38 questions and participation will take approximately 15 - 20 minutes.

Your participation in this research is voluntary and your confidentiality will be maintained throughout the research project. At anytime during the survey you decide to not participate in the study, you may stop participation by exiting the survey with no consequences.

The survey will be open for two weeks starting February 1, 2010 and will close February 14, 2010. It is preferable to complete the survey in one session however, if you cannot complete the survey in one session, there is an option to save your answers and return prior to the close of the survey on February 14, 2010.

While there are no direct benefits to you personally, our intent is to gain more knowledge on factors influencing performance and change within organizations related to Lean transformations. All data will be analyzed and scored then summarized for your organization in a final report. Your participation will be confidential ensuring the researchers and your employer will not be able to link individual participants with their perceptions.

It is not possible to identify all potential risks in research procedures, but the researchers have taken reasonable safeguards to minimize any known and potential, but unknown, risks. If you agree to participate in this study, please proceed by clicking the "I AGREE" button at the end of this page.

If you have any questions or technical issues with the on-line survey, please contact Kyle Stone via e-mail or phone. If you have any questions about your rights as a volunteer in this research, contact Janell Barker, Colorado State University - Human Research Administrator, at 970-491-1655.

Sincerely,

Kyle B. Stone, Ph.D.c
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email: Thomas.Chermack@colostate.edu

By clicking on the following "AGREE" you are consenting to participate in the study.

☐ I AGREE

Lean Organization Self-Assessment Manufacturing Survey (LOSAMS)

The Lean Organization Self-Assessment Manufacturing Survey (LOSAMS) has been developed by modifying the Lean Enterprise Self-Assessment Tool (LESAT) created specifically to assess enterprise leanness within the Aerospace industry. The LESAT was developed by the Lean Advancement Initiative (LAI) based out of MIT and supported by leading Aerospace industry representatives (i.e. Boeing, Lockheed-Martin, Rockwell, Northrup-Grumman, etc.). The LOSAMS modifications included revisions to terminology more commonly associated with manufacturing organizations outside of the Aerospace industry and the elimination of certain sections that were not common to manufacturing with the addition of questions pertaining to manufacturing lean transformations.

The LOSAMS attempts to determine the 'level of leanness' within an organization based on two key elements common to most lean transformations: Lean thinking and Lean principles.

For the sake of this assessment, 'leanness' is used to describe the state of the organization's transformation when employing lean thinking and implementing lean principles. 'Lean thinking' refers to the operational strategy of the organization while 'lean principles' are associated with the tools used to execute lean thinking strategies.

Throughout this assessment you will be asked to determine the level of achievement in numerous areas associated with successful lean transformations. It may be helpful to keep in-mind the following definitions while answering some of the questions:

Divisional level = your actual division, i.e. [REDACTED]. May also be known as 'plant level'. This is the 'default' when specific organizational level is not specified within a question or answer (level).

Organizational level = all divisions. This specific assessment is designed for 'manufacturing' division. Also referred to as 'organization-wide' in some questions.

Extended Enterprise - customers, organization [REDACTED] suppliers.

Senior leaders - individuals involved in the strategic planning process. Typically leading from the executive level (CEO, president, VP), director, general manager, or manager role (stops at supervisor level and below).

This assessment is intended to capture the perceptions of senior leaders within a multi-division organization. A score of 'leanness' will be determined in both Lean Thinking and Lean Principles.

DIVISION LEVEL INFORMATION

Please indicate which division you are assessing.
(Only assess one division per survey)

(If your division or plant is not identified, please choose 'other' and provide plant name or plant #)

*

-- Select --

Lean Thinking Operational Strategy

In the following section, lean implementation plans for both internal and external to the organization itself are reviewed. This section assesses the development, deployment, and management of the lean implementation plan. This plan should reflect the major effects of lean transformations which are: long term sustainability, increasing competitive advantage, and identification and satisfaction of stakeholders.

Strategic Planning

The decision to implement and sustain a lean transformation is strategic in nature. Its impact throughout the organization is profound, and extends outward to both customers and external suppliers. The adoption of a lean vision affects all business practices and processes organization-wide. The lean organization will behave in a new manner, not only identifying and eliminating waste, but focusing on enhancing the relationships with all the stakeholders inside and outside the organization.

What level is Lean integrated in the Strategic Planning Process?
(*Lean impacts growth, profitability and market penetration*)

Examples:

- > Lean implementation is planned, and included explicitly in the organization's strategic plan.
- > Strategic planning makes allowance for anticipated gains from lean improvements

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|--|--|--|--|---|
| <input type="checkbox"/> (Level 1) Concepts and benefits of lean principles and practices are not evident in culture or business plans. | <input type="checkbox"/> (Level 2) Lean is recognized, but relegated to lower levels of the organization and application is fragmented. | <input type="checkbox"/> (Level 3) The growth implications of lean are understood and lean implementation plans are formulated, but not integrated into the strategic plan. | <input type="checkbox"/> (Level 4) Transitioning to lean is adopted as a key operational strategy and included in the strategic plan. | <input type="checkbox"/> (Level 5) Strategic plans leverage the results of lean implementation to achieve growth, profitability and market position. |
|--|--|--|--|---|

What level is the focus on Customer Value?
(Customers are integral to the development of value streams)

Examples:

- > A formal process for determining customer value is used.
- > What constitutes success/satisfaction for customers is understood throughout the organization.
- > A formal process exists to measure and assess customer satisfaction.
- > Customer value strongly influences policies, practices and behavior.

*

○ (Level 1) Means of defining value to customers is informal and unstructured.	○ (Level 2) Structured process for defining value is applied to selected customers.	○ (Level 3) How the organization can best contribute to customer's success is well defined and incorporated into most processes.	○ (Level 4) Customer definition of value strongly influences the strategic direction.	○ (Level 5) Competitiveness is enhanced as customer value becomes the predominant driving force throughout the entire organization.
--	---	--	---	---

What level does leveraging the Extended Enterprise occur?
(Your customer and your suppliers represent different ends of your value stream. The value streams from your customer, through your organization and to your suppliers creates the 'extended enterprise')

Examples:

- > Strategic planning is strongly influenced by stakeholder and customer value.
- > Strategic planning encompasses the total enterprise, including customer, alliances/partners, employees and suppliers.
- > Risk is accepted when planning supplier, customer, or partner activities and responsibilities, some of the risk is also shared by those same groups.

*

○ (Level 1) Relations with customers and suppliers reflect a "We-They" mentality.	○ (Level 2) Initial opportunities identified for establishing extended enterprise linkages.	○ (Level 3) Strategic planning process explicitly includes consideration of key stakeholders in value streams.	○ (Level 4) Integration and balancing of stakeholder values are achieved via collaborative supplier relations and strategic partnering.	○ (Level 5) Integration of the extended enterprise contributes to innovation, growth, increased profitability and market position.
---	---	--	---	--

Adopt Lean Thinking Paradigm

Transitioning to lean requires a significant modification to the business model of the organization. It is imperative leadership understands and supports the lean thinking paradigm since they will be required to create a vision for doing business, behaving and seeing value in fundamentally different ways.

Learning and education in "Lean Thinking" for the leadership team.
("Unlearning" the old, learning the new)

Examples:

- > A formal lean education process for senior leaders has been established.**
- > Majority of senior leaders have received significant exposure and education in lean principles, practices and behavior.**
- > Leaders regularly apply and use lessons learned in "lean".**

- | | | | | |
|---|--|--|--|---|
| <p>○
(Level 1) Little interest in learning lean principles is evident among senior leadership.</p> | <p>○
(Level 2) Senior leaders are actively seeking opportunities to learn about lean. There is an initial grasp of the extent of the paradigm shift for the organization.</p> | <p>○
(Level 3) Senior leaders are adopting lean learning and continuously applying lean principles throughout the organization.</p> | <p>○
(Level 4) Senior leaders contribute to the development / refinement of the body of knowledge about lean.</p> | <p>○
(Level 5) Lessons learned in implementing lean are actively shared across the organization and the extended enterprise.</p> |
|---|--|--|--|---|

Senior Leadership Commitment
(Senior leadership is personally leading lean initiatives)

Examples:

- > There is a consensus commitment supporting a transformation to lean.**
- > Management provides support and recognition for positive actions**
- > Senior management are champions in transforming the organization.**

- | | | | | |
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| <p>○
(Level 1) Level of commitment among senior leaders and management is variable – some endorse while others may actively resist.</p> | <p>○
(Level 2) Senior leaders buy into group commitment; senior leaders / managers who cannot or will not adapt are replaced.</p> | <p>○
(Level 3) "Lean" is integral to organization-wide meetings, senior staff meetings, etc.; senior managers personally and visibly lead lean transition.</p> | <p>○
(Level 4) Senior leaders are championing the transformation to lean throughout the organization and the extended enterprise.</p> | <p>○
(Level 5) Senior leaders and management mentor and foster lean champions internally and through the extended enterprise.</p> |
|--|--|---|--|--|

What level is the focus on Customer Value?
(Customers are integral to the development of value streams)

Examples:

- > A formal process for determining customer value is used.
- > What constitutes success/satisfaction for customers is understood throughout the organization.
- > A formal process exists to measure and assess customer satisfaction.
- > Customer value strongly influences policies, practices and behavior.

*

○	○	○	○	○
(Level 1) Means of defining value to customers is informal and unstructured.	(Level 2) Structured process for defining value is applied to selected customers.	(Level 3) How the organization can best contribute to customer's success is well defined and incorporated into most processes.	(Level 4) Customer definition of value strongly influences the strategic direction.	(Level 5) Competitiveness is enhanced as customer value becomes the predominant driving force throughout the entire organization.

What level does leveraging the Extended Enterprise occur?
(Your customer and your suppliers represent different ends of your value stream. The value streams from your customer, through your organization and to your suppliers creates the 'extended enterprise')

Examples:

- > Strategic planning is strongly influenced by stakeholder and customer value.
- > Strategic planning encompasses the total enterprise, including customer, alliances/partners, employees and suppliers.
- > Risk is accepted when planning supplier, customer, or partner activities and responsibilities, some of the risk is also shared by those same groups.

*

○	○	○	○	○
(Level 1) Relations with customers and suppliers reflect a "We-They" mentality.	(Level 2) Initial opportunities identified for establishing extended enterprise linkages.	(Level 3) Strategic planning process explicitly includes consideration of key stakeholders in value streams.	(Level 4) Integration and balancing of stakeholder values are achieved via collaborative supplier relations and strategic partnering.	(Level 5) Integration of the extended enterprise contributes to innovation, growth, increased profitability and market position.

