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An Empirical Investigation of the Influence of Preparation and Implementation Capabilities on Lean Management Competence

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Graduate Program in Business

A thesis submitted in partial fulfillment of the requirements for the degree in Doctor of Philosophy

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An Empirical Investigation of the Influence of Preparation and Implementation Capabilities on Lean Management Competence

(Thesis format: Monograph)

by

David Barrett

Graduate Program in Business Administration

A thesis submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy

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ABSTRACT

This research offers several noteworthy contributions to advancing a more comprehensive scholarly theorization and managerial understanding of the prerequisites for deploying a “strategically ready” approach to lean management (LM). The first contribution is the conceptualization of a productive LM deployment model as a three phased value generation approach: (1) value design, (2) value delivery, and (3) value capture. This conceptualization is theoretically framed by Resource Advantage Theory and resource orchestration. Supporting this value generation conceptualization is a LM Competence comprised of two operational capabilities: (1) LM Preparation and (2) LM Implementation. In concert, these two capabilities generate a resource comparative advantage, reflecting the firm’s LM Competence. This competence produces potential marketplace competitive advantages and the accruing of Lean-Based Benefits for and from customers.

The second contribution made by this research is the development of reliable and valid measurement instruments for the model constructs. By conducting a review of the literature, four inductive case studies, and two rounds of knowledgeable judge pre-testing, potential measurement items were rigorously scrutinized for adequacy. Subsequently, survey data collected from a sample of 201 US emergency department nurses, experienced in the deployment of lean-based initiatives, was used to subject the scales to further refinements until acceptable reliability and validity levels were attained.

The third contribution this research makes is the empirical measurement of the firm’s LM Competence. An empirical study of the organizational and operational capabilities that underpin the possession of a LM Competence had not been previously been completed; quantification of
the effects of LM Preparation Capability (and its dimensions) on LM Competence were significant and meaningful. The results of this research place explicit focus on the productiveness of managerial preparation decisions and actions critical to the cultivation, leveraging and possession of resources, capabilities and competency that ensure the efficient and effective throughput functionality of work efforts and work flows central to any LM deployment initiative.

The conceptualization and empirical findings highlights the need for adopting firms to undertake a more mindful and productively purposeful, “strategically ready” approach to LM deployment and should complement existing lean practices and outcomes research and enrich future scholarly investigations.

**Keywords**

Lean Management, Deployment, Implementation, Preparation, Operational Capabilities and Competence, R-A Theory, Resource Orchestration, Lean Health Care, Lean Hospitals
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CHAPTER 1 – INTRODUCTION

“Lean Management (LM) (Krafcik, 1988) is an integrated socio-technical system whose main objective is to eliminate waste by concurrently reducing or minimizing supplier, customer, and internal variability” (Shah & Ward, 2007: 791). It represents a systematic approach to managing and improving the efficient and effective throughput functionality of operational work efforts and work flows. Yet, while LM has become a broadly adopted and increasingly popular operational approach in North America (Pay, 2008), the widespread adoption of LM has not been consistently linked to an incremental degree of organizational success (Shah & Ward, 2007; Pay, 2008) and there is significant confusion and inconsistency in how and where LM works (Shah & Ward, 2003, 2007) and how best to deploy it (Eroglu & Hofer, 2011) to maximize desired operational and organizational objectives. While the number of lean-based tools, techniques and technologies available to improve operational performance continues to grow, with the exception of a few dramatic successes, most efforts to deploy them fail to produce significant results (Repenning & Sterman, 2001) and “there are really only 5 per cent who practice the art skilfully in a world class master practitioner kind of way” (Ransom, 2008: 4).

