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LEAN TRANSFORMATION: OVERCOMING THE CHALLENGES, MANAGING PERFORMANCE, AND SUSTAINING SUCCESS

David A. Marshall

University of Kentucky, damars3@uky.edu

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LEAN TRANSFORMATION: OVERCOMING THE CHALLENGES, MANAGING
PERFORMANCE, AND SUSTAINING SUCCESS

DISSERTATION

A dissertation submitted in partial fulfillment of the
requirements for the degree of Doctor of Philosophy in the
College of Business and Economics
at the University of Kentucky

By
David A. Marshall

Lexington, Kentucky

Co-Directors: Dr. Clyde Holsapple, Professor of Decision Science and Info. Systems
and   Dr. Thomas J. Goldsby, Professor of Logistics

Lexington, Kentucky

ABSTRACT OF DISSERTATION

LEAN TRANSFORMATION: OVERCOMING THE CHALLENGES, MANAGING
PERFORMANCE, AND SUSTAINING SUCCESS

To remain competitive in a global market, many organizations are transforming their operations from traditional management approaches to the lean philosophy. The success of the Toyota Production System in the automotive industry serves as a benchmark that organizations continually seek to emulate in search of similar results. Despite the abundance of lean resources, many organizations struggle to attain successful lean transformation. To facilitate investigation of the failure mechanisms and critical success factors of lean transformation, this dissertation addresses the following research questions: (1) Why do transformations from traditional organizational philosophies to lean fail? (2) What are the critical factors for lean transformation success? (3) What is the role of an organization's human resource performance management system during the lean transformation journey?

This dissertation utilizes a multi-method, multi-essay format to examine the research questions. First, managers from organizations in various stages of lean transformation are interviewed to establish a foundational research framework. Subsequently, a theoretical model is empirically tested based on data gathered from a survey of industry professionals with expertise in lean transformation. Data analysis techniques employed for this dissertation include: Partial Least Squares (PLS) regression, case descriptions, and case comparisons.

Very few studies of lean transformation investigate behavioral influences and antecedents. This dissertation contributes to practitioners and researchers by offering a refined understanding of the role that human resource performance management can play in the overall lean transformation process. In an effort to characterize organizational outcomes resulting from lean transformation, this research introduces a new construct, Lean Transformation Success, to the literature.

David A. Marshall
Student's Signature

May 08, 2014
Date

LEAN TRANSFORMATION: OVERCOMING THE CHALLENGES, MANAGING

PERFORMANCE, AND SUSTAINING SUCCESS

By

David A. Marshall

Dr. Clyde W. Holsapple
Co-Director of Dissertation

Dr. Thomas J. Goldsby
Co-Director of Dissertation

Dr. Steve Skinner
Director of Graduate Studies

May 08, 2014

To my beloved wife Victoria,

and beautiful children

Ireland, Benjamin, Weston, and Anniston

ACKNOWLEDGMENTS

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Chapter 1 – Introduction

The lean management philosophy first surfaced nearly four decades ago with the landmark article by Sugimori et al. (1977). Although it was not known as Lean at the time, the term "Lean" was coined by Krafcik (1988) to describe the Toyota Production System which was long-gestating prior to the Sugimori (1977) publication. Lean management, or more appropriately Lean Thinking, was thrust into the limelight with the original publication of the groundbreaking book *The Machine that Changed the World* (James P Womack, Jones, & Roos, 2007), along with other influential books by Ohno (1988) and Monden (1981).

For the past few decades, organizations throughout the world have implemented lean practices and refined various business processes. The success of the Toyota Production System in the automotive industry serves as a benchmark that organizations continually seek to emulate in search of similar results. Lean has exploded in popularity due, in large part to the rise of Toyota, but also the demonstrated improvement in financial, operational, and/or organizational performance enjoyed by so many other organizations that have implemented a lean management philosophy. Over the years, lean has evolved beyond initial implementation in manufacturing to an enterprise-wide, strategic philosophy with widespread adoption in virtually every manufacturing and service industry across the globe (Corbett, 2007; Holweg, 2007; J.P. Womack & Jones, 1994). Shah and Ward (2007) conducted a thorough literature review and subsequent analysis to resolve the confusion associated with lean. They offered the following definition:

> "Lean production is an integrated socio-technical system whose main objective is to eliminate waste by concurrently reducing or minimizing supplier, customer, and internal variability (Shah and Ward, 2007, p. 791)"

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The real contribution and essence of their definition is the characterization of lean as a "socio-technical system", which captures the people and process elements of lean.

Today, organizations face fierce competition from other firms within the dynamic global market, which serves as a catalyst for rapid lean transformation in an effort to enhance performance and gain a competitive edge. While both industry and academia originally pursued lean production or lean manufacturing, we now focus more on extending lean throughout the entire enterprise and value chain (James P Womack & Jones, 2003). Some have described the lean management philosophy as one of the most revolutionary changes in modern organizations since Henry Ford's assembly line (Womack, Jones, & Roos, 2007).

Lean transformation has been empirically studied from a multitude of angles. The primary argument by academics is that implementation of lean will positively affect performance and lead to competitive advantage (Lewis, 2000; MacDuffie, 1995; Shah & Ward, 2003). Another viewpoint that has been investigated is the impact of lean production on industries globally (Bonavia & Marin, 2006; Lawrence & Hottenstein, 1995; Salaheldin, 2005). It is important to note, however, that there is some opposition to the lean thinking obsession. One dominant argument is that the success enjoyed by Toyota in the automotive industry is an extreme case and that competitive advantage is a relative term because many companies (including those in the auto. industry) do not compete on a level playing field (Williams, Haslam, Williams, Adcroft, & Williams, 1992). Even though there are opponents of lean, there is still widespread contention that lean practices are beneficial to

an organization; therefore, it is imperative that we attempt to gain additional insight in regard to the measurable costs and benefits of lean practices.

Although not as well published as the process elements of lean, much of Toyota's success can be derived from the culture of the organization, or people element of lean (Liker & Hoseus, 2008). Likewise, the failure to establish a lean organizational culture and the lack of people support/buy-in are often cited as a significant failure mode of lean transformations (Sanjay Bhasin, 2012; Sim & Rogers, 2009). Liker and Hoseus (2008) describe people as "the heart and soul of the Toyota Way." Indeed, researchers are increasingly recognizing the importance of the people element of lean as it is very much a people-driven system; however, there are very few empirical studies that distinctly highlight the role that people play in the overall success of an organization's lean transformation.

Therefore, the purpose of this dissertation is to extend and develop new knowledge surrounding the human dimension of lean transformation. To accomplish this task, we develop, and subsequently empirically test a multi-stage model as displayed in figure 1.1, which is centered organizational inputs related to the human resource performance management system and their overall influence on organizational outcomes of lean transformation success and competitive advantage.
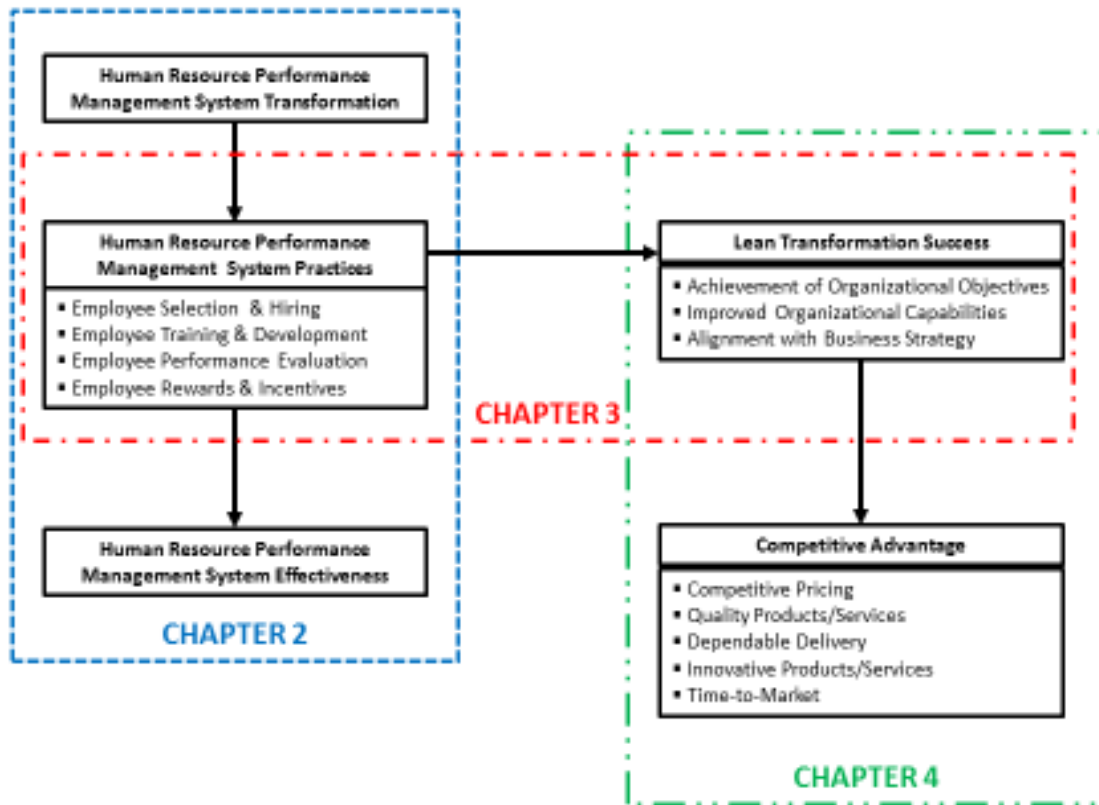
Figure 1.1 – Dissertation Structure

By employing a multi-essay approach, the overarching research question we strive to answer with this dissertation is: *What are the antecedents, critical success factors, and outcomes of successful and sustainable lean transformation?* In chapter two, we focus on the antecedents to lean transformation success. We initially investigate the relationship between human resource performance management (HRPM) system transformation and various HRPM system practices utilized by an organization, followed by an examination of the influence of the HRPM system practices on human resource performance management system effectiveness. The goal of chapter two is to assess the influence and importance of factoring the human dimension into the lean transformation strategy. We anticipate that integration of the lean philosophy into the human resources performance

management system will create a much more effective system. In chapter three, continue our investigation into the human dimension of lean transformation seek to answer the research question: What is the relationship between human resource performance management practices and lean transformation success? We develop a new construct, Lean Transformation Success, to empirically validate the extent to which human resource performance management practices will influence success of an organization's lean transformation journey. By utilizing data collected via a survey of diverse organizations, we anticipate that human resource performance management practices grounded in lean methodologies will enhance the success of an organization's lean transformation journey.

Finally, in chapter four, we focus on organizational outcomes associated with lean transformation. The question we seek to answer in this chapter is: What is the impact of lean transformation success on organizational competitiveness? Several studies have investigated the impact of lean implementation on a host of organizational outcome variables. However, those other studies wander adrift by focusing on lean implementation without capturing the degree to which the implementation was successful. Many organizations have attempted lean implementations over the years, but unfortunately, some organizations are not able to successfully infuse the lean practices throughout the organization. Our study is different because we specifically consider the importance of a successful lean transformation and assess the extent to which lean transformation success will influence the competitive position of the organization.

Chapter 2: Human Resource Performance Management System Practices, Effectiveness, and Transformation in a Lean Environment

2.1. Introduction

Successful lean deployment often requires a cultural shift in the organization, which can lead to stagnant results for those organizations that dismiss the importance of the cultural element (Liker & Hoseus, 2008). Scholars suggest that improper change management techniques and an inability to shift corporate culture can be a significant factor in failures of lean transformation (Liker & Hoseus, 2010; Saurin, Marodin, & Ribeiro, 2011). In fact, recent literature identifying barriers to lean transformation suggests that the largest hurdles faced by organizations pursuing lean transformation are people-related (Hines, Holweg, & Rich, 2004; Ransom, 2008; Shook, 2010). Therefore, the human dimension can essentially be described as the nucleus of successful lean transformation initiatives (Achanga, Shehab, Roy, & Nelder, 2006).

Organizations have turned to strategic human resource management techniques for years to develop organizational culture and drive change management success (B. E. Becker & Huselid, 2006; Fombrun, Tichy, & Devanna, 1984; Lengnick-Hall, Lengnick-Hall, Andrade, & Drake, 2009; Patrick M Wright & McMahan, 1992). The human resource function within an organization is often described from a systems perspective, where the human resource management system is designed to accomplish certain objectives, such as motivating performance, developing employees, establishing culture, implementing business strategies, and many others, that ultimately lead to enhanced performance or competitive advantage for the organization (B. E. Becker & Huselid, 1998; Lado & Wilson, 1994; Lawler III, 2003).

However, there has been a shift in business toward a model of human resource performance management (HRPM) instead of the traditional model of human resource performance measurement (Amaratunga & Baldry, 2002; Folan & Browne, 2005). Human resource performance management systems, in lieu of performance measurement, are designed to ensure goals are consistently achieved by actively coaching, developing, training, and rewarding employees on an ongoing basis instead of annually or quarterly reviews, which are typical as part of a more traditional performance measurement system (Latham, Almost, Mann, & Moore, 2005). Ultimately, the goal of the human resource performance management system is to provide regular feedback to employees in an effort to enhance continuous improvement and promote achievement of both personal and broader organizational goals (Ferreira & Otley, 2009).

To extend lean transformation to the entire enterprise, it has been suggested that not only the operational tools and techniques are modified, but it is also important that all organizational/management policies, procedures, and philosophies, including the human resource performance management system, reflect the lean transformation strategy as well (Koenigsaecker, 2012; Smeds, 1994; J.P. Womack & Jones, 1994). The purpose of this study is to assess the extent to which an organization has transformed the human resource performance management system as part of the lean transformation strategy, and to investigate the relationship between HRPM transformational activities, HRPM practices, and HRPM system effectiveness. Specifically, we investigate the influence of performance management system transformation (extent to which the HRPM system transformed as part of lean transformation) on the practices (selection, development, evaluation, rewards) employed as part of the performance management system. Subsequently, we test the

relationship between the various performance management system practices and the effectiveness of the performance management system.

The rest of this chapter is organized as follows: Section 2 provides the theoretical foundation and hypothesis development for this study. Next, we present details of the instrument development, data collection, and data analysis employed for this research. The next section offers results of the data analysis followed by a discussion of these results. Finally, the chapter concludes by presenting implications of this study for practitioners and researchers, discussing limitations of the study, and describing future research directions concerned with the impact of human resource performance management system transformation on the practices and effectiveness of the performance management system.

2.2. Theoretical Background and Hypotheses Development

Skyttner (1996) defines a system as: "A system is a set of two or more elements where: the behavior of each element has an effect on the behavior of the whole; the behavior of the elements and their effects on the whole are interdependent; and while subgroups of the elements all have an effect on the behavior of the whole, none has an independent effect on it (p. 7)." As Skyttner (1996) reported, rooted in the work of Churchman (1979), systems typically share the following characteristics from an organizational perspective:

- It is teleological (purposeful).
- Its performance can be determined.
- It has a user or users.
- It has parts (components) which have purpose in and of themselves.
- It is embedded in an environment.
- It includes a decision maker who is internal to the system and who can change the performance of the parts.

- There is a designer who is concerned with the structure of the system and whose conceptualization of the system can direct the actions of the decision maker and ultimately affect the end result of the actions of the entire system.
- The designer's purpose is to change a system so as to maximize its value to the user.
- The designer ensures that the system is stable to the extent that he or she knows its structure and function

General Systems Theory has been examined in organizational research for over fifty years (see the seminal work of Boulding (1956)). Gradous (1989) compiled an extensive collection of research that extends systems theory to human resource development. Swanson (2001) identified general systems theory as the most common and unified theory of human resource development and management. Hence, we examine the constructs utilized in this study from a general systems perspective.