Lean Vision *(New mental model of the organization)*

Examples:

- > The role that lean plays in achieving the vision is clearly defined.
- > The vision has been communicated to all levels and has extensive buy-in by most employees.
- > The vision incorporates a new mental model of how the organization would act and behave according to lean principles and practices.

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| ○
(Level 1) Senior leaders have varying visions of lean, from none to well-defined. | ○
(Level 2) Senior leaders adopt common vision of lean. | ○
(Level 3) Lean vision has been communicated and is understood by most employees. | ○
(Level 4) Common vision of lean is shared throughout the organization and expressed consistently. | ○
(Level 5) The stakeholders within the organization have internalized the lean vision and are an active part of achieving it. |
|---|---|--|---|--|

A Sense of Urgency *(Establishing the need for change and continuous improvement)*

Examples:

- > A compelling business case for lean has been developed and communicated.
- > The implications and time scales of the vision have been translated for each area of the organization and the extended enterprise.
- > Lean transformation progress is integral to leadership discussions and events.

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| ○
(Level 1) Scan of external environment identifies competitive threats and need for action. | ○
(Level 2) Senior leaders develop an urgent and compelling case for the lean transformation. | ○
(Level 3) Urgent and compelling case for lean transformation has been communicated and the organization rallies behind it. | ○
(Level 4) Urgent and compelling case for lean is expanded to and accepted by key suppliers. | ○
(Level 5) Urgent and compelling case for lean is expanded to and accepted throughout the extended enterprise. |
|--|---|--|---|---|

Focus on the Value Stream

Identifying and eliminating waste while improving value becomes the primary driving force throughout the organization. The current means of delivering customer value are documented, followed by improving the value stream by minimizing waste. Lean metrics are specified and stakeholder involvement clarified.

Understanding the Current Value Stream *(How value is delivered to the customers)*

Examples:

- > A formal process has been established for identifying customer and stakeholder value (typically known as 'value stream mapping')
- > The practice and language of value stream mapping is recognized as an important part of an iterative improvement process.
- > Current value streams of major customers/product lines have been mapped, and hand-off points and interfaces clearly defined.

- | | | | | |
|---|--|--|--|---|
| <p>○</p> <p>(Level 1) The documented process flow differs from the actual flow, VSM are outdated. There is recognition of the importance for formal mapping and analysis but not fully accepted by ongoing value stream mapping.</p> | <p>○</p> <p>(Level 2) Key stakeholders and what they value are identified. Present processes are mapped and initial analysis is underway.</p> | <p>○</p> <p>(Level 3) Principal current value stream(s) are defined, allowing the identification of critical interactions. Significant opportunities for eliminating waste and creating value are identified and aligned with the strategic objectives.</p> | <p>○</p> <p>(Level 4) Depth and breadth of knowledge of value stream elements and supporting processes exposes interdependencies throughout the organization.</p> | <p>○</p> <p>(Level 5) Updated value streams and their independencies are evaluated across the extended enterprise and drive improvement initiatives.</p> |
|---|--|--|--|---|

Continuous flow
("Single piece flow" of materials and information)

Examples:

- > Information flows have been optimized throughout the organization.
- > Material flow paths have been simplified and shortened to enhance flow.
- > Information and material flows are responsive to customer demand.

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| ○
(Level 1) Material and information flows are disjointed and "optimized" process by process. "Push" mentality prevails. | ○
(Level 2) Some primary flow paths have been overhauled to overcome significant barriers to flow. | ○
(Level 3) Primary flow paths are simplified and aligned to the value streams, which allows information and material to flow as required. | ○
(Level 4) Material and information flow seamlessly throughout the organization. | ○
(Level 5) Material and information flow seamlessly and responsively throughout the extended enterprise. |
|--|--|--|---|---|

Designing the Future Value Stream
(Value stream to meet the Lean vision)

Examples:

- > A formal process has been established to identify how the organization can best deliver value to customers and stakeholders.
- > The future value stream(s) reflects new and improved ways to realize value and minimize non-value adding activities.
- > Future value stream(s) designs have been generated for the primary value stream(s) and their supporting processes.

*

- | | | | | |
|--|--|---|---|--|
| ○
(Level 1) Senior leaders understand the present processes do not meet the future lean vision objectives. | ○
(Level 2) A concept for future value stream(s) design has been created based on balanced stakeholder requirements. | ○
(Level 3) Future value stream(s) are developed, which encompass future organizational goals and satisfy stakeholder requirements. | ○
(Level 4) Future value stream(s) are refined to accommodate a changing environment. | ○
(Level 5) Future value stream(s) are refined to dynamically accommodate a changing environment across the extended enterprise. |
|--|--|---|---|--|

Performance Measures (Performance measures drive organizational behavior)

Examples:

- > A balanced and minimal set of performance measures are used to track lean implementation progress towards the strategic direction.
- > Performance measures used assure lean efforts align organization-wide.

*

○ (Level 1) Performance measures are ad hoc, inconsistent and focused on functional areas rather than value streams.	○ (Level 2) Baseline performance measures are established to stimulate progress towards the lean future state and are visible throughout the division.	○ (Level 3) Performance measurement system uses a minimal and balanced set of measures based on strategic objectives and align with organization-wide metrics.	○ (Level 4) Measurement systems and target setting pulls performance improvement throughout the organization.	○ (Level 5) A common target setting and measurement process pulls performance improvement across the extended enterprise.
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Develop Lean Structure and Behavior

Organization infrastructure must be assessed and modified prior to launching a lean initiative as well as throughout the transformation. Organizational structure, incentives, policies, business systems and processes must be aligned and coordinated to elicit the behavior required for successful implementation of lean principles and practices.

Organizational Orientation (How well your organization is organized to support value delivery)

Examples:

- > Functional barriers have been minimized.
- > There is extensive use of cross-functional processes and a flexible workforce throughout the organization.
- > Career progression potential exists across both processes and functions.

*

○ (Level 1) The organization operates as functional silos.	○ (Level 2) Initial efforts are underway to identify functional barriers and understand their full implications.	○ (Level 3) Partially deployed cross-functional organizational processes are aligned throughout the organization.	○ (Level 4) Extensive cross-functional processes are implemented throughout the organization. Functional units now serve as knowledge centers for skill retention.	○ (Level 5) Cross-functional, process-based orientation is aligned throughout the organization and across the extended enterprise.
--	--	---	--	--

Relationships based on mutual trust
("Win-win" vs. "we-they")

Examples:

- > Communication barriers based upon organizational position have been significantly reduced.
- > Stable and cooperative relationships exist among most enterprise stakeholders.
- > There is a strong sense of "team" when interacting with employees, customers or suppliers.

*

○ (Level 1) Relationships tend to be determined by organizational role, resulting in a "we-they" perspective.	○ (Level 2) Selective application of company-wide perspective results in breaking down of organizational barriers and developing mutual trust.	○ (Level 3) Stable and cooperative relationships exist throughout the organization; cooperative relations are established with some extended enterprise partners.	○ (Level 4) Mutual respect and trust exists throughout the organization with equitable sharing of benefits from continuous improvement initiatives.	○ (Level 5) Stakeholders modify behavior so as to enhance extended enterprise performance (win-win).
--	--	---	---	--

Open and Timely Communications
(Information exchanged informs all stakeholders, as needed)

Examples:

- > Open and timely communications exist among stakeholders. i.e. regular meetings with employees, newsletters, etc.
- > Technology has been leveraged to speed communications flow and accessibility, while filtering unnecessary communications.
- > Employee input is valued and plays a key part in decision-making.

*

○ (Level 1) Communication is largely top-down, limited and lagging.	○ (Level 2) Basic communication mechanisms are employed but are not uniform; communication strategy is under development.	○ (Level 3) Senior leaders are accessible and visible, developing two-way communications in open, concise and timely form.	○ (Level 4) Communication processes are undergoing continuous refinement and information is exchanged or can be pulled as required.	○ (Level 5) Comprehensive system of two-way communication is employed throughout the organization and extended enterprise.
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Employee Empowerment *(Decision-making at lowest possible level)*

Examples:

- > **Managers and supervisors serve as mentors and educators, promoting lower level decision-making.**
- > **The extent and types of empowerment are tailored to match the environment and people empowered.**
- > **Empowerment enables swift and effective decision-making closest to the point of use.**

*

○	○	○	○	○
(Level 1) Centralized decision-making occurs in a hierarchical structure with limited delegation of authority.	(Level 2) Appropriate structure and training is being put in place to enable empowerment.	(Level 3) Organizational environment and management system supports limited decision-making at point of application and need.	(Level 4) Decision processes are continually refined to promote increased accountability and ownership at point of use.	(Level 5) Decision-making throughout the organization and across the extended enterprise is delegated to the point of application.

Incentive Alignment *(Reward the behavior you want)*

Examples:

- > **Incentives include a balance of money and non-monetary rewards / recognition to encourage lean activity.**
- > **Incentives are based on performance measures that encourage lean activity.**
- > **Incentives encourage local improvements that will benefit multiple processes or value stream performance.**

*

○	○	○	○	○
(Level 1) There is sporadic use of incentives and an awareness that some incentives discourage lean behavior.	(Level 2) Incentives that reward and encourage lean behavior are deployed in some areas.	(Level 3) Executive compensation and employee incentives are linked directly to attainment of lean objectives.	(Level 4) Incentive systems successfully contribute to achievement and sustainability of lean objectives.	(Level 5) Lean incentives are deployed, with measurable success throughout the organization.

Innovation Encouragement *(From risk aversion to risk rewarding)*

Examples:

- > The review process for suggestions has been streamlined and gives clear visibility of the progress of each suggestion.
- > Suggestion programs have been properly incentivized to give recognition to originators of innovative ideas.
- > Risk is understood, not avoided. Prudent risk taking is seen as a core strength of your organization, not a liability.
- > Innovations can be measured against the organization's lean vision, and the value of the innovation is considered in relation to its impact on the values stream.

*



(Level 1) Innovation initiatives are sporadic and ad hoc; security, stability and risk aversion drive most decision-making.



(Level 2) Initial efforts are underway to develop systems, processes and procedures for fostering innovations.



(Level 3) Innovation initiatives are underway in selected areas; measures for assessing impact are in use.



(Level 4) Innovation initiatives are flourishing; prudent risk taking is encouraged and rewarded.



(Level 5) Comprehensive innovation program is implemented and positive results recognized.

Lean Change Agents *(The inspiration and drivers of change)*

Examples:

- > Lean change agents have been designated and empowered in your organization, with a mandate to increase value and eliminate waste.
- > Lean change agents operate throughout all areas of your organization and cross-transfer knowledge gained and lean implementation experience to other areas of your organization.
- > A process for mentoring and developing new change agents has been established.
- > Individuals in your organization feel a personal responsibility and authority to make positive change occur in their position.