Despite its reputed limited success, the adoption of LM is often undertaken with the view that effective deployment is automatic (Pay, 2008). Careful scrutiny of the LM journeys of many organizations highlights that effective deployment of LM in actuality is anything but a given (see, for example, Kenney’s [2011] chronicling LM deployment at Virginia Mason Medical Center). Lean can be a transformative management approach with the potential to galvanize an organization (Birkinshaw, 2014) into a continuous improvement juggernaut. The organization that strategically readies itself through the thoughtful preparation of institutional and individual resources increases its chance of attaining beneficial results like those realized by long-time
proponents such as Toyota (Liker & Franz, 2011). Managers unwilling to invest the requisite time and resources to prepare their organizations for the long and challenging LM deployment journey they have chosen to embark upon are usually disappointed in their results.

A fundamental belief of this research study is that successful LM deployment is not a given. Not all organizations possess the same capabilities and thus successful deployment does not just happen once the strategic decision to adopt is made—a significant amount of individual and institutional preparation effort is still required to enable lean-based success. This contradicts Porter’s (1996) view of LM as an operational best practice associated with improving the “competing through executing” requirements of the firm and whose successful deployment is a managerial given. As such, a core supposition of this research is that not all organizations possess the same capabilities and thus successful deployment does not just happen once the strategic decision is made to adopt a LM approach. A significant amount of experience-based institutional and individual LM preparation and implementation capability must be developed to strategically ready a firm for the transformational efforts that enable operational functionality and business success. Only when the organization and its personnel possess a readiness founded upon requisite preparation and implementation capabilities that productive and successful efforts are more likely built on a LM competence (Furterer, 2009). My efforts in this thesis are focused on discovering the requisite capabilities and measuring their respective impact on the development of a LM competency and by extension the LM benefits derived from the possession of that competency.

1.1 Lean Management Defined

The underpinnings and the constitutive elements of LM have their origins in the Toyota Production System (TPS). Yet, LM is not simply a manufacturing strategy or a cost-cutting
program, but a holistic management philosophy and strategic approach applicable to any organization. LM involves the systematic, relentless, problem-focused, facts-driven, and team-based paring of waste from operational systems in order to both improve the productivity and quality of throughput flows, and increase the value-add ratio of all work activities on an ongoing basis. “Simply put, lean management means using less to do more” (Institute for Healthcare Improvement (IHI), 2005: 2). While the descriptor Lean typically refers to the set of tools, concepts, practices and the outcomes associated with their application, the descriptor LM is used to emphasize the managerial and deployment efforts associated with successful lean-based initiatives.

In regard to its roots at Toyota, seminal works by Ohno (1988) and Suzaki (1987, 1993) stressed the importance of two key, integrated aspects of success for TPS: respect for people and kaizen. Kaizen (change for the better) represents the process mechanism used to surface, identify, solve, implement and standardize continuous improvement initiatives within the organization. Kaizen is representative of the tools, concepts and practices used to implement LM. Respect for people represents the social elements of the organization and is representative of the organization’s approach to supporting and developing every employee’s problem solving capabilities and instilling an empowering and safe culture that facilitate continuous improvement. LM is thus an integrated socio-technical system (Shah & Ward, 2007), but many managers emphasize the simpler technical aspects of the system (tools, concepts and practice) and underestimate or avoid the more complex socio requirements of successful, long-run embedded deployment (Fine, Hansen & Roggenhofer, 2008). While these two pillars of Toyota are easily identifiable, determining how to cultivate and leverage them for improved operational performance has proven distinctly challenging.
A typical Toyota assembly line in the US makes thousands of operational modifications a year as employees change the way they work. In fact, you could say that Toyota isn’t really dedicated to producing cars; Toyota is dedicated to finding better ways to produce cars. Managing a business process using a lean-based approach requires the same mentality. Management needs to focus the organization on improving the process by which workers move value forward. That focus involves both the way the value production stream is organized, and the way employees work within that stream. A truly lean organization is one that possesses the resources and capabilities to consistently attain quality and productivity objectives, and simultaneously improves the value generating efficiency and effectiveness of its processes. Such an organization is a high performance learning organization; an organization where doing the work and doing the work better becomes one and the same thing (Shook, 2008).