The extant literature suggests that the human resource performance management system should be comprised of the following four primary elements: employee selection and hiring, employee training and development, employee performance evaluation/appraisal, and reward systems (Abu-Suleiman, Boardman, & Priest, 2005; Goldstein, 2003; Lawrie, Cobbold, & Marshall, 2004). Therefore, we define the *human resource performance management system* as the set of practices, processes, and procedures that are utilized to select, develop, appraise, and reward the organization's human resources (Bowen & Ostroff, 2004; Ferreira & Otley, 2009; M. Huselid, 1995; Latham et al., 2005; Otley, 1999). We draw from the performance management system framework proposed by Ferreira and Otley (2009) to guide our understanding of the key elements associated with human resource performance management. We define *selective hiring* as the extent to which the organization engages in selective hiring practices as a means to find and retain employees that fit the organization's lean transformation strategy.

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The inspiration for our definition of selective hiring practices stems from Pfeffer's work (Y. Cohen & Pfeffer, 1986; Pfeffer, 1998) and more recently the work of Ahmad & Schroeder (2003). We define *employee development* as the extent to which employees are offered formalized training and development opportunities that will enable the employee to support and execute the lean transformation strategy. Our definition is derived from Goldstein (2003), and specifically the element of staff training and development from her employee development construct. Here, we define *employee evaluation* as the extent to which the organization integrates lean transformation objectives, initiatives, and activities into the performance evaluation process (Bourne, Mills, Wilcox, Neely, & Platts, 2000; Neely, Gregory, & Platts, 1995). Finally, *employee rewards* refers to the extent to which the organization offers rewards for performance and encourages employees to pursue lean transformation objectives (Ahmad & Schroeder, 2003; B.B. Flynn & Saladin, 2001). Rewards are typically designed to reinforce positive actions and behavior that aligns with the strategy of the organization in an effort to increase the likelihood of repeat actions and behavior (Stonich, 1985).

Further, we introduce a new construct, *human resource performance measurement system transformation*, to capture the extent to which an organization transforms elements of the performance management system as part of the overall lean transformation strategy. Specific items reflect the extent to which the organization adds new measures of performance, the system transforms from an activity/function/results orientation to a process based orientation, the system captures new strategic priorities introduced by lean transformation, and includes new operational expectations for performance as a result of lean transformation.

We adapt the *human resource performance management effectiveness* construct from Lawler (2003) to capture the perceived effectiveness of the system with respect to developing individual's skills and knowledge, helping the business be successful, supporting company values, providing accurate measures of performance, providing incentives/rewards for employee performance, and empowering employees. Although we do not investigate it here, studies have linked an effective human resource management system with increased firm performance (M. A. Huselid, Jackson, & Schuler, 1997; Richard & Johnson, 2001).