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(Level 1) Change agents are sporadically distributed, but without change authority.



(Level 2) There is formal identification of change agents, along with role definition, authority delegation and program of education and training for change agents.



(Level 3) Appropriately skilled change agents are assigned to key areas with the authority to effect changes.



(Level 4) Change becomes self-generating, initiated by employees as well as change agents.



(Level 5) Change agents are providing a critical resource of lean knowledge, skill and experience in transforming the organization and extended enterprise.

Create and Refine Transformation Plan

In this section, you will evaluate how completely your organization has identified, prioritize and sequence a comprehensive set of lean initiatives that collectively constitute the plan for achieving the desired lean transformation.

Lean Transformation Plan

(Charting the course of a lean transformation)

Examples:

- > A process is in place to incorporate lessons learned into the organization-wide and extended enterprise lean transformation plan.
- > The milestone targets of the lean transformation plan are broken-down by section and deployed.
- > Plans balance long-term and short-term stakeholder objectives for the best overall solution.

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| <p>○
(Level 1) Individual planning efforts are mostly bottom up initiatives with little priority or coordination established throughout the division, organization-wide or extended enterprise.</p> | <p>○
(Level 2) Divisions identify lean implementation projects, which are prioritized to meet long and short-term organizational strategic objectives.</p> | <p>○
(Level 3) Divisional improvement plans are coordinated and prioritized with the organization-wide value stream(s), along with a timeline for expected measurable results.</p> | <p>○
(Level 4) Lean transformation plan is continuously refined through learning from implementation results and changing strategic requirements.</p> | <p>○
(Level 5) Lean transformation plan balances mutual benefits of stakeholders across the entire extended enterprise.</p> |
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Commit Resources for Lean Improvements

(Resource provision for lean)

Examples:

- > Resources are committed to support the level and speed of lean transformation required.
- > Time to build on improvements by personal contribution is given at all levels.
- > The procedure to apply for improvement resources has been simplified, and gives priority to improvements that benefit multiple areas.

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| <p>○
(Level 1) Little or no resources are provided for process improvement or waste elimination.</p> | <p>○
(Level 2) Limited resources are committed and often applied to the symptom rather than the root cause.</p> | <p>○
(Level 3) Resources are allocated as required for execution of the lean transformation plan and prioritized across the value stream.</p> | <p>○
(Level 4) A pool of earmarked resources is provided for lean initiatives with minimal justification required.</p> | <p>○
(Level 5) A pool of earmarked resources is provided for lean initiatives across the extended enterprise.</p> |
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Provide Education and Training *(Just-in-time learning)*

Examples:

- > Education and training programs, including refreshers, are provided on a just-in-time basis.
- > Education and training has a balanced and sequenced set of elements to support the lean transformation plan.
- > The application of lean principles learned in training and education is formally appraised.

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| ○
(Level 1) There is little coordination of education and training programs to facilitate change. | ○
(Level 2) Education and training covers a set of skills required to support the lean transformation projects. | ○
(Level 3) Education and training program is comprised of a balanced and sequenced set of elements to support the coordinated transformation plan. | ○
(Level 4) Education and training at all levels is periodically reviewed to check alignment and suitability to the lean transformation plan. | ○
(Level 5) Education and training program supports the upcoming needs of the extended enterprise transformation plan. |
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Implement Lean Initiatives

In this section, you will evaluate how completely your organization has disseminated the organization-wide lean transformation plan and lean vision into specific actions, programs and projects. You will also determine how thoroughly these projects are executed within each organizational process area and determine how they are re-integrated at the extended enterprise level.

Development of improvement plans *(Coordinating lean improvements throughout the extended enterprise)*

Examples:

- > Detailed implementation plans are aligned to milestone targets.
- > A process is in place to incorporate lessons learned in detailed implementation plans.
- > Detailed improvement plans are coordinated organization-wide where shared implications exist.

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| ○
(Level 1) Improvements are generally optimized for individual areas and employees cannot clearly see the links between divisional, organizational, and extended enterprise goals. | ○
(Level 2) Key goals of the lean transformation plan are understood by most employees. Process owners are involved in developing detailed plans linked to the goals/strategic objectives of the transformation plan. | ○
(Level 3) Detailed lean implementation plans supporting organizational-wide strategy are developed and coordinated across divisions. | ○
(Level 4) Detailed lean implementation plans accounting for any interdependencies are refined and integrated throughout the organization. Best practices are shared. | ○
(Level 5) Implementation plans from extended enterprise are coordinated with and support the lean transformation plan. |
|---|---|--|--|--|

Tracking Detailed Implementation (Assessing actual outcomes against goals)

Examples:

- > Lean initiatives are coordinated and tracked, with the individual results “rolled up” and assessed against organizational milestones and targets.
- > The responsibility and accountability for improvement success is assigned locally to enable fast corrective action on deviations from the plan.
- > Changes to processes / value stream map(s) are documented and updated regularly.

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| <p>○
(Level 1) Results of process improvement initiatives are observed but not quantified.</p> | <p>○
(Level 2) Process is under development to permit tracking and quantification of progress of the detailed lean implementation. Data from some projects is being reviewed.</p> | <p>○
(Level 3) There is a project management process implemented to track progress of detailed lean projects against milestones, with feedback provided to senior leaders. Appropriate corrective action is initiated within individual projects.</p> | <p>○
(Level 4) The project management process can readily assess detailed plans and can accommodate revisions mandated by changes to the lean transformation plan.</p> | <p>○
(Level 5) The project management process is deployed across the extended enterprise to enable real-time tracking.</p> |
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Focus on Continuous Improvement

The successful execution of your organization's lean implementation plan forms the basis for future improvement. The improvement process is monitored and nurtured. Lessons learned are captured, and improved performance becomes a driving force for future strategic planning by organization leadership.

Structured Continuous Improvement Processes (Uniformity in how we get better)

Examples:

- > A consistent improvement/transformation approach is implemented, sustaining improvements gained.
- > The continuous improvement process challenges people to tackle the root cause, rather than the symptom.
- > Lean principles are being applied to most organization-wide systems and processes, utilizing lessons learned.

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| <p>○
(Level 1) Improvement initiatives are ad hoc and not data driven.</p> | <p>○
(Level 2) An improvement process throughout the organization is broadly defined and being selectively applied.</p> | <p>○
(Level 3) Systematic, structured methodology for continuous improvement and value creation is developed and deployed across many areas.</p> | <p>○
(Level 4) Structured continuous improvement process is deployed at all levels, using value stream analysis to target improvements.</p> | <p>○
(Level 5) Structured continuous improvement process is fully ingrained throughout the extended enterprise.</p> |
|---|--|---|--|--|

Monitoring Lean Progress

(Assessing progress toward achieving organization-wide objectives)

Examples:

- > Lean transformation progress is judged by the aggregate benefits, not individual or localized improvements.
- > Leaders actively participate in monitoring implementation progress and addressing deficiencies within the transformation plan.
- > Lean progress reviews are documented in a common format and disseminated.

*

○ (Level 1) Senior leaders are not actively involved in the review of overall lean implementation plan progress.	○ (Level 2) Implementation plan progress is reviewed against organizational milestones and success criteria, for some projects.	○ (Level 3) A formal methodology is used by senior leaders to analyze the overall progress across all lean implementation projects. Current plans are adjusted based on learning from lean implementations.	○ (Level 4) Results of implementation projects are aggregated to permit reallocation of resources and to ensure on-going alignment with strategic objectives.	○ (Level 5) Senior leaders monitor lean progress throughout the extended enterprise. Results are impacting future strategic planning.
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Nurturing the Process

(Assure senior leadership level involvement)

Examples:

- > Senior leaders actively support and are involved in ensuring the success of improvements.
- > Positive actions and the effort taken are recognized and rewarded, even if improvements are not fully successful.

*

○ (Level 1) There is growing awareness that successful lean implementation is highly dependent upon senior leadership support and encouragement.	○ (Level 2) Some senior leaders are providing encouragement, support and recognition, which is not consistent throughout the division.	○ (Level 3) Senior leaders seek to identify and remove barriers to lean implementation. Teams and individuals who successfully implement lean practices are recognized and rewarded.	○ (Level 4) Senior leaders are highly visible in their involvement, support and encouragement of the lean initiative. An enthusiastic atmosphere is evident.	○ (Level 5) Senior leaders champion and nurture a culture of continuous improvement throughout the extended enterprise.
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Capturing Lessons Learned (Ensuring that successes lead to more successes)

Examples:

- > "Best" practice, suggestions and lessons learned are maintained in a concise and clear standard format.
- > A formal process has been established for capturing and reusing lessons learned.
- > Lessons learned are periodically reviewed to maintain relevance of information kept.

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| <p>○
(Level 1) Lessons learned from improvement activities are not documented, residing only in the memories of participants.</p> | <p>○
(Level 2) Lessons learned in some areas are documented and maintained in paper files, design rulebooks, etc.</p> | <p>○
(Level 3) A formal process for readily capturing and communicating lessons learned is being applied. Employee contributions are actively sought.</p> | <p>○
(Level 4) Lessons learned are consistently captured, communicated and regularly used in a structured manner. A organization-wide knowledge base is created.</p> | <p>○
(Level 5) A formal knowledge management process is adopted. Lessons learned are routinely and explicitly incorporated into the formulation of new lean initiatives.</p> |
|--|--|--|---|---|

Impacting Organizational-Wide Strategic Planning (Results lead to strategic opportunities)

Examples:

- > Business results reflect improvements resulting from lean implementation.
- > Strategic planning makes allowance for anticipated gains from lean improvements.
- > Gains realized from lean implementation are leveraged to achieve growth, profitability, market position and employment stability.

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| <p>○
(Level 1) Results of lean implementation are not fed back to strategic planning process.</p> | <p>○
(Level 2) Benefits of lean implementation are beginning to influence the divisional strategic planning process.</p> | <p>○
(Level 3) Senior leaders consider potential impact of performance improvement initiatives in its assessment of new business opportunities.</p> | <p>○
(Level 4) Forecasted improvements from lean implementation are incorporated into company-wide planning and budgeting decisions and the organizational-wide strategic plan.</p> | <p>○
(Level 5) Senior leaders integrate forecasted future results of lean implementation in its assessment of new business opportunities and potential market impact.</p> |
|--|---|--|--|--|

SECTION II - LEAN PRINCIPLES

To achieve successful lean transformation, the organization-wide infrastructure must support the implementation of lean principles, practices and behavior.