1.2 Research Focus

My research focus is on the impact of the cultivation and activation of lean resources and capabilities on an organization’s ability to develop and exploit a lean competence to realize value for and from its customers. It is important to consider the entire value generation system when examining any LM process improvement program because value enhancement is its fundamental goal. In essence, LM is a process deployed to optimize the productivity of functional throughput; an approach used to increase the proportion of value-add activities in a process, moving closer to a pure value-only process (one with no waste; all activities are value-adding). But who judges how value is determined and how is value generated through a LM approach?

If value is defined by what willing buyers are prepared to pay, then superior value is derived from offering lower prices than competitors for equivalent benefits or by providing unique benefits that more than offset a higher price (Porter, 1985). “Value is perceived
worthiness of a subject matter to a socio-economic agent that is exposed to and/or can make use of the subject matter in question” (Pitelis, 2009: 118); value is subjective and context specific (Lepak, Smith & Taylor, 2007). From a consumer’s perspective, value is created when their use value (utility) is increased or their exchange value (price) is decreased (Priem, 2007). Willing consumers validate the value of a product or service (Priem, 2007). Therefore, “a product or service that remains unconsumed is without value – that is, products and services are not "value laden" (Priem, 2007: 222). Through their perceptions and actions, the consumer is the ultimate arbiter of a strategist’s success (Drucker, 1954). Without validation of the customer through specific actions, a process improvement has no value.

Value creation and value capture may require different types of knowledge and skills to succeed (Pitelis, 2009). While value capture is an organizational function reliant on consumer perceptions/behaviour and operational competence, value creation is an internal operational function (although requiring a customer orientation) dependent on operational resources and capabilities. I conceptualize the value generation process as a three stage model (see Figure 1.1). Value creation is bifurcated into two sub-stages of value design and value delivery. Value capture encompasses the third stage of the value generation system as value created is realized both for and from customers in the marketplace.

FIGURE 1.1: VALUE GENERATION PROCESS
When applying the value generation process specifically to LM, an organization is said to be in the process of cultivating its resources as it purposefully and strategically readies itself to deploy LM. In this initial stage, management is acquiring or developing resources in preparation for successful LM efforts. This is the stage requiring the most patience and planning as management constructs a solid foundation of resource bundles capable of designing value generating initiatives to increase Productive Throughput (PT) or Quality Throughput (QT)\(^1\) of the organization and withstanding the transformational stresses ahead. At this stage any value lays dormant, or latent; value is merely potential value at this point awaiting activation in the second phase of value creation.

In the second phase of value creation and value generation via a LM approach, the organization activates its resources, leveraging them to implement lean-based initiatives. Resources that have been prepared and value that has been designed in the first stage is now delivered by the application of the organizations LM implementation capability. Initiatives are executed or put into effect in an attempt to enhance PT and QT functionality. The value creation phase is complete and the organization can assess whether it was effective at designing and delivering on its intended value creation efforts. But the value at this stage is still not realized. The customer of the intended value must assess whether it meets their needs; is it of value to them? Despite the best efforts by the organization to create value, its true value lies in the eyes of the user; if it can increase the end user’s utility or economic benefit, the value created can be realized.

\(^1\) Apt PT is used to highlight an organization’s ability to productively utilize its resources (efficiency) in its products and/or services to meet the demand quantity and delivery needs of its customers. Apt QT is the ability to produce quality offerings that meet customer requirements (effectiveness). Both apt PT and QT meet customer needs with minimal organizational waste.
In the third phase of value generation via a lean approach, the realization of value created occurs. Value is captured not only by the organization, but by the customer. Through the value creation process, benefits designed to induce payments from willing customers are offered so that the firm can derive lean-based benefits. Customers derive lean-based benefits through their consumption of the offering. Therefore, value creation is a pre-condition of value capture. The value generation system is completed as the benefits of the endeavour are realized and value is captured.

The utilization of an external orientation enables an organization to select and combine resources and capabilities to create more viable offers for new or existing customers (Sirmon, Hitt & Ireland, 2007) and enhance the likelihood of value capture from a transaction. Thus, it is important to ensure that value, as defined by the end consumer, is understood by the organization, or the resources invested in creating perceived value (from an organization’s perspective) will not achieve the desired or predicted organizational benefits. These distinct perceptions of value, and how it is defined by the user and the supplier, make for more complex managerial choices (Cox, 2004).