This study supplements extant literature by examining the relationship between human resource performance management system transformation, practices, and effectiveness. As figure 2.1 illustrates, we propose that the extent of transformation of the system will influence performance management practices utilized by the organization, which in turn will influence the overall effectiveness of the human resource performance management system.

```
┌─────────────────────┐              ┌──────────────────────────────┐
│  Human Resource     │              │  Human Resource Performance  │
│  Performance        │─────────────▶│  Management (HRPM) System    │
│  Management System  │              │  Practices                   │
│  Transformation     │              └──────────────────────────────┘
└─────────────────────┘              ┌──────────────────────────────┐
                                     │  ▪ Employee Selection        │
                                     │  ▪ Employee Development       │
                                     │  ▪ Performance               │
                                     │    Appraisal/Evaluation       │
                                     │  ▪ Rewards/Incentives         │
                                     └──────────────────────────────┘
                                                    │
                                                    │
                                                    ▼
                                     ┌──────────────────────────────┐
                                     │  HRPM System Effectiveness   │
                                     └──────────────────────────────┘
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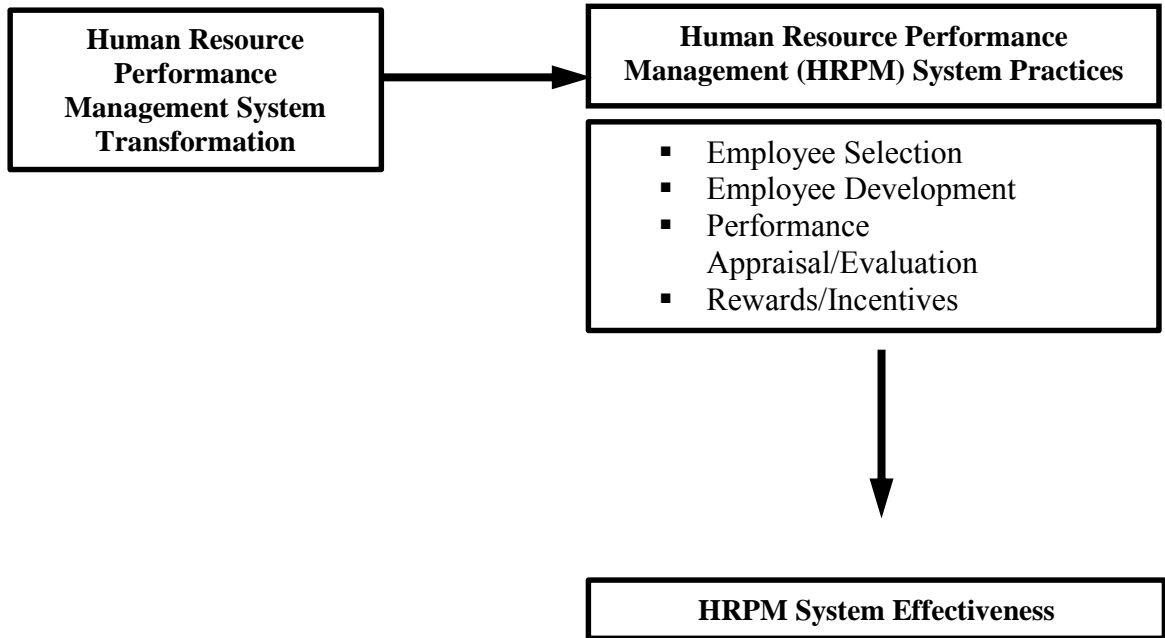
Figure 2.1 – Theoretical Model

The change management literature identifies an abundance of strategies for driving organizational transformation. As part of changing organizational strategies, specifically lean transformation, it is important and necessary that the human resource performance management system is transformed along with other operating procedures within the organization (Salminen, 2000). We often hear the adage "what gets measured, gets done"; therefore, it stands to reason that the human resource performance management system plays a large part in employee motivation and performance. Because the human element is a key driver of successful lean transformation, the human resource performance management system should reflect the goals and objectives of lean transformation to motivate employee performance, ensure that employees are properly trained, and reward employees equitably for behaving and displaying values that align with the lean transformation strategy (Liker & Hoseus, 2010).

Fisher et al. (1999) suggested that the human resources function should be linked to organizational strategy. They contend that the human resources function should hold a much more central, strategic position and adapt as needed to align with changing organizational strategies. Mohrman and Lawler (Mohrman & Lawler, 1997) contend that human resources practices of the past no longer fit within rapidly changing organizations, based on technological advances, information availability, and globalization. They argue that human resource management systems should transform to reflect changing organizational strategies and priorities. Human resource management systems require constant innovation and transformation in the face of increased competition, globalization, workplace partnerships, and a design to align human resource practices with organizational strategy (Beer, 1997; Rowley & Bae, 2002). Moreover, Martin and Beaumont (2001) suggest that the human resource management system "is frequently accorded a key role in shaping direction through a program of strategic change involving best practice transfer or culture change (p. 1234)". Therefore, we offer the following hypothesis:

H1 – *An increased extent of human resource performance management system transformation leads to increased deployment of human resource performance management practices in terms of: (a) selective hiring (b) employee development, (c) performance evaluation, and (d) employee rewards.*

For the past two decades, researchers have linked human resource management system practices to manufacturing performance (Jayaram, Droge, & Vickery, 1999), operational performance (Ahmad & Schroeder, 2003), organizational effectiveness and performance (Delaney & Huselid, 1996), or competitive advantage (Lado & Wilson, 1994). Most researchers and practitioners do not dispute the strategic importance of the human resource performance management system. However, one area that is often overlooked is

the *effectiveness* of the human resource performance management system. The aforementioned studies, while very rigorous, often assume that implementation of the various human resource performance management practices will inherently lead to improved organizational outcomes without considering the effectiveness of implementation or the overall effectiveness of the system. Here, we posit that human resource performance management system *effectiveness* hinges on deployment of HRPM practices.

According to Lawler (2003), human resource performance management effectiveness increases when there is ongoing feedback, behavior-based measures are used, preset goals are established, and trained raters are utilized. Others have suggested that human resource performance management system effectiveness is dependent on the requisite professional capabilities that are related to the human resource practices utilized (Huselid et al., 1997). Richard and Johnson (2001) argue that human resource system effectiveness captures how well the organization has utilized human resource practices to develop employee skills, experience, and knowledge. Lawler (2003) empirically examined the relationship between performance appraisals, reward practices and human resource performance management effectiveness. He found that the system is more effective if there is a connection between performance appraisal results and the rewards offered to employees. Hence, we offer the following hypothesis:

H2 – *Deployment of human resource performance management system practices in terms of: (a) selective hiring (b) employee development, (c) performance evaluation, and (d) employee rewards lead to increased resource performance management system effectiveness.*

2.3.   Methodology

2.3.1. Instrument and Scale Development

In order to evaluate the relationships between constructs in this study, a survey was developed and conducted following Dillman's Tailored Design Method (Dillman, 2007). The survey instrument was developed and subsequently validated for this study using a multi-step process (Churchill Jr, 1979). First, preliminary interviews were conducted with senior executives and managers from organizations in various stages of lean transformation to formulate and refine the domain for this research. Second, a thorough review of relevant literature was conducted to grasp the existing realm of knowledge and to provide guidance for this research effort in terms of existing constructs, definitions, and measurement items. Scales were developed for this study to assess the relative extent to which human resource performance management practices are applied as part of the organization's lean transformation in addition to assessing how well the organization has effectively employed human resource performance management practices. Scales are grounded in the extant literature and rely on scale development techniques employed by prior research (DeVellis, 2011; Dunn, Seaker, & Waller, 1994; Stratman & Roth, 2002).

Multi-item reflective measures were utilized for each construct with Likert-based scales anchored at 1 = no extent to 7 = great extent for each item. The human resource performance management system transformation construct reflects the extent to which the organization transformed the human resource performance management system as part of the lean transformation strategic plan. The human resource performance management construct captured the organization's practices related to personnel selection/hiring, personnel development and training, reward mechanisms, and employee performance

evaluations. The human resource performance management system effectiveness construct measured the perceived effectiveness of various human resources practices as part of the overall HR system. Appendix A illustrates the items, means, standard deviations, and corresponding sources for the constructs utilized in this study.

Validated measures from prior literature were incorporated into this study as often as possible; however, new items that were grounded in prior literature and our interviews with industry professionals were developed for some of the constructs based on the lack of existing scales. To further validate and refine the new items and the previously validated items, a group of industry professionals and academics were assembled to conduct a Q-sort exercise (Moore & Benbasat, 1991; Nahm, Solís-Galván, Rao, & Ragu-Nathan, 2002). Each respondent for the Q-sort exercise was provided a cover page with an introduction to the research project and instructions for the Q-sort method. Each respondent was also presented a document that contained a group of categories (constructs) and a group of items. Respondents were asked to match the appropriate category with the item(s) that represented the category, in their opinion. In total, we collected seven responses to the Q-sort exercise, which is consistent with the sample size of other recent studies employing the Q-sort method (Cao & Zhang, 2011; Kianto, 2008; Kroes & Ghosh, 2010; Wong, Boon-itt, & Wong, 2011). The responses to the Q-sort exercise were compiled in a spreadsheet, and items with an item placement rate less than 70% among the respondents on the appropriate category that represents the item were eliminated from the final draft of the survey instrument (Moore & Benbasat, 1991; Nahm et al., 2002).

A pretest was conducted as the next phase of instrument development. The survey instrument was delivered to a total of eight academics and industry professionals. Each

respondent was asked to thoroughly review the survey and provide feedback on the construction, content, clarity, and quality of the survey. Based on the results of the pretest, the survey was modified to improve flow, decrease the length of the survey, and remove or reword ambiguous items according to the respondents to the pretest. Next, a pilot test was initiated by creating a web-based version of the survey and sending it to a diverse group of industry professionals from organizations actively pursuing lean transformation. The pilot test was delivered to individuals who originally participated in structured interviews to establish the conceptual domain for this research, in addition to professional contacts acquired through industry events associated with supply chain management and lean, respectively. Based on an initial 50 invitations to participate in the pilot test, we received 29 completed questionnaires. Although a sample of 29 is not large enough for robust statistical analysis, we analyzed the descriptive statistics to look for any abnormalities with the data. The pilot test was helpful to understand the time investment required to complete the survey and provided some insight on the variability that can be expected from the full-scale survey. Based on the results of the pilot study, the survey was revised to improve clarity, reduce content, and minimize ambiguity.

2.3.2. Data Collection

A web-based survey was utilized for the large-scale data collection effort. The sample consisted of executive and managers randomly selected from a database provided by a consulting firm specializing in lean supply chain practices. The respondents targeted as part of this sample frame are those individuals that are typically involved, and often leading, the lean transformation activities within their respective organization. The survey

was initially administered via the monthly newsletter published by the consulting firm. Approximately one month later, an email reminder was sent to the sample, followed by one additional reminder two months from the launch of the original newsletter. As an incentive, respondents that completed the survey within the first month were entered into a drawing for a full tuition scholarship to complete a lean certification program at a major university. Those respondents that completed the survey within the first two months were entered into a drawing to receive a book from a select group of titles related to lean transformation.

Initially, the newsletter was issued to 7,959 potential respondents, of which 835 of the messages bounced due to an incorrect/inactive account. Of the remaining 7,124 potential respondents, 769 individuals opened the newsletter and 61 respondents clicked on the survey link. The first reminder was issued to 7,944 potential respondents, of which 938 of the messages bounced due to an incorrect/inactive account or due to recipients opting out of the newsletter distribution list. Of the remaining 7,006 potential respondents, 902 individuals opened the newsletter and 100 respondents clicked on the survey link. The second reminder was issued to 7,914 potential respondents, of which 1,179 of the messages bounced due to an incorrect/inactive account or due to recipients opting out of the newsletter distribution list. Of the remaining 6,735 potential respondents, 742 individuals opened the newsletter and 98 respondents clicked on the survey link. The survey link was also posted on the lean consulting firm's member blog, which resulted in an additional 60 responses.

A total of 319 responses to the survey were received, which equates to a 13.2% initial response rate, when adding the total number of recipients (2,413) that opened the

original newsletter and the total number of recipients that opened the two subsequent reminder messages. However, it is certainly plausible that there is tremendous overlap between the recipients that opened the original newsletter and the recipients that opened the two reminder messages. Based on 100% overlap between recipients that opened the original newsletter and recipients that opened the subsequent newsletters, the initial response rate would be 35.4%. Because of the uncertainty associated with determining how many of the recipients that opened the original newsletter were also recipients that opened one or both of the reminder messages, it is virtually impossible to calculate a truly accurate response rate. It is expected, albeit not scientifically confirmed, that the true response rate would fall somewhere near the middle of the 13.2% - 35.4% range.

Consistent with prior literature, two questions were added to the survey to further qualify respondents (Grawe, Daugherty, & Dant, 2012). The first question asked respondents the extent to which they possess the necessary knowledge and information to answer the survey questions. The second question asked respondents the extent to which the survey questions applied to their organization. Another question designed to qualify respondents and their respective organization, asked the respondents how long their organization had been pursuing lean transformation from "Not at all" to "More than 20 years." In total, 147 responses were eliminated from the final sample due to excessive missing data, excessive responses at either scale anchor (e.g., selected 7 for every question), excessive neutral responses, respondents answered "Not at all" to the duration of lean transformation, or respondents indicated that they did not have enough information to answer the questions or the questions were not relevant to their organization. After eliminating surveys based on the aforementioned factors, the final sample size is 172.

Respondents primarily represented the manufacturing industry (30.7%), but 25 other industry types were also represented in the survey. Most respondents worked for companies with less than 25,000 employees. Respondents were also very experienced with the lean philosophy with over 50% of the respondents indicating that they have delivered lean training to others. Please see Appendix B for detailed demographic information for the survey respondents.

A time-trend extrapolation test was utilized to examine non-response bias, which assumes that non-responses will resemble late responses (J. S. Armstrong & Overton, 1977). To test for non-response bias, we conducted a multivariate analysis of variance between the first 25% of responses and the last 25% of responses. The result of the test suggests that non-response bias is not present as no significant differences between groups were detected (Wilks' Lambda = 0.006, p = 0.38).

Harman's single-factor test was used to check for common method variance (Malhotra, Kim, & Patil, 2006; Podsakoff & Organ, 1986; Spector, 2006). If common method bias exists in the data, a single factor will be present following exploratory factor analysis of the variables included in the study. The exploratory factor analysis revealed six factors with Eigenvalues greater than 1, with no single factor explaining more than 13% of the variance. Therefore, we can conclude that common method bias is not a concern for this study.

2.3.3. Data Analysis

Partial Least Squares (PLS) path analysis was utilized to analyze the relationships among constructs in this study. There are a few distinct features about PLS that distinguish the method from other structural equation modeling techniques. PLS is component-based unlike other covariance-based techniques (AMOS, LISREL, EQS), allows both formative and reflective constructs, and applies bootstrapping technique to determine the significance of associations within the model (Chin, 1995; Chin, Marcolin, & Newsted, 2003; Marcoulides, Chin, & Saunders, 2009). Further, PLS does not require the normality assumption, which allows for smaller sample sizes and places minimal demands on measurement scales without sacrificing predicting power (Chin, 1998). This research utilizes the software package PLS Graph 3.0 with bootstrapping parameters set at 500 re-samples for both measurement model validation and hypothesis testing. Reflective constructs measure the practices, extent of transformation, and effectiveness of the human resource performance management system. Table 2.1 presents the factor loadings and cross-loadings for the higher-order constructs employed in this study. Please note that three items (select5, reward3, & reward6) from the human resource performance management system practices were dropped due to low factor loadings.

Table 2.1: Human Resource Performance Management Practices Factor Loadings

Items	Selection	Development	Evaluation	Rewards
		Factors		
select1	**0.519**	0.42		
select2	**0.809**			
select3	**0.794**			
select4	**0.492**	0.441		0.302
dev1	0.322	**0.563**		
dev2		**0.788**		
dev3		**0.695**		
dev4		**0.652**		
dev5	0.317	**0.745**		
eval1			**0.762**	
eval2			**0.77**	
eval3			**0.587**	0.359
eval4			**0.712**	
eval5		0.42	**0.509**	0.362
eval6			**0.475**	0.319
reward1			0.324	**0.571**
reward2				**0.786**
reward4	0.343			**0.69**
reward5		0.329	0.346	**0.634**

The psychometric properties generated by PLS Graph are used to assess convergent validity, discriminant validity, and internal consistency reliability (ICR). Table 2.2 displays the ICR, square root of the AVE (diagonal terms), and the correlation between constructs. To assess convergent validity, we examined the square root of the average variance extracted (AVE), which should generally be greater than 0.707 or AVE > 0.5 (Fornell & Larcker, 1981). The square roots of the AVE values in this study, which can be equated to an R-square value in simple regression, were all greater than 0.707 with a

lowest AVE value of 0.771. To assess discriminant validity, we compared the AVE square root to the correlation with other constructs. The AVE square root should be larger than the correlation with other constructs to confirm discriminant validity (i.e. measures for a specific construct are unrelated to measures of a different construct). From Table 2.2 below, one can see that the square root of the AVE exceeds all correlations (horizontal rows and vertical columns) for each construct, which supports discriminant validity. The ICR values (similar to Cronbach's alpha) should all be larger than 0.7 (Fornell & Larcker, 1981). As illustrated in the table, the lowest ICR value in this study is 0.877, which supports the reliability of the constructs.

Table 2.2: Reliabilities, Convergent Validities, and Discriminant Validities

Factors	ICR	Correlations and AVE Square Roots					
		Selection	Development	Evaluation	Rewards	Transformation	Effectiveness
Selection	0.877	**0.771**					
Development	0.923	0.640	**0.839**				
Evaluation	0.913	0.543	0.612	**0.799**			
Rewards	0.914	0.575	0.610	0.680	**0.853**		
Transformation	0.943	0.557	0.495	0.532	0.490	**0.897**	
Effectiveness	0.957	0.666	0.722	0.640	0.608	0.637	**0.889**

Figure 2.2 shows results of the PLS analysis. Human resource performance management system transformation is a first-order construct.   Human resource performance management system practices is a second-order reflective construct formed by four first-order constructs – Selection, Development, Evaluations, and Rewards. Human resource performance management system effectiveness is a first-order construct, as well.