Lean Organizational Enablers

The divisions throughout the organization must become lean in executing their assigned function while also supporting lean implementation throughout the organization and extended enterprise.

Financial System Supports Lean Transformation
(*Lean requires appropriate financial data*)

Examples:

> Financial measures that conflict with lean activity are no longer used to measure progress and performance.

> The financial system handles a balanced set of financial and non-financial measures to assist decision-making.

> The financial system has been overhauled to ensure fast and efficient processing of information as required.

*

○
(Level 1) Finance system provides basic balance sheet and cost accounting data; there is little awareness and exploration of broader support roles for finance.

○
(Level 2) Initial efforts are underway to adapt or modify systems to compensate for the inadequacies of the formal financial system.

○
(Level 3) Finance system is overhauled to provide data and financial information to support and enable a lean transformation at any level.

○
(Level 4) Financial system scope is expanded to integrate with non-traditional measures of value creation (e.g., intellectual capital, balanced scorecard, etc.).

○
(Level 5) Financial systems provide seamless information exchange organization-wide, with emphasis on value creation for all stakeholders.

**Divisions throughout the organization pull required financial information
(Data on demand)**

Examples:

- > Financial and performance measurement data can be accessed as needed in user-defined format.
- > Financial information can be extrapolated to forecast outcomes.
- > System provides up to date information on request and rationalizes information no longer used.

*

○ (Level 1) Lagging financial information is reported through regularly scheduled standardized reports. Specific requests for measures require extraordinary effort.	○ (Level 2) Finance actively provides traditional financial information to assist users in planning and programming activities.	○ (Level 3) Users are able to directly access and use financial information to make trade-off decisions.	○ (Level 4) Users are able to pull financial and other value creation information to support decision analysis in the format desired.	○ (Level 5) Users across the extended enterprise generate and share timely financial and performance data. Data reflects extended enterprise results.
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**Promote the learning organization
(Learning Organizations create a flexible workforce)**

Examples:

- > Intellectual capital is regarded as a corporate asset.
- > Employees have individual training plans, which are aligned to the current and projected skill base requirements.
- > Employees actively capture and incorporate lessons learned into future training and practices.

*

○ (Level 1) The human resources processes concentrate on recruiting, placement and benefits. Human resource development training is ad hoc and not aligned to organizational needs.	○ (Level 2) A well-defined human resource development process, aligned with organizational needs, is applied for selected employees.	○ (Level 3) Human resource development process is extended to all employees and incorporates the anticipated future needs of the lean organization. Resources and facilities are dedicated for learning.	○ (Level 4) A learning climate is promoted throughout the organization with ready access to information and input to strategy/ policy making. Opportunities for extending learning experiences are provided.	○ (Level 5) A learning climate is promoted throughout the extended enterprise by the sharing of capabilities, knowledge, skills and best practice.
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Enable the Lean organization with information systems and tools
(Facilitate the flow of information and knowledge)

Examples:

- > **Compatible information systems and tools exist company-wide.**
- > **Information systems facilitate fast and effective transfer and retrieval of information required.**
- > **Information systems and tools complement lean processes and practices and are easily adapted to accommodate change.**

*



(Level 1) The information infrastructure consists mainly of stand-alone systems. The need for systems integration is recognized but no improvement plan exists.



(Level 2) Elements of a common information infrastructure have been determined, and an implementation plan is under development. Maintenance of IT systems consume most IT resources.



(Level 3) The information infrastructure has been formalized and is in use in selected locations. IT systems are rationalized and aligned across the value stream.



(Level 4) An information infrastructure is deployed that supports seamless information exchange organization-wide.



(Level 5) Information systems are fully integrated and the pertinent information is easily accessible and usable across the extended enterprise.

Integration of environmental Protection, health and safety into the business
("Cleaner, healthier, safer")

Examples:

- > **Health and safety issues are routinely addressed in employee driven improvement activities.**
- > **Processes and designs are proactively adapted to minimize environmental, health and safety issues at source.**
- > **Designs meet current environmental regulations and are capable of easy adaptation to meet projected changes over the life cycle of the product.**

*



(Level 1) The division complies with all known legal and regulatory requirements and reacts if issues are identified.



(Level 2) Consideration is given to means of mitigating conditions that cause environmental, health and safety issues.



(Level 3) A process is in place to proactively identify Environmental protection, Health and Safety (EHS) risks and manage them appropriately, with a preference for source prevention.



(Level 4) Forward thinking solutions to potential life cycle EHS risks are implemented early in product (service) design and throughout the value stream.



(Level 5) EHS risk prevention and mitigation is part of the natural way business is conducted across the extended enterprise, creating a sustainable environment and creating a competitive advantage.

Lean Process Enablers

A number of enablers can facilitate lean implementation via consistent application throughout the organization.

Process Standardization

(Strive for consistency and re-use)

Examples:

- > **The workforce plays a significant role in devising standard processes and practices, which are adhered to and periodically updated.**
- > **Process improvements are documented in a concise and easy to use standard format and transferred.**
- > **Processes are standardized where applicable throughout the extended enterprise.**

○
(Level 1) Processes vary by product line or division.

○
(Level 2) Key processes in the organization have been identified that could benefit from standardization, with initial efforts underway.

○
(Level 3) Selected processes are standardized throughout the division and organization-wide.

○
(Level 4) Process standardization and reuse is consistently employed organization-wide.

○
(Level 5) Extended enterprise interface processes have been standardized.

Common Equipment and Systems

(Assuring compatibility, reducing costs)

Examples:

- > **Policies have been established and deployed that require the use of common equipment and systems throughout the division and organization-wide.**
- > **Common equipment and systems provide easy access and reuse of knowledge throughout the organization.**
- > **Company-wide use of common equipment and systems provides enhanced compatibility between processes and aids employee transfer between divisions.**

○
(Level 1) Equipment and systems vary by division or department.

○
(Level 2) Have identified high leverage opportunities for common equipment and systems; initial deployment in a few areas.

○
(Level 3) Plans are in place for achieving common equipment and systems and have been implemented to varying degrees throughout the division.

○
(Level 4) Common equipment and systems have been implemented organization-wide.

○
(Level 5) Compatibility of equipment and systems with those of enterprise partners in the extended enterprise.

Variation Reduction (Reduce uncertainty by reducing variation)

Examples:

- > Process ownership and visual displays of process variation enable quick and easy identification of adverse trends.
- > High levels of process stability are maintained by utilizing mistake proofing and root cause identification techniques to the fullest.
- > Variation reductions achieved enable short predictable lead times for information and material flow.

*

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| <p>○</p> <p>(Level 1) There is limited use of variation reduction tools and methods. There is some evidence of variation understanding in parts of the organization.</p> | <p>○</p> <p>(Level 2) There is evidence that sources of variation are being identified and analyzed. Initial efforts are underway to reduce variability.</p> | <p>○</p> <p>(Level 3) A formal approach that balances customer value and variation reduction is implemented in many parts of the division.</p> | <p>○</p> <p>(Level 4) Considerable benefits are realized from reduced variation in processes and practices organization-wide.</p> | <p>○</p> <p>(Level 5) Benefits of reduced variation are realized across the extended enterprise.</p> |
|---|---|---|--|---|

Localized Performance Metrics (Visual Management Boards - VMB)

Examples:

- > Each process / area has ability to visually understand daily, weekly, monthly, quarterly, and yearly progress and goals associated with identified key performance indicators (i.e. quality, cost, delivery, safety).
- > VMB's are maintained locally requiring minimal resources to update and communicate.
- > VMB's are reviewed regularly by senior leaders with key support personnel responsible for process / area.

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| <p>○</p> <p>(Level 1) Very few VMB type metrics are used throughout the division. Not a regular occurrence.</p> | <p>○</p> <p>(Level 2) VMB's are used on a regular basis but data collection is resource intensive or seldom updated.</p> | <p>○</p> <p>(Level 3) VMB's are used extensively throughout division. Update requires minimal resources and are viewed on regular basis by senior leaders.</p> | <p>○</p> <p>(Level 4) VMB's are used extensively throughout division and links between organizational VMB's are made. Updates require minimal resources and have become the benchmark for other division to use organization-wide.</p> | <p>○</p> <p>(Level 5) VMB's are used extensively throughout division and links between organizational and extended enterprise VMB's are made. Customers and suppliers are integrated into the regular update and communication process.</p> |
|--|---|---|---|--|

Workplace organization
(Place for everything and everything in its place)

Examples:

> Some sort of systematic process or assessing, managing, and sustaining workplace organization (i.e. 5's, 6's).

> Workplace organization is foundational to all kaizen (continuous improvement) events throughout the organization.

> Workplace organization is a key metric used to evaluate the performance of suppliers.

> Standardization occurs across division and organizationally regarding workplace organization standards.

*

○	○	○	○	○
(Level 1) Workplace organization is a function of select areas within the division and not supported or respected by others.	(Level 2) Workplace organization kaizen events have been successful implementing but have difficult sustaining due to lack of formal audit process.	(Level 3) Workplace organization has occurred throughout the division and is regularly assessed through audits. Formalized measurement system is used to determine when new levels have been achieved.	(Level 4) Workplace organization has occurred throughout the division and is regularly assessed through audits. Formalized measurement system is used to determine when new levels have been achieved. The 'system' modeled throughout the organization based on success within the division.	(Level 5) Workplace organization scores are consistently maintained and audits are only used to survey recent change initiatives. The culture has adopted workplace organization as the only way to operate and suppliers are modeling the organizations behaviors.

APPENDIX E:
BURKE-LITWIN OAS ONLINE SURVEY

Thank you for following the link to the on-line Organizational Assessment Survey. As mentioned in the previous e-mail, the survey consists of 90 questions and participation will take approximately 30-45 minutes completed during work hours or anytime with a computer connected to the internet.

Your participation in this research is voluntary and your confidentiality will be maintained throughout the research project. At anytime during the survey you decide to not participate in the study, you may stop participation by exiting the survey with no consequences.

The survey will be open for two weeks starting February 15, 2010 and will close February 28, 2010. It is preferable to complete the survey in one session however, if you cannot, there is an option to save your answers and return prior to the close of the survey on February 28, 2010.

While there are no direct personal benefits to you for participating, our intent is to gain more knowledge about factors influencing performance and change within your organization. All data will be analyzed and scored then summarized for your organization in a final report. Your participation will be confidential ensuring the researchers and your employer will not be able to link individual participants with their perceptions.

It is not possible to identify all potential risks in research procedures, but the researchers have taken reasonable safeguards to minimize any known and potential, but unknown, risks. If you agree to participate in this study, please proceed by clicking the "I AGREE" button at the end of this page.

If you have any questions or technical issues with the on-line survey, please contact Kyle Stone via e-mail or phone. If you have any questions about your rights as a volunteer in this research, contact Janell Barker, Colorado State University - Human Research Administrator, at 970-491-1655.

Sincerely,

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☐ I AGREE

INSTRUCTIONS

The purpose of this questionnaire is to gather your opinions about your organization. The questions cover many aspects of how work gets done and are intended to provide a broad assessment of important areas such as mission and strategy, leadership, managerial behavior, work group climate, employee satisfaction, and overall effectiveness. The questionnaire is also intended to establish a baseline measurement for gauging progress in these key areas of organizational performance.

Each question is rated on a 5-point scale, with "1" and "5" reflecting the ends of the continuum. Please consider the full range between 1 and 5 in making your response. Each question should be answered according to your own experience and opinion and should reflect your perception of current overall conditions. Resist responding in terms of how things were in the past or how they should be in the future, unless specifically asked to do so.

The information from this survey will be kept strictly confidential. Without exception, your individual responses will not be released to anyone. You are therefore encouraged to represent your true feelings as honestly as possible.

DEFINITIONS

The survey you are about to complete is divided into 12 major sections. You may find the following definitions helpful in responding to the questions in each of the different sections. These definitions are also provided at the beginning of each section.

External Environment:

The outside conditions or situations that influence performance of the organization (e.g., government policy, competition, customers).

Mission & Strategy:

The mission is the overall purpose of the organization, what it wants to achieve. The strategy is the means by which the organization intends to achieve the mission.

Leadership:

The most senior level executives in the organization

Culture:

The "way things are done around here"; this includes the values, beliefs, and norms that drive people's actions.

Structure:

How the organization is designed (levels, roles, responsibilities, etc.) to achieve its mission

Management practices:

Behavior that managers exhibit in the normal course of events on a daily basis.

Systems:

The standardized policies, procedures, rewards, and information systems that facilitate and reinforce people's work.

Work Group Climate:

The collective impressions, expectations and feelings that members of work groups have that affect their relationships with each other.

Task Requirements/Individual Skills:

The specific skills and abilities that people need to do their work and how well these skills match the requirements of their jobs.

Motivation:

People's desire to achieve both their own work goals and the goals of the organization.

Individual Needs and Values:

What people believe to be important, good vs. bad, and what should guide daily behavior in the organization.

Performance:

The outcomes, results, and indicators of individual and organizational achievement

Customer:

Immediate user of services or products provided. While there may be internal users, most often this will refer to an external customer -- someone outside the organization.

Work Group Members:

Peers and colleagues with whom you work on a day-to-day basis.

Your Manager:

The person to whom you directly report -- your supervisor

BACKGROUND INFORMATION (OPTIONAL INFORMATION)

Please indicate which plant you work in most.

(If your plant is not identified, please choose 'other' and provide plant name or plant #)

*

-- Select --

Please indicate your current function / department

(use 'other' and provide description if none of these fit)

*

-- Select --

Please indicate if you are a direct (hourly) or indirect (salary) associate.

*

-- Select --

Number of years you have worked for [REDACTED]

(round-up to next level if it falls between ranges)

*

-- Select --

EXTERNAL ENVIRONMENT

The outside conditions or situations that influence performance of the organization (e.g., government policy, competition, customers).

1. What is the rate of change your organization is currently experiencing?

1.	2.	3.	4.	5.	Don't Know
Experiencing relative stability				Experiencing very rapid change	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

2. Does pressure from your organization's environment affect the day-to-day lives of people who run the organization; i.e., how insulated are the people who run the organization from the environment?

1.	2.	3.	4.	5.	Don't Know
Managers highly insulated from environment				Highly responsive	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

3. How responsive do you think managers in your organization are to external factors; e.g., customers, competition, changes in technology, the economy, etc.?

1.	2.	3.	4.	5.	Don't Know
Not responsive				Highly responsive	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

In the next question, customers refer to the immediate user of services or products provided by your organization.

4. To what extent does your organization's culture value customers?

1.	2.	3.	4.	5.	Don't Know
To a very small extent				To a very great extent	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

MISSION & STRATEGY

The mission is the overall purpose of the organization, what it wants to achieve. The strategy is the means by which the organization intends to achieve the mission.

5. To what extent are employees clear about the organization's direction; i.e., its mission and strategy?

1.To a very small extent	2.	3.To some extent	4.	5.To a very great extent	Don't Know
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

6. To what extent do employees know who their target customers and markets are?

1.To a very small extent	2.	3.To some extent	4.	5.To a very great extent	Don't Know
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

7. To what extent can employees identify the primary products and/or services?

1.To a very small extent	2.	3.To some extent	4.	5.To a very great extent	Don't Know
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

8. To what extent do employees know the organization's geographic domains?

1.To a very small extent	2.	3.To some extent	4.	5.To a very great extent	Don't Know
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

9. To what extent can employees describe the organization's core technologies (i.e., how its products and/or services are produced)?

1.To a very small extent	2.	3.To some extent	4.	5.To a very great extent	Don't Know
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

10. To what extent do employees understand the organization's plans regarding survival, growth, and target levels of profitability?

1.To a very small extent	2.	3.To some extent	4.	5.To a very great extent	Don't Know
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

11. To what extent can employees articulate the organization's basic beliefs, values and aspirations (i.e., key elements of the organization's philosophy)?

1.To a very small extent	2.	3.To some extent	4.	5.To a very great extent	Don't Know
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

12. To what extent can employees identify the organization's competitive strengths (i.e., how it differs from the competition)?

1.To a very small extent	2.	3.To some extent	4.	5.To a very great extent	Don't Know
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

13. To what extent can employees articulate the organization's desired public image (i.e., how it wants to be perceived)?

1.To a very small extent	2.	3.To some extent	4.	5.To a very great extent	Don't Know
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

14. How widely shared is the organization's strategy among employees (i.e., how widely is it communicated?)

1.Narrowly communicated; only certain people know it	2.	3.	4.	5.Very widely communicated; everyone knows it	Don't Know
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

15. How relevant do employees believe their day-to-day activities are to achieving the organization's strategy?

1.Not at all relevant	2.	3.	4.	5.Highly relevant	Don't Know
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

LEADERSHIP

The most senior level executives in the organization

The questions in this section ask for your perceptions of leadership. Leadership refers to the most senior executives in your organization

16. To what extent do employees trust the leadership of the organization?

1.To a very small extent	2.	3.	4.	5.To a very great extent	Don't Know
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

17. To what extent do senior managers promote ethics and integrity in the organization, i.e., what the organization stands for, its purpose, its standing in the larger community?

1.To a very small extent	2.	3.	4.	5.To a very great extent	Don't Know
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

18. Are the senior managers of the organization perceived as strongly and unequivocally *supporting* the mission and strategy?

1.To a very small extent	2.	3.	4.	5.To a very great extent	Don't Know
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

19. To what extent do the senior managers of the organization make an effort to keep in personal touch with staff at your level?

1.To a very small extent	2.	3.	4.	5.To a very great extent	Don't Know
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

20. Is excellent leadership valued in your organization?

1.There is little attention given to the value of excellent leadership	2.	3.	4.	5.There is a high degree of attention given to the value of excellent leadership	Don't Know
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

21. Do the senior managers of the organization inspire people to achieve the mission?

1.Leadership is not inspirational	2.	3.	4.	5.Leadership is very inspirational	Don't Know
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

22. To what extent does the behavior of senior managers *demonstrate* their beliefs in the values needed for success?

1.To a very small extent	2.	3.	4.	5.To a very great extent	Don't Know
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

CULTURE

The "way things are done around here"; this includes the values, beliefs, and norms that drive people's actions.

Questions on this section refer to your organization's culture, that is, "the way things are done around here."

23. Are people in the organization *clear* about the *values* needed for success?

1. Very unclear	2.	3.	4.	5. Very clear	Don't Know
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

24. Do employees act in ways that support the mission and strategy?

1. Employees act in ways that do not support our mission and strategy	2.	3.	4.	5. Employees act in ways that do support our mission and strategy	Don't Know
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

25. To what extent does your organization's culture value employees?

1. To a very small extent	2.	3.	4.	5. To a very great extent	Don't Know
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

26. To what extent does your organization's culture value its owners (shareholders, members, taxpayers, etc.)?

1. To a very small extent	2.	3.	4.	5. To a very great extent	Don't Know
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

27. To what extent are employees treated fairly and equitably?

1. To a very small extent	2.	3.	4.	5. To a very great extent	Don't Know
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

28. Do employees feel comfortable bringing up their issues and concerns?

1. Employees feel they cannot raise concerns for fear of negative consequences	2.	3.	4.	5. Employees feel they can air their concerns without negative consequences	Don't Know
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

These questions concern the capacity of your organization to change its culture

29. Are the beliefs and values employees hold well established and deeply rooted; i.e., <i>difficult</i> to change?					
1. Deeply rooted beliefs and values-- difficult to change	2.	3.	4.	5. Not deeply rooted beliefs and values-- susceptible to change	Don't Know
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
30. Do employees take action and make change happen?					
1. Employees are waiting for direction from management to act	2.	3.	4.	5. Employees are taking active steps to do things differently	Don't Know
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
31. Are employees attempting new approaches to doing their work?					
1. Employees are over cautious, conservative, and risk averse	2.	3.	4.	5. Employees are trying new things, taking risks, exploring options	Don't Know
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
32. Do employees seek ways to improve their performance?					
1. Employees rarely spend time thinking about new and better ways of doing work	2.	3.	4.	5. Employees constantly monitor the quality of their performance and make needed changes	Don't Know
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
33. To what extent do employees learn from past experiences so that history does not repeat itself?					
1. To a very small extent	2.	3.	4.	5. To a very great extent	Don't Know
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
34. To what extent is new knowledge transferred throughout the organization quickly and efficiently?					
1. To a very small extent	2.	3.	4.	5. To a very great extent	Don't Know
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

STRUCTURE

How the organization is designed (levels, roles, responsibilities, etc.) to achieve its mission

The following items refer to the structure of your organization; how it is currently organized to accomplish its mission and strategy.

35. To what extent does the organization's structure help different departments *work together effectively*?

1. To a very small extent	2.	3.	4.	5. To a very great extent	Don't Know
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

36. Does the structure *support the accomplishment of the organization's mission and strategy*?

1. Structure hinders mission and strategy	2.	3.	4.	5. Structure supports mission and strategy	Don't Know
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

37. To what extent do managers give people the *authority* they need to accomplish their work effectively?

1. To a very small extent	2.	3.	4.	5. To a very great extent	Don't Know
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

38. For managers in your organization, how would you characterize the breadth and depth of responsibilities they are expected to manage?