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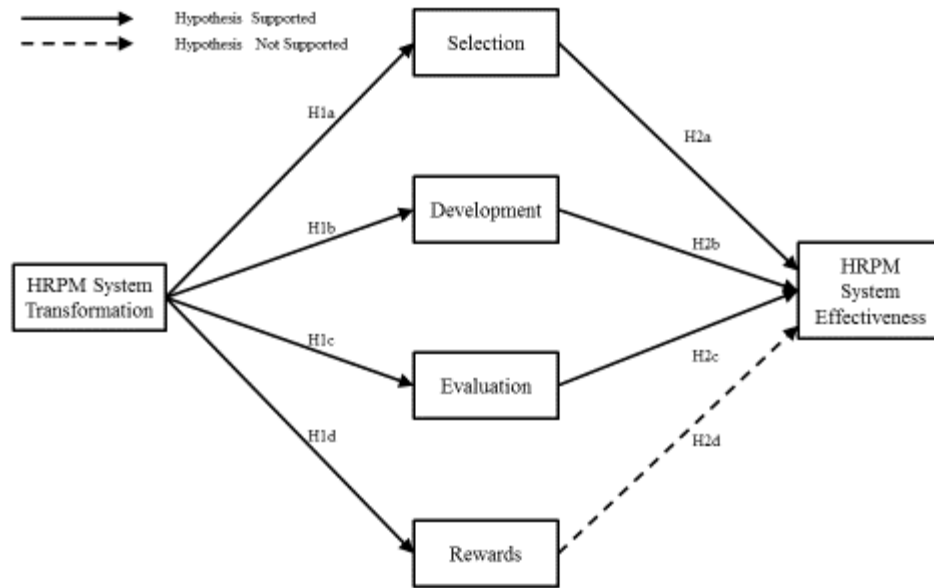
Figure 2.2: PLS Results

Table 2.3 presents the path coefficients and t-statistics between the higher-order constructs in this study. There is statistically significant support for a positive relationship between human resource performance management system transformation and each of the first-order human resource performance management system practices. We also find statistically significant support for a positive relationship between personnel selection, personnel development, personnel evaluation/appraisal and human resource performance management system effectiveness. We did not find significant support for a relationship between reward systems and human resource performance management system effectiveness. The next section provides some insight on the findings in this study and discusses implications of these findings for researchers and practitioners.

Table 2.3: Path Coefficients and T-Statistics

Path	Hyp.	Path Coeff.	t-stat
Meas. Trans. → Selection	H1a	0.557	9.157*
Meas. Trans. → Development	H1b	0.202	2.941*
Meas. Trans. → Evaluation	H1c	0.532	10.281*
Meas. Trans. → Rewards	H1d	0.490	7.198*
Selection → HR effectiveness	H2a	0.265	3.409**
Development → HR effectiveness	H2b	0.372	4.125*
Evaluation → HR effectiveness	H2c	0.211	2.419**
Rewards → HR effectiveness	H2d	0.086	1.170

*p<0.01, **p<0.05

2.4. Discussion

The purpose of this study is to investigate the relationship between human measurement system transformation, practices, and effectiveness from a lean transformation perspective. We find statistically significant positive support for hypotheses H1a, H1b, H1c, and H1d, which represent the relationship between each of the first-order human resource performance management system practices construct and performance management system transformation. Our results indicate that the extent to which organizations transform their human resource performance management systems, as part of the overall lean transformation strategy, will positively impact selective hiring practices utilized by the organization, as well as employee training and development policies. In addition, our results indicate that employee performance evaluations/appraisal and employee reward practices are significantly influenced by performance management system transformation.

We find statistically significant positive support for hypotheses H2a, H2b, and H2c, which represent the relationships between selective hiring, employee development, and employee performance evaluation and human resource performance management system effectiveness. Our results suggest that the effectiveness of the human resource performance management system can be influenced by selectively hiring the right associates that possess the values and display the behaviors that the organization expects as part of the overall lean transformation strategy. The results further indicate that proper training and development practices enhance the overall effectiveness of the human resource system. Finally, our results suggest that properly evaluating and coaching employees can enhance the human resource system effectiveness.

We do not find a statistically significant relationship between reward practices and human resource performance management system effectiveness. We have a couple plausible explanations for this result. First, as seen from the low mean values and relatively large standard deviations for the items that comprise the reward practices construct in Appendix A, application of reward system practices appears to be sporadically applied. This suggests that either organizations are not providing appropriate rewards for performance, as perceived by the survey respondents, or the rewards provided by organizations do not meet respondents' expectations. As mentioned above, we conducted a series of preliminary interviews with executives engaged in lean transformation in their respective organizations. Generally, we find from those interviews that many organizations still rely on traditional performance measurement systems in lieu of human resource performance management systems, which may lend some additional insight to our result for reward system practices. Performance management is not a novel or

revolutionary concept, yet many organizations have failed to embrace the overall performance management system and are still relying on traditional, periodic performance measurement.

2.5.   Conclusion

To date, we have been unable to find any studies that empirically investigate outcomes of human resource performance management (or measurement) system transformation with respect to the lean transformation journey. There is also limited literature that investigates the relationship between the overall human resource performance management system and the effectiveness of the system. This study makes a few important contributions. It supplements the human resource performance management literature by providing empirical evidence to support the position that key performance management practices will lead to performance management system effectiveness. It also demonstrates the relative importance, via a new construct grounded in prior literature, of transforming the performance management system as part of the change management strategy.

This study provides several interesting opportunities and implications for researchers. First, the new construct advanced in this study is just the initial step towards additional performance management system transformation research. While our construct is rooted in lean transformation, the scale could certainly be adapted to other organizational change strategies. Second, there is an abundance of research investigating the impact of human resource practices on organizational outcomes (e.g., performance, competitive advantage). However, there is a limited body of knowledge highlighting the importance

of not only practices, but also the effectiveness of the practices. Therefore, we offer additional opportunities to researchers to expand this work, and perhaps address additional/other dimensions of human resource performance management system practices.

We would be remiss if we did not acknowledge a few of the limitations to this study. The methodology we utilized for survey distribution makes it difficult to track response rate. While we contend that our response rate exceeds institutional norms, we would prefer to have a firmer grasp of the true response rate for the survey. Our original sample was cleansed substantially to remove excessive missing data, excessive selections at either scale anchor (e.g., selected 7 for every question), excessive neutral responses, respondents not pursuing lean transformation, or respondents indicating that they did not have enough information to answer the questions and/or the questions were not relevant to their organization. Finally, our new human resource performance management system construct, while empirically and statistically valid, could incorporate other dimensions, such as technical and strategic performance management system transformation.

Chapter 3: The Impact of Human Resource Performance Management on Lean Transformation Success

3.1 Introduction

Despite the prevalence of lean, many organizations struggle to attain successful lean transformation (Hines et al., 2004). Recent surveys indicate that over 70% of U.S. based manufacturers are actively engaged in lean transformation; however, only 2% of the companies pursuing lean report that they have fully achieved their objectives associated with lean transformation, and only 24% reported achieving any significant results (Digest, 2013; Pay, 2008). The pervasive lean literature suggests that organizations face many hurdles and challenges along the road to successful lean transformation. A few of the more prominent challenges to successful lean transformation, from a broad perspective, include: human/cultural aspects, strategic orientation, organizational infrastructure, and a narrow operational focus (Boyer & Sovilla, 2003; Hines et al., 2004; Karlsson & Ahlström, 1996; Sim & Rogers, 2009). Unfortunately, as Jim Womack exclaimed: "We are yet to come close to creating a second Toyota, much less a third, fourth or fifth (J. Womack, 2007, p. 4)", which leads us to an interesting question: What are the characteristics of lean transformation success?

For years, researchers have highlighted the notion of the human resource management system as a path to competitive advantage (de Pablos & Lytras, 2008; Guest, 1997; Lado & Wilson, 1994; Schuler & MacMillan, 2006). The human resource management system has been linked to improved organizational performance (B. Becker & Gerhart, 1996) and many other organizational outcomes. Recently, attention has shifted

from traditional human resource management activities to human resource performance management (Latham et al., 2005). Human resource performance management (HRPM) allows the organization to actively coach, motivate, and direct employees in a real-time manner that is not possible with a traditional human resource management system based on prioritized targets and goals that align with the organizational strategy. Establishing a lean organizational culture very much depends on the organization's ability to select, develop, engage, and inspire human resources through effective performance management strategies (Liker & Hoseus, 2008). According to Latham, et al. (2005) the primary purpose of performance management is to instill in the employees a desire for continuous improvement, which is the foundation of lean transformation. Through a resource-based and human capital lens, the purpose of this study is to explore the relationship between human resource performance management and lean transformation success as an extension of organizational performance. Despite the abundance of research discussing the benefits and implementation strategies of lean, there are no comprehensive studies that highlight critical success factors for lean transformation. We seek to fill this void by identifying and characterizing the key elements of lean transformation success based on a survey of organizations actively engaging in a lean transformation journey.

The remainder of this chapter is organized as follows. The next section discusses the theoretical foundation and develops the hypotheses for this study. The third section presents the methodology utilized in this research. The fourth and fifth sections provide a detailed summary and discussion of the results of the data analysis. The research concludes with a discussion of the implications of our findings for practitioners, researchers, and theory development.

3.2 Theoretical Background and Hypotheses Development

The resource-based view suggests that resources that are valuable, rare, imperfectly imitable, or without an equivalent substitute can lead to sustainable competitive advantage for the firm (J. Barney, 1991). From a resource-based perspective, human capital can be described as the value gained by developing human resources that are valuable, rare, imperfectly imitable, or without an equivalent substitute. Therefore, human capital can be leveraged as a strategic asset to improve organizational outcomes (J. A. Cohen, 2011). In fact, many researchers have utilized the resource-based theoretical lens to examine the relationship between human resource management and a variety of organizational outcomes, such as competitive advantage, financial performance, and operational performance, among others (Gong, Law, Chang, & Xin, 2009; Lado & Wilson, 1994; Peteraf, 2006; P.M. Wright, McMahan, & McWilliams, 1994). Historically, the resource-based view has been extensively utilized to empirically test and predict many different dependent variables (Ray, Barney, & Muhanna, 2003). For a detailed review of the resource-based view literature, please see C.E. Armstrong and Shimizu (2007), Newbert (2006), or Barney, Wright, and Ketchen Jr. (2001).

Human Capital theory suggests that investments in the organization's human resources can create significant operational and economic value (G. S. Becker, 1962, 1964; Schultz, 1961). From an organizational perspective, human capital results from an organization's effort to invest in human resources by selectively hiring new employees, extensively developing and training employees, effectively evaluating employee performance, and competitively rewarding employees based on performance (G. S. Becker,

1994; Lepak & Snell, 1999; Ployhart & Moliterno, 2011; Snell & Dean Jr, 1992). Over the years, many researchers have demonstrated that investments in human capital can significantly influence organizational objectives and outcomes, such as increased productivity (Black & Lynch, 1996; M. Huselid, 1995), manufacturing performance (Challis, Samson, & Lawson, 2005; Jayaram et al., 1999), operational performance (Ahmad & Schroeder, 2003; Dan & Yuxin, 2011), organizational performance (B. Becker & Gerhart, 1996; Delaney & Huselid, 1996), and individual performance (Myers, Griffith, Daugherty, & Lusch, 2004). Hatch and Dyer (2004) conclude that investments in human capital can create a long-term, sustainable competitive advantage for the organization.

In this study, we adopt the Performance Management System Framework proposed by Ferreira and Otley (2009) to guide our understanding of the key elements associated with human resource performance management. Specifically, we focus on three critical areas of Ferreira's and Otley's (2009) framework to devise our view of the human resource performance management system. First, we capture the processes and methods utilized to assess the level of achievement of the organization's targets and objectives from a human resource perspective. Next, we integrate the performance measurement and evaluation procedures implemented by the organization with respect to the targets and objectives. Finally, we embrace the mechanisms employed by the organization to reward associates for exhibiting the desired behaviors that drive superior performance. By centering on the three areas listed above, we draw upon the extant performance management literature and the mature human resource management practices literature to further refine our characterization of human resource performance management.

Research during the past decade has identified the following practices as the core elements associated with the human resource performance management system: employee selection and hiring, employee training and development, employee performance evaluation/appraisal, and reward systems (Abu-Suleiman et al., 2005; Ahmad & Schroeder, 2003; Goldstein, 2003; Lawrie et al., 2004; M. Swink, Narasimhan, & Kim, 2005). Therefore, we define the human resource performance management system as the set of practices, processes, and procedures that are utilized to select, develop, appraise, and reward the organization's human resources as a means of achieving organizational objectives and improving organizational capabilities (Bowen & Ostroff, 2004; Ferreira & Otley, 2009; M. Huselid, 1995; Latham et al., 2005; Otley, 1999; Snell & Dean Jr, 1992).

A planning system can briefly be described as a formalized system to facilitate and/or support strategic planning in an organization, which has been an important stream of organizational research over the years (Schendel & Hofer, 1979). Venkatraman and Ramamujam (1987) introduced the concept of planning systems success based on the notion that traditional strategic planning research has been "handicapped by lack of an appropriate operationalizing scheme for measuring the success of planning systems." They conceptualize a two-dimensional model to measure planning systems success: improvements in the systems' capabilities and the extent of fulfillment of planning system objectives. According to Venkatraman and Ramamujam (1987), improved system capabilities captures the "means" perspective, focusing on the capabilities of the system that enable the system to meet specific planning needs, whereas the extent of fulfillment of planning system objectives captures the "ends" perspective, focusing on the outcome benefits of the planning system. Countless additional research since the Venkatraman and

Ramamujam (1987) article have further developed the two constructs above and adapted the model to other contexts, such as information systems planning success (Raghunathan & Raghunathan, 1994), manufacturing planning success (Papke-Shields, Malhotra, & Grover, 2002), enterprise resource planning success (Umble, Haft, & Umble, 2003), and many others. Segars and Grover (1998) introduced "strategy alignment" as another dimension to the planning systems success model in their effort to develop a strategic information systems planning construct. Strategy alignment refers to the desired linkage between the organization's business strategy and other business planning strategies, such as information systems, manufacturing, or in our case lean transformation (Papke-Shields et al., 2002; Segars & Grover, 1998).

In this study, we adapt the manufacturing planning systems success construct from Papke-Shields et al. (2002) to measure lean transformation success. Similar to Papke-Shields et al. (2002) and others, we include the three dimensions of objective achievement/fulfillment, improved capabilities, and strategy alignment in our conceptualization of lean transformation success. Achievement of objectives refers to the extent of fulfillment of organizational objectives associated with lean transformation. As with any organizational transformation, lean transformation, if executed properly, involves extensive planning including establishing a set of goals or targets that the organization hopes to achieve by adopting a lean strategy. Thus, in order to successfully execute lean transformation, it is important that the goals and targets established during the planning phase are achieved (James P Womack & Jones, 2003). Improved organizational capabilities refer to the extent to which the organization has noticed improvement in key organizational capabilities associated with lean transformation. Over the years, it has been

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stated by numerous authors that a lean organization is one that can effectively problem solve, eliminate waste, minimize inventory, improve productivity, improve quality, and improve agility/flexibility, among others (T.J. Goldsby, Griffis, & Roath, 2011; Shah & Ward, 2007; James P Womack & Jones, 2003). Therefore, lean transformation success hinges on effectively assessing improvements in the above key capabilities. Alignment with organizational strategy refers to the extent to which the lean transformation strategy aligns with the formal organizational strategy. Some researchers argue that lean thinking should be the prevailing organizational strategy; therefore, we would expect very close alignment between lean transformation and the organizational strategy (Holweg, 2007; J.P. Womack & Jones, 1994).

This study builds upon prior research by assessing the impact of the human resource performance management system on the success of lean transformation. Specifically, we investigate the relationship between each of the first-order human resource performance management system constructs and the first-order lean transformation constructs. As you can see in figure 3.1 below, we propose that investments in an organization's human resource performance management system will influence the success of lean transformation.
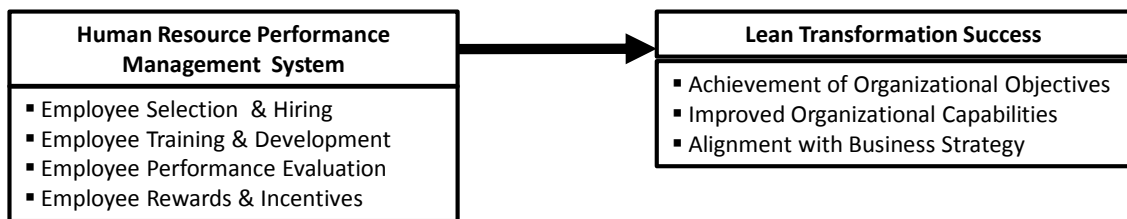
Figure 3.1 – Theoretical Model

As a central element to the overall human resource performance management system, selective screening and hiring of employees for the organization can have a tremendous impact on organizational performance (Adam et al., 1997; Ahmad & Schroeder, 2003; Delaney & Huselid, 1996). We define selective hiring as the extent to which the organization engages in selective hiring practices as a means to find and retain employees that fit the organization's lean transformation strategy. The inspiration for our definition of selective hiring practices stems from Pfeffer's work (Y. Cohen & Pfeffer, 1986; Pfeffer, 1998) and more recently the work of (Ahmad & Schroeder, 2003) Selective hiring practices for new employees can allow the organization to select individuals with the desired knowledge, skills, and values to support the organization's long-term lean transformation strategy. More importantly, it allows the organization to weed out potential employees that would be detrimental to the success of lean transformation.

Ahmad and Schroeder (2003) found positive support for the impact of selective hiring practices on organizational performance after controlling for industry and country effects. Huselid (1995) investigated the impact of human resource practices on turnover, productivity, and corporate financial performance and found positive support for attracting and selecting the right employees in high performance companies. Paul and Anantharaman (2003) contend that organizations can experience increased economic performance and production of high quality products by effectively selecting and hiring employees with the necessary qualifications, values, and behavior to support the long-term mission of the organization. Lean transformation success is directly dependent upon the extent to which human resources within the organization actively support and participate in the lean transformation process; therefore finding, selecting, and investing in individuals that fit