1. To limited	2.	3. About right	4.	5. Too much	Don't Know
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

MANAGEMENT PRACTICES

Behavior that managers exhibit in the normal course of events on a daily basis.

Please rate the extent to which the following management practices are exhibited by your manager on a daily basis.

Your manager refers to the person to whom you directly report; your supervisor.

39. To what extent does your manager act in ways that reflect concern for people.

1.To a very small extent	2.	3.To some extent	4.	5.To a very great extent	Don't Know
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

40. To what extent does your manager inspire and motivate people.

1.To a very small extent	2.	3.To some extent	4.	5.To a very great extent	Don't Know
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

41. To what extent does your manager encourage autonomy.

1.To a very small extent	2.	3.To some extent	4.	5.To a very great extent	Don't Know
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

42. To what extent does your manager recognize innovation.

1.To a very small extent	2.	3.To some extent	4.	5.To a very great extent	Don't Know
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

43. To what extent does your manager demonstrate a commitment to safety.

1.To a very small extent	2.	3.To some extent	4.	5.To a very great extent	Don't Know
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

44. To what extent does your manager hold people accountable for their actions.

1.To a very small extent	2.	3.To some extent	4.	5.To a very great extent	Don't Know
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

45. To what extent does your manager demonstrate a concern for the customer.

1.To a very small extent	2.	3.To some extent	4.	5.To a very great extent	Don't Know
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

46. To what extent does your manager demonstrate respect for people.

1.To a very small extent	2.	3.To some extent	4.	5.To a very great extent	Don't Know
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

47. To what extent does your manager encourage participation.

1.To a very small extent	2.	3.To some extent	4.	5.To a very great extent	Don't Know
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

48. To what extent does your manager engage in realistic budgeting.

1.To a very small extent	2.	3.To some extent	4.	5.To a very great extent	Don't Know
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

49. To what extent does your manager encourage communication up, down and across.

1.To a very small extent	2.	3.To some extent	4.	5.To a very great extent	Don't Know
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

50. To what extent does your manager promote career development of employees.

1.To a very small extent	2.	3.To some extent	4.	5.To a very great extent	Don't Know
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

51. To what extent does your manager demonstrate knowledge and expertise in his/her area of the business.

1.To a very small extent	2.	3.To some extent	4.	5.To a very great extent	Don't Know
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

SYSTEMS

The standardized policies, procedures, rewards, and information systems that facilitate and reinforce people's work.

How effectively does your organization process information--do people, for example, receive relevant and timely information on matters important to their jobs?

52. How relevant is the information you receive?

1.Information has little relevance to my work	2.	3.	4.	5.Information has high relevance to my work	Don't Know
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

53. How timely is the information you receive?

1.Information is not timely	2.	3.	4.	5.Information gets to me at the right time	Don't Know
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

54. With respect to how managers in your organization are rewarded, what is the balance between results and how the managers(their behavior) achieve these results?

1.Rewarded only for results	2.	3.Rewarded equally for results and behavior	4.	5.Rewarded only for how they behave	Don't Know
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

55. To what extent are people adequately rewarded for their work performance?

1.To a very small extent	2.	3.	4.	5.To a very great extent	Don't Know
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

56. Does your organization have the right rewards and benefits necessary to attract and retain the very best people for each job?

1.Rewards not appropriate	2.	3.	4.	5.Rewards very appropriate	Don't Know
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

57. How well informed do you feel about issues affecting the organization as a whole?

1.Poorly informed	2.	3.	4.	5.Very well informed	Don't Know
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

58. How well informed do you feel about issues affecting your division, function, area, or department?

1. Poorly informed	2.	3.	4.	5. Very well informed	Don't Know
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

59. How well informed do you feel about issues affecting you and your jobs?

1. Poorly informed	2.	3.	4.	5. Very well informed	Don't Know
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

WORK GROUP CLIMATE

The collective impressions, expectations and feelings that members of work groups have that affect their relationships with each other.

This section deals with your perceptions of the level of teamwork exhibited in your work group. Throughout this section, work group refers to peers and colleagues with whom you work on a day-to-day basis.

60. How clear are work group members about what is expected at them, their responsibilities, roles, and goals?

1. Very unclear	2.	3.	4.	5. Very clear	Don't Know
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

61. To what extent are work group members involved in making decisions that directly affect their work?

1. To a very small extent	2.	3.	4.	5. To a very great extent	Don't Know
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

62. Is there cooperation and teamwork between you and your colleagues?

1. Work group members work individually, there is little cooperation & teamwork	2.	3.	4.	5. Work group members collaboratively, cooperate to get the job done	Don't Know
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

63. Is there *trust* and *mutual respect* among work group members?

1. Very little trust and mutual respect	2.	3.	4.	5. High trust and mutual respect	Don't Know
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

64. To what extent does your work group make good use of individual differences of style, approach and skills?

1. To a very small extent	2.	3.	4.	5. To a very great extent	Don't Know
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

65. Is there <i>trust</i> and mutual <i>respect</i> between your work group and other groups inside the organization?						
1. Very little trust and mutual respect	2.	3.	4.	5. High trust and mutual respect	Don't Know	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		<input type="radio"/>

66. Do work group members recognize each other for doing good work?						
1. Members give little to no recognition for others' good work	2.	3.	4.	5. Members give a great deal of recognition for others' good work	Don't Know	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		<input type="radio"/>

67. Do work group members work at the highest possible standard?						
1. Members work to look busy, not much gets accomplished	2.	3.	4.	5. Members work to achieve higher levels of performance	Don't Know	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		<input type="radio"/>

TASK REQUIREMENTS/INDIVIDUAL SKILLS

The specific skills and abilities that people need to do their work and how well these skills match the requirements of their jobs.

68. How *challenged* do you feel in your present job?

1. Not at all challenged	2.	3.	4.	5. Highly challenged	Don't Know
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

69. To what extent do you believe your *skills*, knowledge, and *experience* appropriately fit the job you currently hold?

1. To a very small extent	2.	3.	4.	5. To a very great extent	Don't Know
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

70. To what extent are the right people selected for promotion or assignment to projects in your organization?

1. To a very small extent	2.	3.	4.	5. To a very great extent	Don't Know
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

71. Do employees feel they can request formal training and development?

1. Employees are afraid to ask for training and development	2.	3.	4.	5. Employees feel they can openly request more skill building and training	Don't Know
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

MOTIVATION

People's desire to achieve both their own work goals and the goals of the organization.

Questions in this section refer to the existing level of employee motivation to perform effectively in their jobs.

72. How would you characterize employee morale?

1. Very low, people feel discouraged frustrated and anxious	2.	3.	4.	5. Very high, there is a positive sense of commitment confidence and motivation	Don't Know
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

73. To what extent do you feel encouraged to reach higher levels and standards of performance in your work?

1. To a very small extent	2.	3.	4.	5. To a very great extent	Don't Know
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

74. To what extent do you feel your total *motivational* energies are being drawn on to support the organization's mission and purpose?

1. Have to work to keep myself motivated	2.	3.	4.	5. Total motivation & commitment	Don't Know
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

75. To what extent are other employees in your organization motivated to do what is needed to achieve the organization's mission and purpose?

1. Employees have a low level of motivation	2.	3.	4.	5. Employees are highly motivated	Don't Know
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

INDIVIDUAL NEEDS & VALUES

What people believe to be important, good vs. bad, and what should guide daily behavior in the organization

This section examines the extent to which employees' needs and values are consistent with the organization's needs and values.

76. How *meaningful* to you is the work you are currently performing?

1. Not meaningful	2.	3.	4.	5. Very meaningful	Don't Know
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

77. To what extent do you feel *free* to conduct your work the way you think it should be done?

1. To a very small extent	2.	3.	4.	5. To a very great extent	Don't Know
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

78. Do you feel *valued* as a person in your organization?

1. I feel undervalued, not trusted or supported	2.	3.	4.	5. I feel I am recognized as a valuable asset, trusted and supported	Don't Know
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

79. To what extent are you satisfied with your job?

1. To a very small extent	2.	3.	4.	5. To a very great extent	Don't Know
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

80. Is there a healthy balance between your work and personal life?

1. I want more balance between work and personal life. Currently, I feel overworked	2.	3.	4.	5. I feel I have a good balance between work and personal life	Don't Know
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

PERFORMANCE

The outcomes, results, and indicators of individual and organizational achievement

Questions in this section refer to how performance is measured in your organization.

81. Are there clear standards for employee performance?

1. Very unclear	2.	3.	4.	5. Very clear	Don't Know
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

82. Given existing resources and technology, is your organization currently achieving the highest level of performance of which it is capable?

1. Achieving a very low level of performance	2.	3.	4.	5. Achieving a maximum level of performance	Don't Know
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

83. To what extent is your organization a good place to work compared with other organizations?

1. To a very small extent	2.	3.	4.	5. To a very great extent	Don't Know
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

84. To what extent is your organization effective at eliminating waste and inefficiency throughout the organization?

1. To a very small extent	2.	3.	4.	5. To a very great extent	Don't Know
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

85. To what extent does your organization develop trusting relationships between management and employees?

1. To a very small extent	2.	3.	4.	5. To a very great extent	Don't Know
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

86. To what extent does your organization make effective use of talented people?

1. To a very small extent	2.	3.	4.	5. To a very great extent	Don't Know
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

87. To what extent does your organization make use of state of the art technology to increase efficiency of service?

1.To a very small extent	2.	3.	4.	5.To a very great extent	Don't Know
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

88. To what extent does your organization earn recognition as a world class competitor in our industry?

1.To a very small extent	2.	3.	4.	5.To a very great extent	Don't Know
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

89. To what extent does your organization provide high quality products and/or services to customers?

1.To a very small extent	2.	3.	4.	5.To a very great extent	Don't Know
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>


90. To what extent does your organization consistently meet revenue objectives?

1.To a very small extent	2.	3.	4.	5.To a very great extent	Don't Know
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

APPENDIX F:
BURKE-LITWIN OAS REQUEST DOCUMENTS

RE: Request to use Burke Organizational Assessment Survey in Disserstaion research
Burke, W. Warner [burke1@exchange.tc.columbia.edu]

You forwarded this message on 8/23/2009 4:05 PM.

Sent: Tuesday, July 07, 2009 3:26 PM
To: Stone,Kyle
Attachments:  The Burke-Litwin Organizat~1.pdf (7 MB) [Open as Web Page]

Dear Mr. Stone,
You have my permission to use B-L Model survey for your dissertation research. See the attachment for the copy.
Thanks for your interest in my work, and good luck with your research.
wwb

-----Original Message-----
From: Stone,Kyle [mailto:kbstone@cahs.colostate.edu]
Sent: Tuesday, July 07, 2009 4:42 PM
To: wwb3@columbia.edu
Cc: Chermack,Thomas (EID)
Subject: Request to use Burke Organizational Assessment Survey in Disserstaion research

Dr. Burke,

I am writing to request permission for use of the Burke Organizational Assessment Survey and, if granted, a copy of the assessment. I am currently in the process of refining my dissertation research agenda for a PhD in Organizational Performance and Change at Colorado State University (<http://soe.cahs.colostate.edu/Graduate/PhD/OPC/Default.aspx>) and would like to use the survey as the instrument to gather data of organizations involved in Lean Transformations. The target population will be in the manufacturing industry with a sample of 150 surveys from at least four different organizations.

I am unsure how much information you require to inform your decision so I am keeping my request brief. However, should you need additional information or would like to discuss my research agenda in more detail, please feel free to contact me. I have attached my CV in order to provide some insight into my experience and research interest.

Regards,

Kyle B. Stone
Colorado State University
Organizational Performance & Change
232 Education
Fort Collins, CO 80523-1588
970-488-0057

RE: Request to use Burke Organizational Assessment Survey in Disserstaion research
Burke, W. Warner [burke1@exchange.tc.columbia.edu]

Sent: Monday, August 24, 2009 8:52 AM
To: Stone,Kyle

Dear Kyle,

Good thinking on your part, but unfortunately I have never produced a manual for the model. There is ongoing work now with the EMC corporation with the model. Should useful information come from this work, I can let you know.
Best wishes with your research.
wwb

From: Stone,Kyle [mailto:kbstone@cahs.colostate.edu]
Sent: Sun 8/23/2009 6:05 PM
To: Burke, W. Warner
Subject: FW: Request to use Burke Organizational Assessment Survey in Disserstaion research

Dr. Burke,

As I continue my literature review surrounding the Burke-Litwin organizational assessment survey, the thought crossed my mind to inquire about any sort of "manual" that might accompany the instrument. Specifically, I am curious about validity and reliability measures. I am gleaming a lot of information from previous dissertations (i.e. Falletta (1999), Anderson-Rudolf (1996)) and obviously your published articles and books but thought I would "just ask" to see if the information was already compiled. If you can think of any other "must read" dissertations / articles, suggestions would be appreciated.

If nothing is available, no worries.

Thanks again for the opportunity to use your instrument in my research. I am getting ready for the pilot study soon and look forward to seeing the outcomes.

Regards,

Kyle B. Stone
Colorado State University
Organizational Performance & Change
232 Education
Fort Collins, CO 80523-1588
970-488-0057

APPENDIX G:
BURKE-LITWIN OAS PILOT TEST



Executive Summary

Title: Assessing Organizational Performance with the Burke-Litwin Model

Researcher: Kyle B. Stone; Ph.D. Dissertation Pilot Research Project

Background Information:

Successful organizational change is often predicated upon an organization's ability to understand dimensions influencing change interventions as outlined in the Burke-Litwin Organizational Performance and Change (OP&C) Model shown in Figure 1. To better understand why interventions succeed in some instances and not in others, it is important to study the strength of the association between Organizational Performance and Change (OP&C) dimensions and their impact on the performance an organization achieves.

Burke and Litwin's (1992) causal model of Organizational Performance and Change is based on open systems theory with the input being external environment and output as individual and organizational performance. Burke and Litwin hypothesize organizations engaged in planned change and performance improvement interventions recognize transformational change predicates transactional change and too often, organizations mired in details (transactional and incremental activities) often overlook the importance leadership, mission and strategy, and culture have on successful transformations. Burke (2008) purported the predictive relationships between factors common to organizations engaged in change and offered a process, "how to bring about change..." in addition to content, "what needs to change..." approach lacking in other organizational change models (p. 165).

A key aspect of the Burke-Litwin OP&C model is the transformational and transactional dimensions, which are based on research of transformational and transactional leadership styles. Burke combined these two styles and hypothesized "that each leader (transformational) or manager (transactional) could empower others effectively, but the behaviors would differ when one was acting as leader and when as manager" (Burke, 2008, p. 190). Drawing on this, Burke concluded "transformational change is more closely linked with leadership and transactional change is more closely associated with management" (p.190). Within the Burke-Litwin OP&C model the transformational factors are: external environment, leadership, mission and strategy, organizational culture, and individual and organizational performance. The transactional factors are: management practices, structure, systems, work unit climate, motivation, tasks and skills, and individual needs and values.

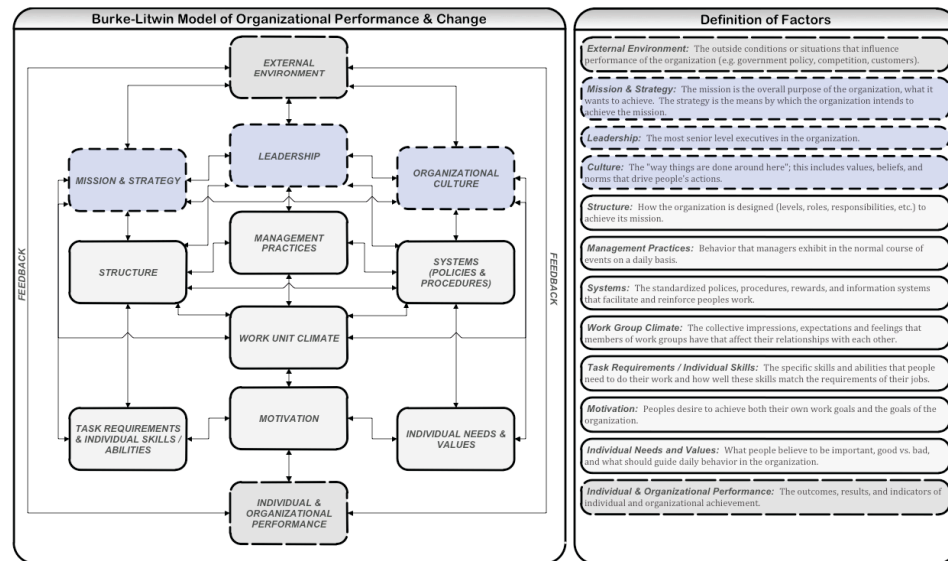


Figure 1. Burke-Litwin OPC Model

Burke-Litwin Organizational Assessment Survey (OAS) results:

The survey your organization participated in was designed to determine the level (1 being low, 5 being high) of each factor based on the perceptions of the participants. These results can be useful when trying to diagnose current organizational dynamics and to help guide change initiatives that improve performance. Table 1 outlines the mean scores, standard deviations, and ranking of each factor.

Table 1

Pilot Study Results by Factor

Factor	Survey Questions	Mean	SD	Rank
Transformational				
External Environment	1 – 4	4.03	.43	4
Mission and Strategy	5 – 15	4.16	.43	3
Leadership	16 – 22	4.48	.40	1
Organizational Culture	23 – 34	3.70	.42	12
Individual and Organizational Performance	81 – 90	3.95	.54	6
Transactional				
Structure	35 – 38	3.90	.54	7
Management Practices	39 – 51	4.27	.44	2
Systems	52 – 59	3.73	.58	9
Work Unit Climate	60 – 67	3.96	.53	5
Task, Skills, Abilities	68 – 71	3.71	.88	11
Motivation	72 – 75	3.71	.71	10
Needs and Values	76 – 80	3.88	.71	8

The scores for all of the factors indicated positive perceptions of the employees with leadership, management practices, and mission / strategy being the most positive and culture being least positive. The standard deviations for these four factors have relatively low variation indicating some congruency among participants.

It may be helpful to review the results as shown in Figure 2 keeping in mind transformational factors are typically associated with leadership and transactional factors associated with management. For example, when planning future interventions such as manager development, the scores in the transactional dimensions might be able to guide specific areas to develop. When working on leadership tasks, culture might be of more importance.

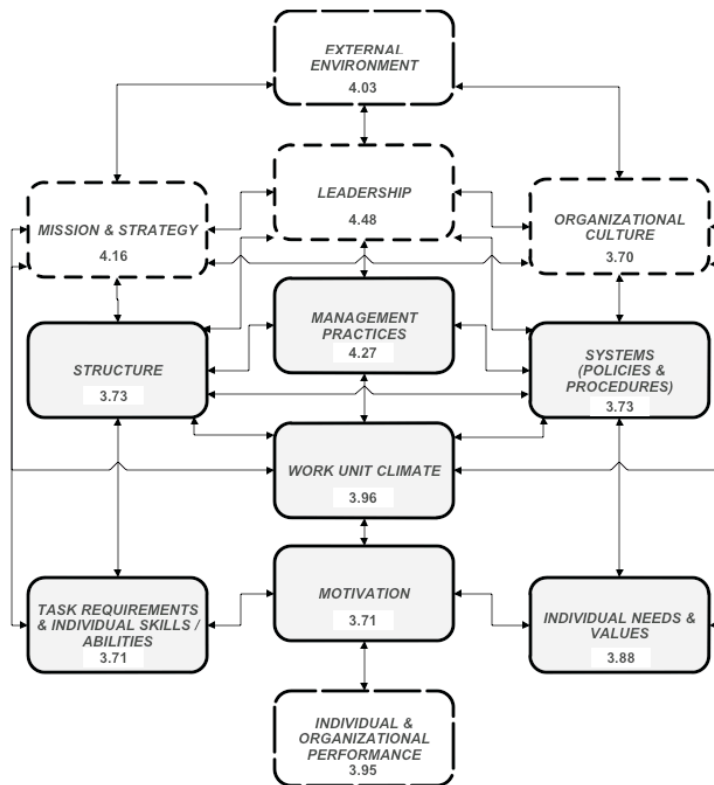


Figure 2. Burke-Litwin OAS Scores

Another important aspect when interpreting results from the Burke-Litwin OP&C model is to concentrate first on the factors 'down the middle' of the model (leadership, management practices, climate, and motivation) and the direction of the arrow showing influence. For example, motivation scored 3.71 and is influenced by climate, needs / values, and task / skills. If wanting to improve motivation, these three other areas would need to be reviewed as well.

Attached as separate documents, you will find the open-ended responses in Appendix A and should prove to be useful when trying to illuminate deeper meaning of the participants' responses. Appendix B is a compilation of each question from the Burke-Litwin OAS with participant responses.