within the broader lean transformation strategy can lead to greater organizational transformation success rates (MacDuffie & Krafcik, 1992). Hence, we offer the following hypothesis:

H1 – *The extent of Selective Hiring Practices utilized leads to Increased Lean Transformation Success in terms of: (a) achievement of objectives, (b) improved organizational capabilities, and (c) alignment with business strategy.*

In addition to existing associates, new employees acquired through selective hiring practices typically thrive when offered extensive training and development opportunities (Liker & Hoseus, 2010). We define employee development as the extent to which employees are offered formalized training and development opportunities that will enable the employee to support and execute the lean transformation strategy. Our definition is derived from Goldstein (2003), specifically the element of staff training and development from her employee development construct. In a lean environment, employees need to develop an in-depth understanding of the lean philosophy with specific emphasis on the use of continuous improvement methodologies and formalized problem solving techniques. Hence, employee development should focus on activities that enable the organization to develop a lean culture as the lifeblood of the ongoing, strategic operation system (Liker & Hoseus, 2008).

The Malcolm Baldrige National Quality Award has recognized organizations for performance excellence for the past 25 years. The Baldrige Award Criteria for Performance Excellence (2011-2012) is updated every two years, yet one predictor has been continuously included over the years, which is the importance workforce development, engagement, and management. In fact, Flynn and Saladin (2001) utilized

the Baldridge framework to find a positive relationship between human resource development and a construct they defined as business results, consisting of production control systems and customer support and service. Jayaram et al. (1999) studied the relationship between human resource management practices and manufacturing performance. Relying on data collected from tier 1 suppliers to the U.S. based automakers, they contend that employee training programs can lead to improved performance in the following strategic priorities consistent with organizations pursuing lean transformation: cost, quality, flexibility, and time. Employee training has also been linked to diminished employee turnover and improved productivity (M. Huselid, 1995), Just-in-time systems success (Im, Hartman, & Bondi, 1994), firm growth (Vlachos, 2009), and improved organizational performance (Ahmad & Schroeder, 2003; Collins & Clark, 2003). Therefore, we offer the following hypothesis:

H2 – *The extent of Employee Development Practices deployed leads to Increased Lean Transformation Success in terms of: (a) achievement of objectives, (b) improved organizational capabilities, and (c) alignment with business strategy.*

In business, we often hear the adage "What gets measured gets done." With this in mind, it is imperative that organizations integrate lean targets and objectives into the performance appraisal criteria in order to successfully transform the organization (S Bhasin, 2008). In this study, we define employee evaluation as the extent to which the organization integrates lean transformation objectives, initiatives, and activities into the performance evaluation process (Bourne et al., 2000; Neely et al., 1995). Employee performance evaluations serve as a mechanism to provide feedback on the success of employee training and development programs. There are two broad purposes for employee evaluation: 1) employee evaluation as an administrative tool to determine raises,

promotion, terminations, etc., and 2) employee evaluation as a development tool to identify

training needs, coach employees and provide feedback (Latham & Wexley, 1981). From

a performance management perspective, we focus more on the developmental aspect of

performance evaluation in this study. As with any other transformational strategy, the

performance evaluation process in a lean environment should establish goals and targets

consistent with the lean transformation strategy (Yeung & Berman, 1997). Snell and Dean

(1992) found a significant positive relationship between developmental performance

appraisal and elements of lean transformation, namely just-in-time (JIT), total quality

management (TQM), and advanced manufacturing technology. Other performance

management research has linked developmental performance evaluation to operational

performance (Youndt, Snell, Dean Jr, & Lepak, 1996), manufacturing performance

(MacDuffie, 1995), and organizational performance (Delaney & Huselid, 1996). We offer

the following hypothesis:

H3 - *The extent of Employee Evaluation Practices utilized leads to Increased Lean Transformation Success in terms of: (a) achievement of objectives, (b) improved organizational capabilities, and (c) alignment with business strategy.*

As a complement to the performance evaluation process, rewards and incentives

are normally offered to employees to motivate the employee to exhibit actions and

behaviors that support the mission and vision of the organization, especially as it is

concerned with lean transformation (Ferreira & Otley, 2009). The employee reward

system refers to the extent to which the organization offer rewards for performance and

encourages employees to pursue lean transformation objectives (Ahmad & Schroeder,

2003; B.B. Flynn & Saladin, 2001). Rewards are typically designed to reinforce positive actions and behavior that aligns with the strategy of the organization in an effort to increase the likelihood of repeat actions and behavior (Stonich, 1985). Rewards come in many different forms and may be as simple as recognition by a colleague or a member of management, as common as compensation and other financial rewards (raise, bonus, etc.), or more long-term in nature such as equity ownership. Equitable rewards entice individuals to join the organization, develop a long-term relationship with the organization, and support the mission and vision of the organization (Snell & Dean Jr, 1992). Unfortunately, some employees may perceive incentives as a behavior control mechanism (Lawler & Rhode, 1976), which can lead to employees that are less committed and prone to turnover (Ahmad & Schroeder, 2003).   However, employee rewards have widely been linked to increased organizational performance (B. E. Becker & Huselid, 2006; Cardon & Stevens, 2004; Dyer & Reeves, 1995). Vlachos (2009) conducted a survey of international food companies and positively linked the employee reward system to firm growth. Therefore, we offer the following hypothesis:

H4 - *Increases in Employee Rewards leads to Increased Lean Transformation Success in terms of: (a) achievement of objectives, (b) improved organizational capabilities, and (c) alignment with business strategy*

The next section details the methodology employed to test the hypotheses offered above including a discussion of the instrument development, data collection, and data analysis processes.

3.3 Methodology

3.3.1   Instrument and Scale Development

In order to evaluate the relationships between constructs in this study, a survey was developed and conducted following Dillman's Tailored Design Method (Dillman, 2007). The survey instrument was developed and subsequently validated for this study using a multi-step process (Churchill Jr, 1979). First, preliminary interviews were conducted with senior executives and managers from organizations in various stages of lean transformation to formulate and refine the domain for this research. Second, a thorough review of relevant literature was conducted to grasp the existing realm of knowledge and to provide guidance for this research effort in terms of existing constructs, definitions, and measurement items. Scales were developed for this study to assess the relative extent to which human resource performance management practices are applied as part of the organization's lean transformation in addition to assessing how well the organization has achieved the objectives of lean transformation and improved organizational capabilities. Scales are grounded in the extant literature and rely on scale development techniques employed by prior research (DeVellis, 2011; Dunn et al., 1994; Stratman & Roth, 2002).

Multi-item reflective measures were utilized for each construct with Likert-related scales anchored at 1 = no extent to 7 = great extent for each item. The Human Resource Performance Management construct captured the organization's practices related to personnel selection/hiring, personnel development and training, reward mechanisms, and employee performance evaluations. The Lean Transformation Success construct measured the extent to which the organization 1) achieved lean transformation objectives, 2) improved organizational capabilities, and 3) developed a lean transformation strategy that

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aligned with the overall business strategy of the organization. Appendix A highlights the items, means, standard deviations, and corresponding sources for both the Human Resource Performance Management and Lean Transformation Success constructs.

Validated measures from prior literature were incorporated into this study as often as possible; however, new items that were grounded in prior literature and our interviews with industry professionals were developed for some of the constructs based on the lack of existing scales. To further validate and refine the new items and the previously validated items, a group of industry professionals and academics were gathered to conduct a Q-sort exercise (Moore & Benbasat, 1991; Nahm et al., 2002). Each respondent for the Q-sort exercise was provided a cover page with an introduction to the research project and instructions for the Q-sort method. Each respondent was also presented a document that contained a group of categories (constructs) and a group of items. Respondents were asked to match the appropriate category with the item(s) that represented the category, in their opinion. In total, we collected seven responses to the Q-sort exercise, which is consistent with the sample size of other recent studies employing the Q-sort method (Cao & Zhang, 2011; Kianto, 2008; Kroes & Ghosh, 2010; Wong et al., 2011). The responses to the Q-sort exercise were compiled in a spreadsheet, and items with an item placement rate less than 70% among the respondents on the appropriate category that represents the item were eliminated from the final draft of the survey instrument (Moore & Benbasat, 1991; Nahm et al., 2002).

A pretest was conducted as the next phase of instrument development. The survey instrument was delivered to a total of eight academics and industry professionals. Each

respondent was asked to thoroughly review the survey and provide feedback on the construction, content, clarity, and quality of the survey. Based on the results of the pretest, the survey was modified to improve flow, decrease the length of the survey, and remove or reword ambiguous items according to the respondents to the pretest. Next, a pilot test was initiated by creating a web-based version of the survey and sending it to a diverse group of industry professionals from organizations actively pursuing lean transformation. The pilot test was delivered to individuals that originally participated in structured interviews to establish the conceptual domain for this research in addition to professional contacts acquired through industry events associated with supply chain management and lean, respectively. Based on an initial 50 invitations to participate in the pilot test, we received 29 completed questionnaires. Although a sample of 29 is not large enough for robust statistical analysis, we analyzed the descriptive statistics to look for any abnormalities with the data. The pilot test was helpful to understand the time investment required to complete the survey and provided some insight on the variability that can be expected from the full-scale survey. Based on the results of the pilot study, the survey was revised to improve clarity, reduce content, and minimize ambiguity.

3.3.2 Data Collection

A web-based survey was utilized for the large-scale data collection effort. The sample consisted of executive and managers randomly selected from a database provided by a consulting firm specializing in lean supply chain practices. The respondents targeted as part of this sample frame are those individuals that are typically involved and often

leading the lean transformation activities within their respective organization. The survey was initially administered via the monthly newsletter published by the consulting firm. Approximately one month later, an email reminder was sent to the sample, followed by one additional reminder two months from the launch of the original newsletter. As an incentive, respondents that completed the survey within the first month were entered into a drawing for a full tuition scholarship to complete a lean certification program at a major university. Those respondents that completed the survey within the first two months were entered into a drawing to receive a book from a select group of titles related to lean transformation.

Initially, the newsletter was issued to 7,959 potential respondents, of which 835 of the messages bounced due to an incorrect/inactive account. Of the remaining 7,124 potential respondents, 769 individuals opened the newsletter and 61 respondents clicked on the survey link. The first reminder was issued to 7,944 potential respondents, of which 938 of the messages bounced due to an incorrect/inactive account or due to recipients opting out of the newsletter distribution list. Of the remaining 7,006 potential respondents, 902 individuals opened the newsletter and 100 respondents clicked on the survey link. The second reminder was issued to 7,914 potential respondents, of which 1,179 of the messages bounced due to an incorrect/inactive account or due to recipients opting out of the newsletter distribution list. Of the remaining 6,735 potential respondents, 742 individuals opened the newsletter and 98 respondents clicked on the survey link. The survey link was also posted on the Lean Consulting Firm's member blog, which resulted in an additional 60 responses.

A total of 319 responses to the survey were received, which equates to a 13.2% initial response rate, when adding the total number of recipients (2,413) that opened the original newsletter and the total number of recipients that opened the two subsequent reminder messages. However, it is certainly plausible that there is tremendous overlap between the recipients that opened the original newsletter and the recipients that opened the two reminder messages. Based on 100% overlap between recipients that opened the original newsletter and recipients that opened the subsequent newsletters, the initial response rate would be 35.4%. Because of the uncertainty associated with determining how many of the recipients that opened the original newsletter were also recipients that opened one or both of the reminder messages, it is virtually impossible to calculate a truly accurate response rate. It is expected that the true response rate would fall somewhere near the middle of the 13.2% - 35.4% range.

Consistent with prior literature, two questions were added to the survey to further qualify respondents (Grawe et al., 2012). The first question asked respondents the extent to which they possess the necessary knowledge and information to answer the survey questions. The second question asked respondents the extent to which the survey questions applied to their organization. Another question designed to qualify respondents and their respective organization, asked the respondents how long their organization had been pursuing lean transformation from "Not at all" to "More than 20 years." In total, 147 responses were eliminated from the final sample due to excessive missing data, excessive responses at either scale anchor (e.g., selected 7 for every question), excessive neutral responses, respondents answered "Not at all" to the duration of lean transformation, or respondents indicated that they did not have enough information to answer the questions

or the questions were not relevant to their organization. After eliminating surveys based on the aforementioned factors, the final sample size is 172. Respondents primarily represented the manufacturing industry (30.7%), but 25 other industry types were also represented in the survey. Most respondents worked for companies with less than 25,000 employees. Respondents were also very experienced with the lean philosophy with over 50% of the respondents indicating that they have delivered lean training to others. Please see Appendix B for detailed demographic information for the survey respondents.

A time-trend extrapolation test was utilized to examine non-response bias, which assumes that non-responses will resemble late responses (J. S. Armstrong & Overton, 1977). To test for non-response bias, we conducted a multivariate analysis of variance between the first 25% of responses and the last 25% of responses. The result of the test suggests that non-response bias is not present as no significant differences between groups were detected (Wilks' Lambda = 0.006, p = 0.38).

Harman's single-factor test was used to check for common method variance (Malhotra et al., 2006; Podsakoff & Organ, 1986; Spector, 2006). If common method bias exists in the data, a single factor will be present following exploratory factor analysis of the variables included in the study. After conducting exploratory factor analysis, our analysis revealed 11 factors with Eigenvalues greater than 1 with no single factor explaining more than 18% of the variance. Therefore, we can conclude that common method bias is not a concern for this study.

3.3.3   Data Analysis

Partial Least Squares (PLS) path analysis was utilized to investigate the relationship between Human Resource Performance Management and Lean Transformation Success. PLS has increased in popularity among recent supply chain and operations management studies, and has been utilized for years by many other disciplines. In fact, Goodhue et al. (2006) found that research published in well-respected journals from other business disciplines from 2000-2003 relied on PLS as the chosen method for data analysis in approximately one third of the studies. There are a few distinct features about PLS that distinguish the method from that employed by other structural equation modeling techniques. PLS is component-based unlike other covariance-based techniques (AMOS, LISREL, EQS), allows both formative and reflective constructs, and applies bootstrapping technique to determine the significance of associations within the model (Chin, 1995; Chin et al., 2003; Marcoulides et al., 2009). Further, PLS does not require the normality assumption, which allows for smaller sample sizes and places minimal demands on measurement scales without sacrificing predicting power (Chin, 1998). This research utilizes the software package PLS Graph 3.0 with bootstrapping parameters set at 500 re-samples for both measurement model validation and hypothesis testing.

This study uses reflective constructs to measure Human Resource Performance Management and Lean Transformation Success. Tables 3.1 and 3.2 below present the factor loadings and cross-loadings for both the independent and dependent variables and their associated constructs in this study. Please note that 12 total items from both Human Resource Performance Management and Lean Transformation Success were dropped due to low factor loadings.

Table 3.1: Human Resource Performance Management Factor Loadings

Items	Selection	Development	Evaluation	Rewards
		Factors		
select1	**0.519**	0.42		
select2	**0.809**			
select3	**0.794**			
select4	**0.492**	0.441		0.302
dev1	0.322	**0.563**		
dev2		**0.788**		
dev3		**0.695**		
dev4		**0.652**		
dev5	0.317	**0.745**		
eval1			**0.762**	
eval2			**0.77**	
eval4			**0.712**	
eval5		0.42	**0.509**	0.362
eval6			**0.475**	0.319
reward1			0.324	**0.571**
reward2				**0.786**
reward4	0.343			**0.69**
reward5		0.329	0.346	**0.634**

Table 3.2: Lean Transformation Success Factor Loadings

	Factors		
Items	Achieve Objectives	Improved Capabilities	Alignment
achieveobj1	**0.563**	0.368	0.557
achieveobj2	**0.579**	0.332	0.535
achieveobj3	**0.631**	0.418	0.458
achieveobj6	**0.683**	0.416	0.449
improvecap1	0.465	**0.521**	0.492
improvecap2	0.485	**0.593**	0.461
improvecap4	0.417	**0.573**	0.33
align3	0.402	0.399	**0.774**
align4	0.44	0.441	**0.712**

The psychometric properties are generated by PLS Graph, and were used to assess convergent validity, discriminant validity, and internal consistency reliability (ICR). Table 3.3 displays the ICR, square root of the AVE (diagonal terms), and the correlation between constructs. To assess convergent validity, we examined the square root of the average variance extracted (AVE), which should generally be greater than 0.707 or AVE > 0.5 (Fornell & Larcker, 1981). The square roots of the AVE values in this study, which can be equated to an R-square value in simple regression, were all greater than 0.707 with a lowest AVE value of 0.787. To assess discriminant validity, we compared the AVE square root to the correlation with other constructs. The AVE square root should be larger than the correlation with other constructs to confirm discriminant validity (i.e. measures for a specific construct are unrelated to measures of a different construct). From Table 3.3 below, one can see that the square root of the AVE exceeds all correlations (horizontal rows and vertical columns) for each construct, which supports discriminant validity. The