Summary:

First, I want to thank your organization for participating in the survey and the opportunity to help understand how these factors influence organizational performance and change. A 100% response rate is not typical in most organizations and highlights the dedication everyone has in improving your organization. As your leadership team works to digest these results, keep in mind these are a 'snap shot' of a moment in time and the perceptions of the participants. These data can serve as a benchmark to help when future interventions are made and another survey conducted to measure the difference in scores.

To help with interpretation, I have also included the Burke and Litwin (1992) article describing each of the factors in a more detail. For an in-dept reference, you can use Burke (2008) *Organizational Change: Theory and Practice*. I am also available to assist with additional interpretation and integrating the findings into interventions designed to improve individual and organizational performance.

Should you have any questions or require additional information, please feel free to ask.

Regards,

Kyle B. Stone
Colorado State University
Organizational Performance and Change
25 Education Building
Fort Collins, CO 80523
970-488-0057
kbstone13@mesanetworks.net

APPENDIX H:
BURKE-LITWIN OAS EXPLORATORY FACTOR ANALYSIS

Factor Loadings for the Rotated Factors of the Burke-Litwin OAS

Item	Factor												h ²
	1	2	3	4	5	6	7	8	9	10	11	12	
Q42 Management practices	.761												.941
Q39 Management practices	.760												.915
Q51 Management practices	.742												.961
Q49 Management practices	.736												.915
Q40 Management practices	.732		.318										.956
Q47 Management practices	.731												.926
Q46 Management practices	.720												.948
Q50 Management practices	.648												.912
Q48 Management practices	.627	.307											.823
Q41 Management practices	.556												.885
Q43 Management practices	.527	.406											.873
Q27 Culture	.514		.469										.944
Q45 Management practices	.481	.317											.920

Factor Loadings for the Rotated Factors of the Burke-Litwin OAS (Cont.)

Item	Factor												h ²
	1	2	3	4	5	6	7	8	9	10	11	12	
Q37 Structure	.459	.335				.325							.903
Q81 Needs and Values	.435				.387								.858
Q44 Management practices	.399		.333										.852
Q86 Performance	.388			.312									.879
Q71 Task Req. / Indv. Skill	.313												.859
Q6 Mission and Strategy		.662											.881
Q23 Culture		.656											.888
Q11 Mission and Strategy		.656											.896
Q12 Mission and Strategy		.648											.867
Q15 Mission and Strategy		.645											.910
Q5 Mission and Strategy		.634			.324								.925
Q4 External Environment		.570											.862
Q14 Mission and Strategy		.530											.896

Factor Loadings for the Rotated Factors of the Burke-Litwin OAS (Cont.)

Item	Factor												h ²
	1	2	3	4	5	6	7	8	9	10	11	12	
Q10 Mission and Strategy		.527											.869
Q24 Culture		.527		.386									.900
Q9 Mission and Strategy		.504										.393	.900
Q3 External Environment		.485								.359			.862
Q7 Mission and Strategy		.477						.301					.875
Q13 Mission and Strategy		.420	.327										.844
Q26 Culture		.361											.813
Q18 Leadership			.659										.931
Q22 Leadership	.307		.638			.325							.920
Q17 Leadership	.413		.615										.891
Q19 Leadership			.577										.841
Q28 Culture	.412		.576										.934
Q21 Leadership			.570			.341							.937

Factor Loadings for the Rotated Factors of the Burke-Litwin OAS (Cont.)

Item	Factor												h ²
	1	2	3	4	5	6	7	8	9	10	11	12	
Q16 Leadership	.306	.409	.561				.321						.933
Q20 Leadership			.555										.900
Q85 Performance	.408	.305	.488		.372								.941
Q25 Culture	.391	.394	.470										.922
Q72 Motivation	.342	.321	.466		.372								.926
Q70 Task Req. / Indv. Skill	.344		.447	.418	.303								.910
Q63 Work Group Climate				.674									.934
Q64 Work Group Climate				.672									.905
Q66 Work Group Climate				.661									.938
Q62 Work Group Climate				.641									.903
Q36 Structure				.535							.327		.871
Q67 Work Group Climate		.304	.300	.530									.873
Q65 Work Group Climate				.514									.857

Factor Loadings for the Rotated Factors of the Burke-Litwin OAS (Cont.)

Item	Factor												h ²
	1	2	3	4	5	6	7	8	9	10	11	12	
Q61 Work Group Climate				.508						.312			.924
Q35 Structure				.468							.344		.870
Q52 Systems				.416		.317						-.304	.819
Q60 Work Group Climate		.309		.381									.907
Q75 Motivation		.338	.343	.366		.339							.892
Q33 Culture													.863
Q56 Systems			.340		.672								.914
Q84 Performance		.329			.620								.918
Q34 Culture				.306	.605								.912
Q87 Performance					.528								.870
Q55 Systems	.348		.379	.382	.486								.940
Q82 Performance		.404			.447			.330					.891
Q83 Performance		.338			.437	.311							.875

Factor Loadings for the Rotated Factors of the Burke-Litwin OAS (Cont.)

Item	Factor												h ²
	1	2	3	4	5	6	7	8	9	10	11	12	
Q80 Needs and Values		.309			.362								.868
Q53 Systems					.360								.890
Q54 Systems													.844
Q76 Needs and Values						.684							.902
Q79 Needs and Values			.318			.637							.906
Q69 Task Req. / Indv. Skill						.565							.805
Q74 Motivation	.302			.381		.531							.892
Q68 Task Req. / Indv. Skill						.527							.871
Q73 Motivation	.463					.483							.912
Q78 Needs and Values				.335		.397							.948
Q32 Culture		.341		.326			.665						.918
Q30 Culture		.318					.653						.913
Q31 Culture							.651						.913

Factor Loadings for the Rotated Factors of the Burke-Litwin OAS (Cont.)

Item	Factor												h ²
	1	2	3	4	5	6	7	8	9	10	11	12	
Q29 Leadership							.437						.801
Q8 Mission and Strategy		.374					.384						.917
Q90 Performance								.656					.872
Q88 Performance		.394						.517					.855
Q89 Performance		.431						.445					.877
Q58 Systems	.461				.320				.573				.946
Q59 Systems	.362		.352	.401					.550				.947
Q57 Systems	.305				.417				.500				.892
Q38 Structure									.369				.796
Q2 External Environment			.336							.450			.848
Q77 Motivation						.337				.363			.841
Q1 External Environment											-.466		.736

Factor Loadings for the Rotated Factors of the Burke-Litwin OAS (Cont.)

Item	Factor												h ²
	1	2	3	4	5	6	7	8	9	10	11	12	
Eigenvalues	10.61	8.82	7.01	6.83	5.06	4.28	3.13	2.18	1.98	1.64	1.44	1.39	
% of Variance	11.79	9.80	7.79	7.58	5.62	4.75	3.48	2.43	2.20	1.82	1.60	1.55	
Cumulative %	11.79	21.59	29.38	36.96	42.58	47.33	50.81	53.24	55.44	57.26	58.86	60.41	

Note. Loadings < .30 are omitted; Extraction Method: Principal Axis Factoring; Rotation Method: Varimax with Kaiser Normalization.

APPENDIX I:
LOSAMS EXPLORATORY FACTOR ANALYSIS

Factor Loadings for the Rotated Factors of the LOSAMS

Item	Factor									h ²
	1	2	3	4	5	6	7	8	9	
Q24 Structured continuous improvement process	.739		.332							.864
Q23 Tracking detailed implementation	.700	.413								.833
Q26 Nurturing the process	.695		.315			.371				.857
Q25 Monitoring lean process	.666									.882
Q18 Lean change agents	.594	.319	.305							.869
Q27 Capturing lessons learned	.535			.440						.803
Q22 Development of improvement plans	.499									.798
Q28 Impacting Organizational-Wide Strategic Planning	.495		.373	.361						.868
Q21 Provide Education and Training	.483						.410			.849
Q38 Workplace organization	.441		.388	.331						.715
Q6 Lean Vision		.745								.834
Q12 Organizational Orientation		.716						.338		.838
Q9 Continuous flow		.691								.875

Factor Loadings for the Rotated Factors of the LOSAMS (Cont.)

Item	Factor									h ²
	1	2	3	4	5	6	7	8	9	
Q37 Localized Performance Metrics	.342	.559								.792
Q16 Incentive Alignment		.554	.430							.847
Q11 Performance Measures	.304	.553		.489						.862
Q7 A Sense of Urgency		.540			.347		.324			.866
Q5. Senior Leadership Commitment	.369	.512	.312			.328				.874
Q1 What level is Lean integrated in the Strategic Planning Process		.458	.434							.772
Q13 Relationships based on mutual trust	.334	.409	.323					.335		.824
Q15 Employee Empowerment			.651							.748
Q14 Open and Timely Communications			.576							.838
Q33 Integration of environmental Protection, health and safety into the business	.416		.452							.780
Q29 Financial System Supports Lean Transformation	.308			.752						.925
Q30 Divisions throughout the organization pull required financial information				.631						.897

Factor Loadings for the Rotated Factors of the LOSAMS (Cont.)

Item	Factor									h ²
	1	2	3	4	5	6	7	8	9	
Q3 What level does leveraging the Extended Enterprise occur		.378	.357	.572		.340				.862
Q35 Common Equipment and Systems			.329		.672					.799
Q36 Variation Reduction					.661					.895
Q8 Understanding the Current Value Stream					.610		.473			.853
Q10 Designing the Future Value Stream					.532					.865
Q4 Learning and education in “Lean Thinking” for the leadership team	.361					.579				.815
Q20 Commit Resources for Lean Improvements	.376	.316				.501				.849
Q34. Process Standardization			.389		.334	.469				.807
Q19 Lean Transformation Plan	.342	.325					.512			.789
Q31 Promote the learning organization				.404			.512			.823
Q17 Innovation Encouragement	.318							.556		.829
Q2 What level is the focus on Customer Value				.376	.479			.483		.819

Factor Loadings for the Rotated Factors of the LOSAMS (Cont.)

Item	Factor									h ²
	1	2	3	4	5	6	7	8	9	
Q32 Enable the Lean organization with information systems and tools									.841	.692
Eigenvalues	5.30	4.98	3.11	3.10	3.06	1.85	1.79	1.44	1.11	
% of variance	13.95	13.11	8.18	8.16	8.05	4.87	4.70	3.78	2.92	
Cumulative %	13.95	27.06	35.24	43.40	51.45	56.32	61.02	64.80	67.72	

Note. Loadings < .30 are omitted; Extraction Method: Principal Axis Factoring; Rotation Method: Varimax with Kaiser Normalization.