ICR values (similar to Cronbach's alpha) should all be larger than 0.7 (Fornell & Larcker, 1981). As illustrated in the table, the lowest ICR value in this study is 0.889, which supports the reliability of the constructs.

Table 3.3: Reliabilities, Convergent Validities, and Discriminant Validities

Factors	ICR	Correlations and AVE Square Roots						
		Selection	Dev.	Eval.	Rewards	Achievement of Objectives	Improved Capabilities	Alignment w/ Org. Strategy
Selection	0.889	**0.787**						
Development	0.929	0.675	**0.850**					
Evaluation	0.905	0.541	0.624	**0.810**				
Rewards	0.923	0.576	0.619	0.694	**0.867**			
Achievement of Objectives	0.951	0.640	0.678	0.516	0.511	**0.908**		
Improved Capabilities	0.932	0.654	0.668	0.550	0.495	0.878	**0.906**	
Alignment w/ Org. Strategy	0.977	0.611	0.677	0.551	0.535	0.812	0.817	**0.976**

Figure 3.2 shows the results of the PLS analysis. Human Resource Performance Management is a second-order reflective construct formed by four first-order constructs – Selection, Development, Evaluations, and Rewards. Lean Transformation Success is a second-order reflective construct formed by three first-order constructs – Achievement of Objectives, Improved Organizational Capabilities, and Alignment with Organizational Strategy.
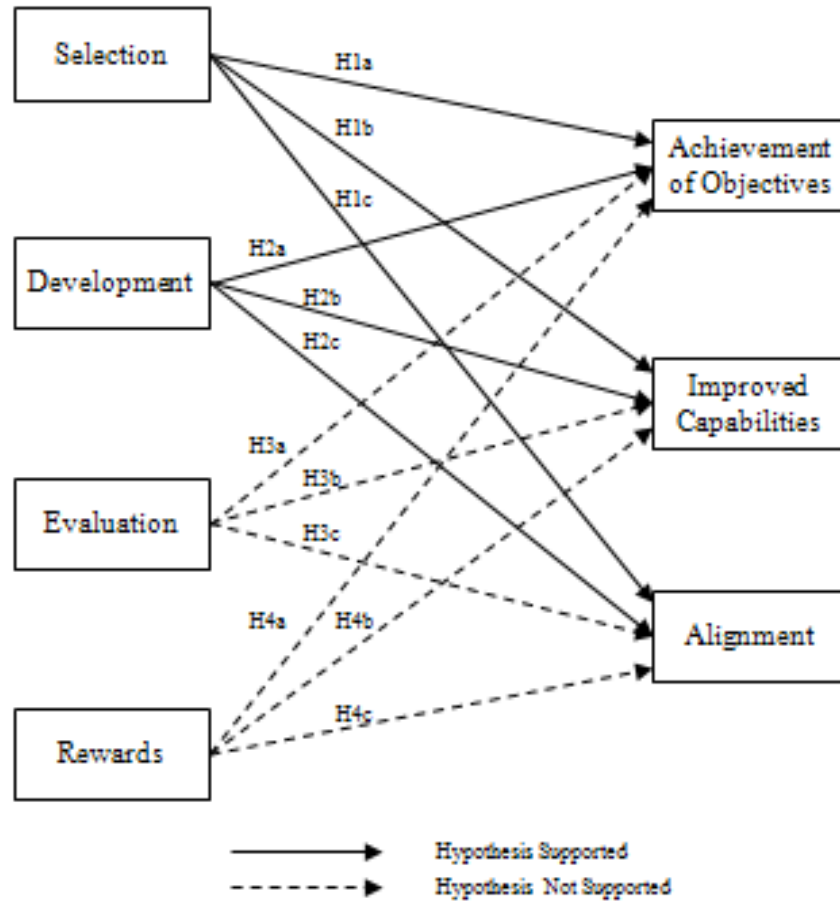
Figure 3.2: PLS Results

Table 3.4 presents the path coefficients and t-statistics between the four first-order constructs of HRPM and the three second-order constructs of Lean Transformation Success. As you can see from the table, we found significant support for a positive relationship between HRPM Selection practices and the three first-order constructs measuring Lean Transformation Success. We also found significant support for a positive relationship between HRPM Development practices and the three first-order constructs measuring Lean Transformation Success. Surprisingly, we found no support for a relationship between HRPM Evaluation practices, HRPM Reward practices and Lean Transformation Success. The next section provides some insight on the findings in this

study and discusses implications of these findings for industry professionals and academics.

Table 3.4: Path Coefficients and T-Statistics

Path	Path Coeff.	t-stat
Selection → Achievement of Obj.	0.310	3.64*
Development → Achievement of Obj.	0.401	4.20*
Evaluation → Achievement of Obj.	0.078	1.00
Rewards → Achievement of Obj.	0.031	0.42
Selection → Improved Capabilities	0.334	3.32*
Development → Improved Capabilities	0.355	3.26*
Evaluation → Improved Capabilities	0.076	0.96
Rewards → Improved Capabilities	0.041	0.52
Selection → Alignment	0.237	2.63*
Development → Alignment	0.394	4.21*
Evaluation → Alignment	0.135	1.76
Rewards → Alignment	0.060	0.92

*$p<0.01$

3.4 Discussion

Consistent with prior literature, we found significant support for hypotheses 1a, 1b, and 1c. This result suggests that organizations pursuing lean transformation can significantly benefit from selectively hiring new associates. Specifically, organizations should select employees based on lean transformation related skills, such as problem-solving aptitude, desire to work in a team, and their ability to provide ideas that improve the lean transformation process, in addition to other required skills and knowledge specific to the position (Liker & Hoseus, 2008). We note, however, that often it is not new employees that organizations are typically concerned with when it comes to lean

transformation; it is the existing employees and their attitude/behavior towards lean transformation initiatives.

We also found positive support for hypotheses 2a, 2b, and 2c, which indicates that organizations can tremendously benefit from investing in employees by offering training and development opportunities. The items included in the employee development construct relate to key elements of lean transformation (problem solving, cross training, etc.), so organizations should seek employee development investments that enhance employee abilities in these key lean elements in addition to other basic skills and knowledge. Recall from above that the organization should strive to develop a lean environment where all employees engage in problem solving activities to make improvements that align with the targets and goals of the organization, so investing in a company-wide, systematic problem solving methodology will propel the organization towards achieving the goal of successful and sustainable lean transformation (Liker & Hoseus, 2008).

We did not find significant support for the relationship between employee performance evaluation and lean transformation success. There are a couple of potential explanations for this result. As indicated by the low mean values for the items in Appendix A, there is not widespread application of the human resource performance management practices, which points to the nascent stage of implementation associated with lean transformation. Organizations pursuing lean transformation should consider transforming their performance evaluation process to reflect the new priorities associated with lean transformation; however, as uncovered during our preliminary interviews with senior leaders of companies actively engaged in lean transformation, many organizations still rely

on existing performance evaluation processes to drive performance. Also, as described above, performance measurement is still transitioning to performance management where ongoing, real-time coaching, feedback, and goal setting replaces the traditional, periodic (annual, quarterly) performance review session. Performance management is reflected in our employee evaluation scale, yet many organizations still rely on traditional performance evaluation procedures. That is not to say that organizations utilizing traditional performance evaluation procedures cannot enjoy some degree of lean transformation success, but they may be able to enjoy a much more successful lean transformation by adopting a performance management philosophy.

We also did not find a significant relationship between employee rewards and lean transformation success. Although traditionally, extrinsic rewards often lead to intrinsic motivation to perform well and repeat positive behavior, some individuals do not require extrinsic rewards in order to maximize their performance (Deci, Koestner, & Ryan, 1999). Additionally, there has been an ongoing debate regarding the impact of extrinsic rewards on intrinsic motivation, with some authors suggesting that extrinsic rewards may not lead to intrinsic motivation (Cameron & Pierce, 1996). In other words, providing equitable and competitive rewards to employees may not motivate them to exhibit actions and behaviors that support the long-term lean transformation strategy. The items that are included in our employee rewards scale focus on the extent to which rewards are offered to employees that support and achieve lean transformation objectives. However, an organization may utilize a reward system that is not necessarily focused on lean transformation objectives and still find some degree of lean transformation success.

3.5 Conclusion

Becker (1994) suggested that education and training were the most important elements of the human capital equation. Investing in training and development of human resources within the organization, Becker stated, will lead to long-term economic value. Our results echo that sentiment based on our findings that selective hiring practices and employee development lead to lean transformation success. This study makes a few important contributions. First, this study extends the philosophy of human resource management to human resource performance management and empirically tests the impact of common HRPM practices on a new construct defined as lean transformation success. To our knowledge, this is the first study to identify critical success factors associated with lean transformation. Most studies centered on the topic of lean concentrate on conceptualization of the philosophy, implementation strategies, and/or benefits of lean, whereas we distinctly develop a lean transformation construct to capture the extent to which the organization was able to successfully transform the organization towards the lean model. Also, the use of Partial Least Squares path analysis is a novel approach to the subject as well.

Practitioners can find this study particularly useful based on our findings of a significant relationship between the human resource performance management practices of selective hiring and employee development. Based on our findings, organizations will see a much larger return by investing in selective hiring and, specifically, employee development practices. As organizations strive to achieve successful lean transformation, employee development becomes the single most important human capital investment,

which aligns with historical research conducted by Becker (1962, 1964), Schultz (1961), Mincer (1958), and others. Even though we did not find significant results for the relationships associated with employee evaluation and rewards practices, organizations should consider adopting a performance *management* approach in lieu of the traditional performance *evaluation* and align the employee reward system with the targets and objectives of lean transformation.

Researchers can find this study useful as one of the few studies to empirically test human resource performance management practices and the first known study to characterize lean transformation success. Although the lean transformation success construct is derived from the well-established planning systems success construct, additional research could identify additional dimensions of lean transformation success, both within and beyond the four walls of the organization. Many organizations have recognized the strategic importance of the human resource performance management system. An inadequate HRPM system including lack of employee support/buy-in is often a failure mode for lean implementation (Hines et al., 2004), which dictated our focus on HRPM in this study. However, additional research may investigate the impact of other organizational elements (e.g., competitive capabilities) on lean transformation success.

Chapter 4: An Empirical Investigation of the Relationship between Lean Transformation Success and Competitive Advantage

4.1.   Introduction

Scholars argue that implementation of lean improves the competitive position of a firm due to the performance enhancing nature of the lean production practices, particularly waste reduction, continuous improvement, and total quality management programs, among others (R. R. Fullerton & McWatters, 2001; Lawrence & Hottenstein, 1995; Sakakibara, Flynn, Schroeder, & Morris, 1997). There is widespread contention that lean practices are beneficial to an organization. Therefore, it is imperative that we attempt to gain additional insight in regard to the true impact of lean transformation success on competitiveness. Unfortunately, lean transformation can be equated to climbing Mount Everest or any other monumental task, where many have tried but few have truly succeeded.

Over the years, anecdotal evidence suggests that many organizations pursuing lean transformation, quite often do not achieve the goals and/or improvements outlined in the lean transformation strategy, which leads to a breakdown or failure of the lean transformation journey (S Bhasin, 2008). Failure typically stems from an organization abandoning or drastically modifying the lean transformation strategy and resuming a more traditional management philosophy based on internal and external forces. Recent estimates of lean transformation failure rates approach 70% and beyond because many organizations are not readily prepared to admit failure, or are aggressively adapting their strategy to prevent failure (S Bhasin, 2008). One misunderstanding of modern literature rests in the notion that improvements in organizational outcomes and efficiency can be achieved solely

by implementing lean practices and techniques. Most studies overlook the importance of *successfully* transforming the organization to a lean operating philosophy, and more importantly, *sustaining* the lean transformation long-term. While organizations can certainly achieve short-term gains by deploying lean techniques, a truly successful and sustainable lean organizational transformation requires a cultural shift to fully embrace the lean philosophy with commitment and support from personnel at every level within the organization (Liker & Hoseus, 2010).

Holsapple and Jin (2007) contend that "competitiveness is a pressing concern that demands never-ending attention because of the complexities, challenges, and opportunities posed by today's environment" (Holsapple and Jin, 2007, p. 20). Lewis (2000) studied the impact of lean production on sustainable competitive advantage based on empirical data gathered from three case studies. Lewis primarily focused on productivity improvements fostered by implementation of lean principles and concludes that firms can increase their competitive position as long as the firm can embrace the savings created by implementation of lean production practices. However, there are many other avenues or channels that organizations can exploit to increase their competitive position in addition to enhancements in productivity. Holsapple and Singh (2001) suggest that firms can enhance competitiveness through improvements in productivity, agility, innovation, and reputation (PAIR).

The purpose of this study is to expand the work of Lewis (2000) by investigating the impact of lean transformation success on improved organizational performance and competitiveness. While the preliminary study conducted by Lewis (2000) provided some clarity based on an analysis of 3 cases, we contribute by conducting a broad and

comprehensive survey of diverse organizations. Here, we seek to explore the relationship between the success of various lean production practices and the competitiveness of a firm to determine if implementation of lean is truly beneficial or if there may be some trade-offs that inhibit long-term sustainable competitive advantage. Hence, the question we seek to answer in this study is: What is the impact of lean transformation success on organizational competitiveness?

The rest of this chapter is organized as follows: Section 2 provides the background for this study by highlighting, at a high level, the major elements of lean and by providing a brief overview of competitiveness. The background concludes by discussing the theoretical foundation for this study and offering hypotheses. Section 3 presents details of the methodology employed for this research. The next section offers the results of the data analysis followed by a discussion of the results. Finally, we conclude the paper by presenting the implications of this study to practitioners and researchers, discussing limitations to the study, and describing future research directions concerned with the impact of lean transformation on organizational competitiveness.

4.2. Background

There is considerable research literature examining practices and principles of Lean Thinking (see (Holweg, 2007; Moyano-Fuentes & Sacristán-Díaz, 2012; Ramarapu, Mehra, & Frolick, 1995; Shah & Ward, 2003) for reviews). While we do not intend to provide a comprehensive review of the literature here, we do find it important to expand the key elements of lean in an effort to define our constructs and frame this study. Over the years, lean research has evolved from early conceptualization (Monden, 1981; Ohno,

1988; Sugimori et al., 1977), to the purported benefits of implementation (Barbara B Flynn, Sakakibara, & Schroeder, 1995; R. R. Fullerton, McWatters, & Fawson, 2003; Sakakibara et al., 1997; Shah & Ward, 2003), to a unified definition (Shah & Ward, 2007), with various extensions such as agility (Thomas J Goldsby, Griffis, & Roath, 2006), or even the possibility of becoming "too lean" (Eroglu & Hofer, 2011). Despite the abundance of research, a gap that currently exists in the literature is the absence of any study that specifically assesses the *success* of lean implementation and transformation strategies. The next sections briefly identify some of the key characteristics of lean and competitiveness.

4.2.1. Characteristics of Lean

In an effort to understand the relationship between lean and competitiveness, we must first develop an understanding of lean concepts and highlight the common practices that are implemented throughout various industries. Most ascribe that, lean is the evolutionary product of and term used to describe the Toyota Production System (TPS). In the early days, lean was characterized by certain elements of modern day Lean Thinking, namely just-in-time production, which created tremendous confusion in academic and industrial circles alike (Shah & Ward, 2007). Additionally, many scholars have characterized lean based on the diverse practices that underlie the lean management philosophy. Originally adapted from McLachlin (1997), Shah and Ward (2003) highlight 22 common practices associated with lean along with a wealth of sources for additional information (see table 1, p. 131). While the lean practices identified by Shah and Ward (2003) are important to consider when conceptualizing the lean concept, some scholars would argue that a truly lean organization would not only implement and refine the various

lean practices, but also strive to develop human resources as the centerpiece of a lean culture (Liker & Hoseus, 2010). While the lean philosophy can be applied in nearly all organizational settings, there is no one-size-fits-all transformation strategy. A lean transformation strategy that works well for one organization may or may not work well for another. Many empirical studies associated with lean transformation have investigated relationships between the various lean practices and some measure of organizational performance. However, in this study, we focus on the perceived success of lean transformation based on the organization's chosen lean transformation strategy, which to our knowledge is a novel and unique approach.

A people centric lean culture, popularized by TPS purists, serves as the lens through which we develop our conceptualization of lean transformation success (Liker & Hoseus, 2008). In this study, we define our higher-order construct, Lean Transformation Success, as the extent to which the organization has successfully transformed the organization towards a lean management and operating philosophy. By adopting and adapting the planning systems success construct from Papke-Shields et al. (2002), we include the three dimensions of objective achievement/fulfillment, improved capabilities, and strategy alignment in our conceptualization of lean transformation success. Achievement of objectives refers to the extent of fulfillment of organizational objectives associated with lean transformation. Improved organizational capabilities refer to the extent to which the organization has noticed improvement in key organizational capabilities associated with lean transformation. Alignment with organizational strategy refers to the extent to which the lean transformation strategy aligns with the formal organizational strategy. A list of items comprising each first-order construct can be found in Appendix A.

4.2.2. Characteristics of Competitiveness

Competitiveness is arguably the primary point of emphasis within an organization in an increasingly global marketplace. Nearly all organizations seek to maximize returns and, ultimately, gain an advantage over other competing organizations by exploiting core competencies and developing new technologies. Perhaps the most influential work on the nature of competitiveness and competitive advantage stems from the work of Michael Porter. As Porter (2008b) outlines in his "five forces" model, the forces differ by industry and/or application but can have lasting effects on the overall landscape and profitability of the industry. Intense forces can limit industry progression, while gentle forces typically allow competitors to thrive in the industry (Porter, 2008b). Cockburn et al. (2000) captures Porter's microeconomic theory with an example:

> A firm operating in an industry in which there are substantial returns to scale coupled with opportunities to differentiate, that buys from and sells to perfectly competitive markets and that produces a product for which substitutes are very unsatisfactory (e.g., the U.S. soft drink in the 1980s), is likely to be much more profitable than one operating in an industry with few barriers to entry, and a large number of similarly sized firms who are reliant on a few large suppliers and who are selling commodity products to a few large buyers (e.g., the global semiconductor memory market). (Cockburn et al., 2000, p. 1126)

In addition to the five forces, Porter (2008a) went on to define activities that create value for the customer as a primary source of competitive advantage. The value chain consists of the five primary activities of: inbound logistics, operations, outbound logistics, marketing and sales, and service. Porter also identified four secondary activities that support the primary activities and consist of: firm infrastructure, human resource management, technology development, and procurement. It was Porter's belief that, with

the support of the four secondary activities, organizations could create value and ultimately

gain a competitive advantage by leveraging the five primary activities. Beyond Porter's

work on competitiveness, many other streams of research have identified potential causes

or paths to competitive advantage, such as the resource-based view that suggests

competitive advantage is generated from the resources contained within the firm (J.

Barney, 1991).

By extending notions of Porter's value chain to the context of knowledge

management, Holsapple and Singh (2001) identify five knowledge manipulation activities

(primary) and four managerial influences (support) that can enhance the competitive

position of an organization based on four dimensions that formulate the 'PAIR' model,

namely Productivity, Agility, Innovation, and Reputation. Holsapple and Singh (2001)

break down the four dimensions of PAIR to illustrate the potential enhancements that may

improve organizational competitiveness by offering the following examples:

- Productivity – lower cost or greater speed
- Agility – rapid response ability, more alertness, or great flexibility and adaptability.
- Innovation – inventing new products, processes, or services
- Reputation – better quality, dependability, and brand differentiation

It is through the PAIR lens that we examine the relationship between lean principles

and competitiveness. In this study, we adopt the competitive advantage construct

developed by (Li, Ragu-Nathan, Ragu-Nathan, & Subba Rao, 2006). Competitive

advantage is a higher-order construct and consists of the first-order dimensions of: cost,

quality, delivery, innovation, and time to market. Li et al. (2006) define competitive

advantage as "the extent to which an organization is able to create a defensible position

over its competitors" by leveraging competitive capabilities. The research framework

proposed by (Koufteros, Vonderembse, & Doll, 1997) provides the foundation for the competitive advantage construct based on competitive capabilities of: competitive pricing, premium pricing, value-to-customer quality, dependable delivery, and production innovation.

4.2.3. Theoretical Foundation

According to Rumelt et al. (1994), the fundamental question investigated in the field of strategic management over the years is how firms achieve and sustain competitive advantage. The seminal resource-based view suggests that resources that are valuable, rare, imperfectly imitable, or without an equivalent substitute can lead to sustainable competitive advantage for the firm (J. Barney, 1991). Teece et al. (1997) extended the resource-based view based on the suggestion that the resource-based view does not adequately address the competitive environment in a dynamic and unpredictable market. As Teece et al. (1997) describe, a firm's dynamic capabilities stem from the firm's ability to "integrate, build, and reconfigure internal and external competencies to address rapidly changing environments," which serves as a catalyst for achieving and sustaining competitive advantage. Eisenhardt and Martin (2000) further conceptualized dynamic capabilities theory as consisting of "specific strategic and organizational processes like product development, alliancing, and strategic decision making that create value for firms within dynamic markets by manipulating resources into new value-creating strategies (p. 1106)." Moreover, dynamic capabilities hinge on the ability of the organization to accomplish internal and external transformation to reconfigure the organization's assets (Amit & Schoemaker, 1993). Successful transformation relies on environmental scanning

and market evaluation to develop organizational knowledge and foster learning (Amit & Schoemaker, 1993).

Changing routine operating processes through organizational learning to improve operational performance has been defined as a dynamic capability (Zahra, Sapienza, & Davidsson, 2006). Anand et al. (2009) offered the notion that continuous improvement can serve as a dynamic capability from an organizational context. Grounded in organizational learning theory, they develop a conceptual map of continuous improvement infrastructure to demonstrate that continuous improvement (Lean, Six Sigma, etc.) can serve as an organizational dynamic capability. Wu et al. (2010) highlight operational capabilities as a potential source of competitive advantage. They develop a taxonomy of operational capabilities including: operational improvement, operational innovation, operational customization, operational cooperation, operational responsiveness, and operational reconfiguration. Wu et al. (2010) define their operational reconfiguration capability through a dynamic capability lens as a "differentiated sets of skills, processes, and routines for accomplishing the necessary transformation to re-establish fit between operations strategy and the market environment (p. 730)." Other scholars have focused simply on implementation of the lean production element of the overall lean philosophy that leads to sustainable competitive advantage (R. Fullerton & Wempe, 2009; Lewis, 2000; Shah & Ward, 2007). Based on the Anand et al. (2009) characterization of continuous improvement as a dynamic capability leading to competitive advantage, we offer the theoretical model in figure 4.1. We propose that the extent to which an organization successfully transforms towards a lean operating philosophy will enhance the competitive position of the organization. We offer the following hypothesis:

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H1 – *The extent of Lean Transformation Success leads to Competitive Advantage for the organization.*

Lean Transformation Success	Competitive Advantage
▪ Achievement of Organizational Objectives ▪ Improved Organizational Capabilities ▪ Alignment with Business Strategy	▪ Competitive Pricing ▪ Quality Products/Services ▪ Dependable Delivery ▪ Innovative Products/Services ▪Time-to-Market
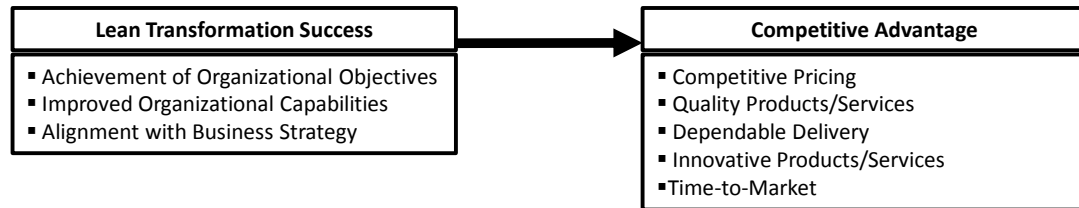
Figure 4.1 – Theoretical Model

The next section details the methodology employed to test the hypotheses offered above including a discussion of the instrument development, data collection, and data analysis processes.

4.3.   Methodology

4.3.1. Instrument and Scale Development

In order to evaluate the relationships between constructs in this study, a survey was developed and conducted following Dillman's Tailored Design Method (Dillman, 2007). The survey instrument was developed and subsequently validated for this study using a multi-step process (Churchill Jr, 1979). First, preliminary interviews were conducted with senior executives and managers from organizations in various stages of lean transformation to formulate and refine the domain for this research. Second, a thorough review of relevant literature was conducted to grasp the existing realm of knowledge and to provide guidance for this research in terms of existing constructs, definitions, and measurement items. Several scales were developed for this study to assess the extent to which the organization's

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lean transformation journey has been successful in addition to assessing how well the organization has achieved competitive advantage. Scales are grounded in the extant literature and rely on scale development techniques employed by prior research (DeVellis, 2011; Dunn et al., 1994; Stratman & Roth, 2002).

Multi-item reflective measures were utilized for each construct with Likert-based scales anchored at 1 = no extent to 7 = great extent for the Lean Transformation Success construct, and 1 = strongly disagree to 7 = strongly agree for the Competitive Advantage construct. The Lean Transformation Success construct measured the extent to which the organization 1) achieved lean transformation objectives, 2) improved organizational capabilities, and 3) developed a lean transformation strategy that aligned with the overall business strategy of the organization. The competitive advantage construct captured the extent to which the organization offers 1) competitive prices, 2) high quality products, 3) dependable delivery, 4) innovative products, and 5) delivers products to market rapidly. Appendix A highlights the items, means, standard deviations, and corresponding sources for the constructs utilized in this study.

Validated measures from prior literature were incorporated into this study as often as possible; however, new items that were grounded in prior literature and developed from our interviews with industry professionals were added for some of the constructs based on the lack of existing scales. To further validate and refine the new items and the previously validated items, a group of industry professionals and academics were gathered to conduct a Q-sort exercise (Moore & Benbasat, 1991; Nahm et al., 2002). Each respondent for the Q-sort exercise was provided a cover page with an introduction to the research project and instructions for the Q-sort method. Each respondent was also presented a document that

contained a group of categories (constructs) and a group of items. Respondents were asked to match the appropriate category with the item(s) that represented the category, in their opinion. In total, we collected seven responses to the Q-sort exercise, which is consistent with the sample size of other recent studies employing the Q-sort method (Cao & Zhang, 2011; Kianto, 2008; Kroes & Ghosh, 2010; Wong et al., 2011). The responses to the Q-sort exercise were compiled in a spreadsheet, and items with an item placement rate less than 70% among the respondents on the appropriate category that represents the item were eliminated from the final draft of the survey instrument (Moore & Benbasat, 1991; Nahm et al., 2002).

A pretest was conducted as the next phase of instrument development. The survey instrument was delivered to a total of eight academics and industry professionals. Each respondent was asked to thoroughly review the survey and provide feedback on the construction, content, clarity, and quality of the survey. Based on the results of the pretest, the survey was modified to improve flow, decrease the length of the survey, and remove or reword ambiguous items according to the respondents to the pretest. Next, a pilot test was initiated by creating a web-based version of the survey and sending it to a diverse group of industry professionals from organizations actively pursuing lean transformation. The pilot test was delivered to individuals that originally participated in structured interviews to establish the conceptual domain for this research in addition to professional contacts acquired through industry events associated with supply chain management and lean, respectively. Based on an initial 50 invitations to participate in the pilot test, we received 29 completed questionnaires. Although a sample of 29 is not large enough for robust statistical analysis, we analyzed the descriptive statistics to look for any

abnormalities with the data. The pilot test was helpful to understand the time investment required to complete the survey and provided some insight on the variability that can be expected from the full-scale survey. Based on the results of the pilot study, the survey was revised to improve clarity, reduce content, and minimize ambiguity.

4.3.2. Data Collection

A web-based survey was utilized for the large-scale data collection effort. The sample consisted of executive and managers randomly selected from a database provided by a consulting firm specializing in lean supply chain practices. The respondents targeted as part of this sample frame are those individuals that are typically involved and often leading the lean transformation activities within their respective organization. The survey was initially administered via the monthly newsletter published by the consulting firm. Approximately one month later, an email reminder was sent to the sample, followed by one additional reminder two months from the launch of the original newsletter. As an incentive, respondents that completed the survey within the first month were entered into a drawing for a full tuition scholarship to complete a lean certification program at a major university. Those respondents that completed the survey within the first two months were entered into a drawing to receive a book from a select group of titles related to lean transformation. Initially, the newsletter was issued to 7,959 potential respondents, of which 835 of the messages bounced due to an incorrect/inactive account. Of the remaining 7,124 potential respondents, 769 individuals opened the newsletter and 61 respondents clicked on the survey link. The first reminder was issued to 7,944 potential respondents, of which 938 of the messages bounced due to an incorrect/inactive account or due to

recipients opting out of the newsletter distribution list. Of the remaining 7,006 potential respondents, 902 individuals opened the newsletter and 100 respondents clicked on the survey link. The second reminder was issued to 7,914 potential respondents, of which 1,179 of the messages bounced due to an incorrect/inactive account or due to recipients opting out of the newsletter distribution list. Of the remaining 6,735 potential respondents, 742 individuals opened the newsletter and 98 respondents clicked on the survey link. The survey link was also posted on the Lean Consulting Firm's member blog, which resulted in an additional 60 responses.

A total of 319 responses to the survey were received, which equates to a 13.2% initial response rate, when adding the total number of recipients (2,413) that opened the original newsletter and the total number of recipients that opened the two subsequent reminder messages. However, it is certainly plausible that there is tremendous overlap between the recipients that opened the original newsletter and the recipients that opened the two reminder messages. Based on 100% overlap between recipients that opened the original newsletter and recipients that opened the subsequent newsletters, the initial response rate would be 35.4%. Because of the uncertainty associated with determining how many of the recipients that opened the original newsletter were also recipients that opened one or both of the reminder messages, it is virtually impossible to calculate a truly accurate response rate. It is expected, albeit not scientifically confirmed, that the true response rate would fall somewhere near the middle of the 13.2% - 35.4% range.

Consistent with prior literature, two questions were added to the survey to further qualify respondents (Grawe et al., 2012). The first question asked respondents the extent to which they possess the necessary knowledge and information to answer the survey

70

questions. The second question asked respondents the extent to which the survey questions applied to their organization. Another question designed to qualify respondents and their respective organization, asked the respondents how long their organization had been pursuing lean transformation from "Not at all" to "More than 20 years." In total, 147 responses were eliminated from the final sample due to excessive missing data, excessive responses at either scale anchor (e.g., selected 7 for every question), excessive neutral responses, respondents answered "Not at all" to the duration of lean transformation, or respondents indicated that they did not have enough information to answer the questions or the questions were not relevant to their organization. After eliminating surveys based on the aforementioned factors, the final sample size is 172. Respondents primarily represented the manufacturing position in the supply chain (30.7%), with 25 industry types represented in the survey. Most respondents worked for companies with less than 25,000 employees. Respondents were also very experienced with the lean philosophy with over 50% of the respondents indicating that they have delivered lean training to others. Please see Appendix B for detailed demographic information for the survey respondents.

A time-trend extrapolation test was utilized to examine non-response bias, which assumes that non-responses will resemble late responses (J. S. Armstrong & Overton, 1977). To test for non-response bias, we conducted a multivariate analysis of variance between the first 25% of responses and the last 25% of responses. The result of the test suggests that non-response bias is not present as no significant differences between groups were detected (Wilks' Lambda = 0.006, p = 0.38).

Harman's single-factor test was used to check for common method variance (Malhotra et al., 2006; Podsakoff & Organ, 1986; Spector, 2006). If common method bias

exists in the data, a single factor will be present following exploratory factor analysis of the variables included in the study. After conducting exploratory factor analysis, our analysis revealed 13 factors with Eigenvalues greater than 1 with no single factor explaining more than 21% of the variance. Therefore, we can conclude that common method bias is not a concern for this study.

4.3.3. Data Analysis

Partial least squares (PLS) path analysis was utilized to investigate the relationship between Lean Transformation Success, Organizational Performance, and Competitive Advantage. There are a few distinct features about PLS that distinguish the method from other structural equation modeling techniques. PLS is component-based unlike other covariance-based techniques (AMOS, LISREL, EQS), allows both formative and reflective constructs, and applies bootstrapping technique to determine the significance of associations within the model (Chin, 1995; Chin et al., 2003; Marcoulides et al., 2009). Further, PLS does not require the normality assumption, which allows for smaller sample sizes and places minimal demands on measurement scales without sacrificing predicting power (Chin, 1998). This research utilizes the software package PLS Graph 3.0 with bootstrapping parameters set at 500 re-samples for both measurement model validation and hypothesis testing.

Tables 4.1 and 4.2 below present the factor loadings and cross-loadings for the higher-order constructs employed in this study. Please note that 13 total items from both Lean Transformation Success and Competitive Advantage were dropped due to low factor loadings.

Table 4.1: Lean Transformation Success Factor Loadings

Items	Factors		
	Achieve Objectives	Improved Capabilities	Alignment
achieveobj3	**0.646**	0.433	0.331
achieveobj4	**0.580**	0.452	0.401
achieveobj6	**0.658**	0.374	0.441
improvecap2	0.551	**0.577**	0.327
improvecap3	0.536	**0.592**	
improvecap4	0.425	**0.561**	
align3	0.377	0.412	**0.772**
align4	0.424	0.458	**0.716**
align5	0.383	0.377	**0.759**

Values less than 0.3 not displayed

Table 4.2: Competitive Advantage Factor Loadings

Items	Factors				
	Price	Quality	Delivery	Innovation	Time
Price1	**0.814**				
Qual2		**0.895**			
Qual4		**0.826**			
Deliv1			**0.770**		
Innov1		0.352		**0.691**	
Time1			0.326	0.362	**0.636**
Time2				0.360	**0.709**
Time3					**0.811**

Values less than 0.3 not displayed

The psychometric properties are generated by PLS Graph, and were used to assess convergent validity, discriminant validity, and internal consistency reliability (ICR). Table 4.3 displays the ICR, square root of the AVE (diagonal terms), and the correlation

between constructs. To assess convergent validity, we examined the square root of the average variance extracted (AVE), which should generally be greater than 0.707 or AVE > 0.5 (Fornell & Larcker, 1981). The square roots of the AVE values in this study, which can be equated to an R-square value in simple regression, were all greater than 0.707 with a lowest AVE value of 0.787. To assess discriminant validity, we compared the AVE square root to the correlation with other constructs. The AVE square root should be larger than the correlation with other constructs to confirm discriminant validity (i.e. measures for a specific construct are unrelated to measures of a different construct). From table 4.3 below, one can see that the square root of the AVE exceeds all correlations (horizontal rows and vertical columns) for each construct, which supports discriminant validity. The ICR values (similar to Cronbach's alpha) should all be larger than 0.7 (Fornell & Larcker, 1981). As illustrated in the table, the lowest ICR value in this study is 0.891, which supports the reliability of the constructs.

Table 4.3: Reliabilities, Convergent Validities, and Discriminant Validities

Factors	ICR	Correlations and AVE Square Roots	
		Lean Transformation Success	Competitive Advantage
Lean Transformation Success	0.921	**0.758**	
Competitive Advantage	0.891	0.370	**0.717**

Figure 4.2 shows the results of the PLS analysis. Lean Transformation Success is a second-order reflective construct formed by three first-order constructs – Achievement of Objectives, Improved Organizational Capabilities, and Alignment with Organizational

Strategy. Competitive Advantage is a second-order reflective construct formed by five

first order constructs – Cost, Quality, Delivery, Innovation, and Time.

```
┌──────────────────┐                              ┌──────────────────┐
│       Lean       │           H1                 │                  │
│  Transformation  │ ───────────────────────────► │   Competitive    │
│     Success      │   Hypothesis Supported       │    Advantage     │
└──────────────────┘                              └──────────────────┘
```
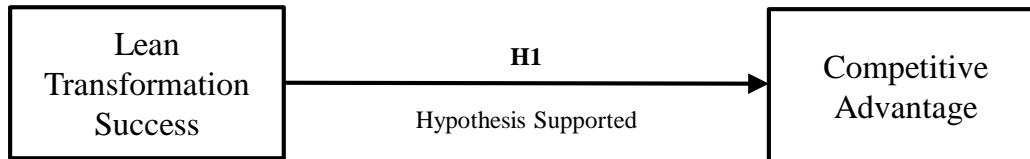
Figure 4.2: PLS Results

Table 4.4 presents the path coefficient and t-statistic between the higher-order

constructs in this study. As you can see from the table, we found significant support for a

positive relationship between Lean Transformation Success and Competitive Advantage.

Table 4.4: Path Coefficient and T-Statistic

Path	Path Coeff.	t-stat
Lean Trans. Success → Comp. Advantage	0.235	2.67*

*p<0.01

4.4. Discussion

The purpose of this study is to investigate the relationship between lean

transformation success and competitive advantage. Building upon prior literature, we

found that the extent to which an organization can successfully transform towards the lean

operating philosophy, can significantly influence the competitive position of the

organization. The findings suggest that in addition to concentrating on implementation of the various practices associated with lean transformation, organizations can assess the success of their lean transformation initiatives based on the extent to which the organization has achieved the objectives associated with lean transformation, improved the capabilities of the organization, and increased alignment between the lean transformation strategy and the overall business strategy.

Researchers can find this study helpful in a few ways. Lean research has matured to the point that we can move towards investigating long-term, sustainable, lean transformation solutions. Indeed, a few studies have peered into the critical success factors of other continuous improvement methodologies (Morgan Swink & Jacobs, 2012), yet no previous studies specifically address the dimensions of lean transformation success. This study takes the first step towards developing a comprehensive view of the critical success factors associated with lean and adds to the current body of work. To some, it may make sense to achieve some quick solutions by conducting Kaizen blitzes or implementing lean in small phases; however, our results support and suggest a shift towards investigating long-term solutions for sustained lean transformation success.

This study stresses the importance of not getting bogged down in the nuances inherent in the various lean practices. Instead of concentrating solely on lean practices, managers need to look at the big picture and identify strategies that will promote lean transformation success throughout the supply chain. In other words, instead of focusing solely on implementation of lean practices (kanban, quick changeover, etc.), managers can drive lean transformation success by establishing comprehensive strategic goals and assessing the extent to which the organization has achieved the goals to improve

organizational capabilities. It may be helpful to document the current state in order to paint an accurate picture of the true improvement of organizational capabilities. Strategic alignment between the lean transformation strategy and the overall business strategy is also a driver of lean transformation success that requires managerial attention. Based on our findings, organizations may achieve a greater level of lean transformation success and, ultimately, competitive advantage by developing a long-term lean strategy instead of focusing on small projects or isolated implementation.

4.5.   Conclusion

Countless studies have purported to investigate the relationship between lean implementation and organizational performance. Here, we depart from the mainstream and study the impact of lean transformation success and competitive advantage. This research makes several important contributions. First, this study empirically tests and confirms the long-standing notion that investments into lean initiatives can yield positive results for the organization. Indeed, our results support such contentions. However, our results stress the importance of a long-term lean strategy, aligned with the business strategy, to define targets, goals, and outcomes of the lean transformation journey. To our knowledge, this is the first study to develop a framework for lean transformation success. While we anticipate additional dimensions, we have established solid footing for future research to conceptualize, define, and empirically test lean transformation success.

While it is no surprise that lean transformation success can lead to competitive advantage as we find here, there may be a so-called tipping point. Most scholars would agree that the Toyota Production System has revolutionized the manner in which many

firms operate. Yet, since the start of the new millennium, Toyota products have not been produced without fault. A simple web search will yield stories of recalls from 2000-2013 that number in the thousands for a variety of issues. Is it possible to become "too lean"? Eroglu and Hofer (2011) first brought forth the position that it may be possible to trim too much from the organization. While their study did shine critical light on the potential pitfalls of lean transformation, many stones remain unturned.

Despite the positive results obtained from this study, there are a few limitations that we would like to address. First, we dropped several measurement items from the final analysis in an effort to achieve the most parsimonious model. While this approach is consistent with prior literature employing partial least squares methodology, it is, nevertheless, a limitation to this study. Ideally, we would use all measurement items; however, our effort to achieve parsimony, without concerns of convergent or discriminant validity, trumped our concern for inclusiveness. Our sample, while certainly large enough for partial least squares path analysis in this study, could have been more robust. We trimmed the initial sample based on excessive missing data, mostly from respondents that clicked on the survey link but did not actually start the survey or completed very little of the survey. We further eliminated responses based on excessive selections at either scale anchor (e.g., selected 7 for every question), excessive neutral responses, respondents answered "Not at all" to the duration of lean transformation, or respondents indicated that they did not have enough information to answer the questions or the questions were not relevant to their organization. Our close scrutiny provided, in our opinion, a very adequate and representative sample. Although, we were forced to sacrifice sample size.

Chapter 5 – Summary of Findings and Future Research

This chapter summarizes the empirical findings for each chapter and provides an overview of the anticipated future research stemming from this dissertation. In chapter 2, we investigate the relationship between human resource performance management system transformation and human resource performance management practices. We find statistically significant support for a positive relationship between HRPM system transformation and each of the first-order human resource performance management system practices. We also investigate the impact of HRPM system practices on the effectiveness of the HRPM system in chapter 2. We find statistically significant support for a positive relationship between personnel selection, personnel development, personnel evaluation/appraisal and human resource performance management system effectiveness; however, we do not find significant support for a relationship between reward systems and HRPM system effectiveness. Results from chapter 2 suggest that the extent to which organizations transform their human resource performance management systems, as part of the overall lean transformation strategy, will positively impact HRPM practices. Our results also indicate that deploying HRPM practices can enhance the overall effectiveness of the HRPM system.

We examine the impact of human resource performance management system practices on lean transformation success in chapter 3. Results of the data analysis indicate that organizations pursuing lean transformation can significantly benefit from selectively hiring new associates and subsequently investing in developing employees. Organizations should select employees with values, skills, and abilities that align with the lean transformation strategy, then develop those employees, along with existing employees to

drive lean transformation success. In addition, our study suggests that employee rewards do not play a large part in the overall success of lean transformation. An organization may be able to gain more value by allocating investments into employee rewards elsewhere in the organization, such as training and development. Likewise, we found no statistically significant influence of personnel evaluation on lean transformation success, which suggests that organizations have not fully embraced the performance management style of employee evaluation or it may suggest that employees have enough intrinsic motivation to set and achieve goals independent of the performance evaluation.

Finally, in chapter 4 we investigate the higher-order relationship between lean transformation success and competitive advantage. We find statistically positive support, which suggests that organizations can significantly affect their competitive position by consciously harnessing their ability to achieve the objectives associated with lean transformation, improve capabilities of the organization, and increase alignment between the lean transformation strategy and the overall business strategy. Based on our findings, organizations may achieve a greater level of lean transformation success and, ultimately, competitive advantage by developing a long-term lean strategy instead of focusing on small projects or isolated implementation.

By assessing the findings among the three distinctive, yet interrelated studies, we also find an interesting observation. The employee rewards construct was not statistically significant as neither an independent variable nor a dependent variable. This finding suggests that organizations do not enhance their employee rewards practices as part of human resource performance management system transformation. The result also suggests that employee rewards play a minimal part in the overall success of lean transformation.

Results of the employee rewards analysis, while contrary to prior studies, may indicate that employees do not require external rewards to encourage superior performance, or perhaps organizations are able to enjoy lean transformation success without providing a comprehensive reward package.

There are a few overarching limitations to this research project. First, we attempted to use as many existing scales as possible; however, we did introduce a new construct, which was utilized for two studies. Additional testing and validation of the new scales may improve the outcome of the studies. Another limitation stems from the data collection process. Collecting data via a large-scale survey of diverse organizations can be quite challenging. While we contend that our dataset is robust, we also recognize that the process could be improved. We were forced to trim a relatively large number of respondents from the final sample for a variety of reasons, which we acknowledge could have been improved at the research design or sample selection phases.

While this research carves a path toward understanding factors associated with the human dimension of lean transformation, and despite our significant findings here, there is much work yet to be completed. Additional research may assess mediating and/or moderating effects of variables, such as length of lean transformation journey, lean transformation readiness, or environmental uncertainty. Future research may also investigate lean transformation success through the lens of competitiveness, specifically concentrating on the dimensions of Productivity, Agility, Innovativeness, and Reputation/Quality (C.W. Holsapple & Singh, 2001). Various lean practices could be classified under the four PAIR dimensions to assess the relative importance and impact of each lean practice as presented in figure 5.1. We could also investigate the

interrelationship(s) among the lean practices characterized as part of the PAIR model to determine if there may be interdependencies (e.g., increased productivity may lead to increased agility).
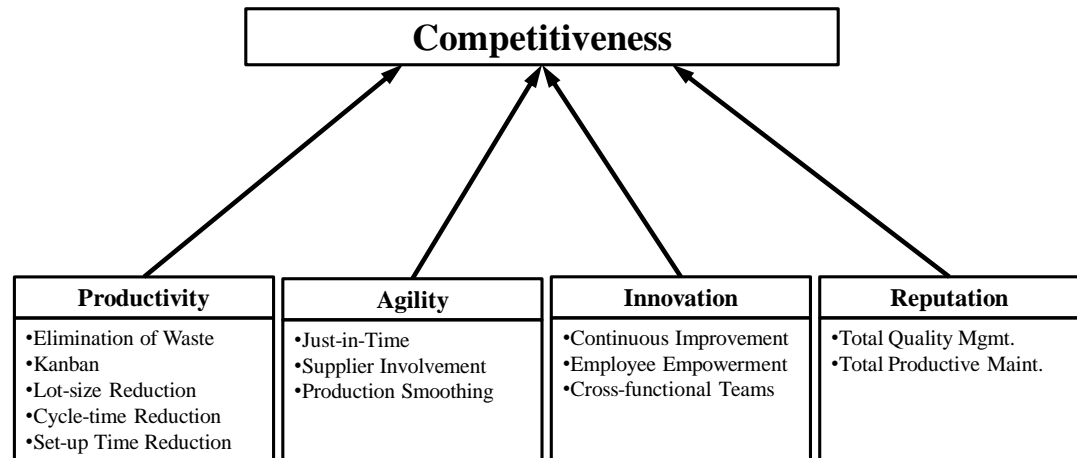
Figure 5.1: Lean practices and PAIR framework

As Liker and Hoseus (2008) describe, organizations should strive to develop a lean culture as the ultimate outcome of the lean transformation initiative. Another extension of this study would require investigation of the impact of a lean organizational culture on competitive advantage through the lens of (Liker & Hoseus, 2010) or (J. B. Barney, 1986). Additional research is also need to further develop the lean transformation framework presented here. While we believe that we have provided an adequate foundation, we acknowledge that additional dimensions of lean transformation success most likely exist. Finally, a longitudinal study of lean transformation can be very valuable and powerful to further refine/develop the underlying dimensions. While a cross-sectional analysis is

indeed important and justifiable, a longitudinal study may provide valuable insight to the long-term strategies, methodologies, and contextual factors that underpin lean transformation success leading to competitive advantage for the organization.

Appendices

Appendix A: Items, Means, and Standard Deviations

Measurement System Transformation construct

To what extent (1 = no extent, 7 = to great extent) do you agree with the following statements about the human resource performance management system in your company.

(New Scale)

	Item	Mean	Std. Dev.
Our human resource performance management system did not change/transform as part of our lean transformation.	trans1	3.73	2.023
New measures of performance have been added to our human resource performance management system as part of our lean transformation.	trans2	3.01	1.777
Significant changes have been made to our performance management system as part of our lean transformation.	trans3	2.94	1.665
Our performance management system has transformed from an activity/function/results orientation to a process orientation.	trans4	2.79	1.581
Our performance management system has transformed to reflect new strategic priorities introduced by lean transformation.	trans5	3.14	1.696
Our performance management system has transformed to reflect new operational expectations for performance as a result of lean transformation.	trans6	3.25	1.693

Human Resource Performance Management Practices construct

To what extent (1 = no extent, 7 = to great extent) do you agree with the following statements …

	Item	Mean	Std. Dev.
Selection			
(Adapted from Adam et al., 1997; Ahmad and Schroeder, 2003)			
Our company uses problem-solving aptitude as a criterion in employee selection.	select1	2.98	1.706
Our company uses attitude/desire to work in a team as a criterion in employee selection.	select2	4.06	1.738
Our company uses work values and behavioral attitudes as a criterion in employee selection.	select3	4.20	1.692
Our company selects employees who can provide ideas to improve the lean transformation process.	select4	3.16	1.653
Pre-employment testing/screening is used to select employees.	select5	4.10	2.040
Development			
(Adapted from Goldstein, 2003; Swink et al., 2005)			
Our company offers developmental opportunities to employees.*	dev1	4.59	1.720
Employees are well trained in problem solving skills/techniques.	dev2	3.63	1.571
Coaching is a significant component of employee development.*	dev3	3.90	1.826
Employees are cross-trained to perform a variety of activities.	dev4	3.99	1.688
Training is offered to build the capabilities of our employees.	dev5	4.37	1.724

Evaluation

(Adapted from Flynn and Saladin, 2001; Snell and Dean, 1992)

Performance appraisals/evaluations account for performance outcomes/results.*	eval1	4.27	1.773
Performance appraisals assess individual contribution to process/team performance.*	eval2	4.15	1.786
Lean initiatives are a significant part of the performance appraisal.	eval3	3.33	1.687
Performance appraisals focus on achievement of goals/targets.*	eval4	4.77	1.765
Performance appraisals focus on problem-solving aptitude.*	eval5	3.49	1.769
Multiple people provide input to the performance appraisal of each employee.	eval6	3.27	1.925

Rewards

(Adapted from Ahmad and Schroeder, 2003; Flynn and Saladin, 2001; Snell and Dean, 1992)

Our company offers rewards/incentives for performance.*	reward1	4.08	2.042
Incentives encourage employees to vigorously pursue lean objectives.	reward2	3.21	1.920
Incentives are fair in rewarding people who accomplish lean objectives.	reward3	3.27	1.943
Our reward system really recognizes the people who contribute the most to our company.	reward4	3.37	1.938
Employees are rewarded for continuous improvement.	reward5	3.32	1.831
Compensation and rewards are competitive for this industry.	reward6	3.86	1.923

* Indicates new item

Human Resource Management Effectiveness construct

On a scale of 1 - 7 (1 = Not effective at all, 7 = Very effective), how would you rate the effectiveness of your human resource management system with respect to the following items?	Item	Mean	Std. Dev.
(Adapted from Lawler, 2005)			
Developing individuals' skills and knowledge	effective1	3.48	1.632
Helping the business be successful	effective2	3.68	1.581
Supporting company values	effective3	4.36	1.634
Providing accurate measures of performance	effective4	3.33	1.741
Providing incentives/rewards for employee performance	effective5	3.32	1.831
Empowering employees	effective6	3.66	1.683
Overall effectiveness	effective7	3.58	1.593

* Indicates new item

Lean Transformation Success Construct

To what extent (1 = no extent, 7 = to great extent) do you agree with the following statements…

	Item	Mean	Std. Dev.
Achievement of Lean Transformation Objectives			
(New Scale)			
Eliminating waste	achieveobj1	4.29	1.570
Reducing cost	achieveobj2	4.44	1.572
Improving organizational capabilities	achieveobj3	4.23	1.550
Improving competitive position of the organization	achieveobj4	4.45	1.691
Improving financial performance	achieveobj5	4.57	1.591
Improving operational performance	achieveobj6	4.77	1.597
Improved Organizational Capabilities			
(New Scale)			
Ability to eliminate waste	improvecap1	4.58	1.563
Problem-solving ability	improvecap2	4.42	1.559
Ability to improve quality	improvecap3	4.47	1.531
Ability to gain cooperation and support from employees for lean transformation activities	improvecap4	4.47	1.602
Ability to improve innovativeness	improvecap5	4.24	1.576
Ability to gain a competitive advantage	improvecap6	4.60	1.617
Alignment with Organizational Strategy			
(Adapted from Papke-Shields et al., 2002)			
Adapting goals/objectives of the lean transformation strategy to the changing goals/strategies of the company	align1	4.06	1.729
Maintaining a mutual understanding with top management on the role of the lean transformation strategy in supporting the business strategy	align2	4.00	1.795
Identifying lean transformation opportunities to support the strategic direction of the company	align3	4.18	1.739
Assessing the strategic importance of new lean transformation opportunities	align4	4.08	1.749
Aligning lean transformation strategies with the strategies of the company*	align5	4.16	1.817

* Indicates new item

Competitive Advantage Construct

(Adopted from (Li et al., 2006)

On a scale of 1 - 7 (1 = strongly disagree, 4 = neutral, 7 = strongly agree), please indicate the extent to which you disagree or agree with each of these statements about competitive advantage.

	Item	Mean	Std. Dev.
We offer competitive prices.	price1	4.86	1.55
We are able to offer prices as low or lower than our competitors.	price2	4.24	1.64
We are able to compete based on quality.	qual1	5.55	1.35
We offer products that are highly reliable.	qual2	5.71	1.21
We offer products that are very durable.	qual3	5.66	1.22
We offer high quality products to our customer.	qual4	5.72	1.22
We deliver customer order on time.	deliv1	5.47	1.30
We provide dependable delivery.	deliv2	5.47	1.31
We provide customized products.	innov1	5.61	1.41
We alter our product offerings to meet client needs.	innov2	5.38	1.36
We deliver product to market quickly.	time1	4.91	1.47
We are first in the market in introducing new products.	time2	4.46	1.70
We have time-to-market lower than industry average.	time3	4.55	1.53

* Indicates new item

Appendix B: Respondent Profile

Demographic Variables	Percentage
Industry Type	
Manufacturing	30.9
Wholesale/Retail	9.0
Transportation/Logistics	8.5
Aerospace	7.2
Automotive	6.3
Consumer Products	5.4
Health Care	4.5
Education	4.5
Other (sum of 17 remaining industry types – each less than 4%)	23.7
Number of employees	
Less than 1,000	33.6
1,000 – 4,999	21.1
5,000 – 9,999	10.8
10,000 – 24,999	13.5
25,000 – 49,999	6.3
50,000 – 99,999	6.3
100,000 or more	8.4
Length of time company has been pursuing Lean Transformation	
Less than 1 year	10.5
1 – 2 years	22.5
3 – 5 years	39.2
5 – 10 years	18.4
More than 10 years	9.4
Respondent Title	
Senior Executive	5.8
Vice President	5.4
Director	14.3
Manager	43.9
Professional (e.g. Engineer, Accountant, I.T., Logistics Analyst, etc.)	30.5
Experience with Lean Transformation (respondents can select more than one)	
Received informal training	38.6
Received Formal training	52.5
Earned certification in Lean	35.0
Provided/Delivered formal training to others	53.8
Participated in lean transformation projects	72.2
Championed lean transformation projects	57.4

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Vita

Place of Birth

    Lima, Ohio

Educational Institutions Attended

    Master of Science, University of Toledo

    Bachelor of Science, University of Toledo

Professional Positions Held

    Assistant Professor, Eastern Michigan University

    Research Assistant, University of Kentucky

    Teaching Assistant, University of Kentucky

    Manufacturing Engineer & Quality Control Team Advisor, Ford Motor Company

Scholastic & Professional Honors

    Fellowship in Sustainable Systems, University of Kentucky

    Outstanding Graduate Teacher in Decision Science, University of Kentucky

    Gatton Scholarship, University of Kentucky

Professional Publication

    "Impact of Human Resource Management on Lean Transformation Success" with Thomas J. Goldsby; *Proceedings of 2013 Annual Meeting of Decision Sciences Institute,* Baltimore, MD.