1.3 Conceptual Research Model

The more common term “Lean” typically refers to an array of concepts, tools and practices and their related outcomes. In this research I utilize the descriptor “Lean Management” (LM) to emphasize the managerial and executional deployment efforts associated with any LM-based initiative. As such, my conceptual research model of LM deployment highlights my interest in advancing theorization and managerial practice related to a more strategically mindful and productive resource cultivation and orchestration approach to decision-making in support of a LM approach rather than just the pursuit of greater understanding of lean practices and
benefits. My focus is on the development of organizational resources, capabilities and competencies of LM. As such before outlining in greater detail my conceptual research model, I should distinguish between the terms resource, capability and competence.

Barney and Arikan (2001) define resources and capabilities as follows: resources are "the tangible and intangible assets firms use to conceive of and implement their strategies" (pg.138) while capabilities are "those attributes of a firm that enable it to exploit its resources in implementing strategies" (pg.139). Organizational capabilities are tacit social structures that over time are established in an organization to address specific problems and challenges existing within the firm’s business and operating environments (Flynn, Wu & Melnyk, 2010). As such, a capability is distinctly different from a resource; a capability represents management's deliberate and purposeful building of a means to productively allocate, coordinate and deploy resources towards a beneficial end.

The distinction between competence and capability is also important. From a resource based perspective, a competence is defined as “a bundle of aptitudes, skills and technologies that a firm performs better than its competitors, that is difficult to imitate, and provides an advantage in the marketplace” (Coates & McDermott, 2002:436). An operational capability is thus the capacity to generate potential functional value, while an operational competence is the manifestation of the operational capability in the perception of consumers; the validation of the capability through the realization of its functional potential. A capability is the ability to do something, is internal and firm specific usually not perceived by consumers or often the organization itself (Wu et al., 2010), while the competence is perceived by the market and indicates that the firm has performed in a way valued by the marketplace, incurring benefits if the competence is well aimed.
In my conceptual model, I have aligned with the three stage value generation process model (outlined in Figure 1.1) with a three phased LM deployment model. The conceptualization of the three value stages is captured by the constructs of the conceptual model. Aligned with Value Design is the cultivation of resources and capabilities as management purposefully and strategically readies the organization. The organization develops, acquires or accesses resources that will enable it to create a LM Preparation Capability. Management is in the process of cultivating and orchestrating resources in a manner that facilitates value design. In essence it is strategically readying itself for the deployment of LM.

A greater level of LM Preparation Capability will likely result in a greater level of LM Competence and the degree of this likelihood is positively moderated by the level of LM Implementation Capability. Successful implementation involves preventing various implementation problems from occurring in the first place and doing the things that help promote success (Alexander, 1985), thus an organization’s likelihood of achieving higher levels of operational performance is a result of higher levels of LM Preparation Capability. But, possessing a LM Preparation Capability alone is not a guarantee of success; its potential lays ready, yet dormant. In the second stage, the organization utilizes its LM Implementation Capability to successfully activate its Lean Preparation Capability. It utilizes a structured Lean-based problem solving mechanism to leverage its potential to deliver value and thus complete the value creation phase. In essence, value design is activated by LM Implementation Capability resulting in value delivery as represented through a LM Competence. Without value design, there is no value to deliver; hence LM Implementation Capability cannot create value alone, but is reliant on LM Preparation Capability to initially design value. However, with no LM Implementation Capability, any value design will not be activated and thus a LM Competence
(functionality) will not exist. At this point the value of its LM efforts is purely potential and unfulfilled.

Through the fulfillment of its potential, the organization has leveraged its Lean-based resources to generate an organizational LM Competence and create a value-adding offer to the market. The more proficient the LM Competence the better its operational performance and the more likely the organization will be able to translate operational performance into organizational benefit; at the LM Competence stage, it has done Lean the right way – the organization is efficient.

Once activated, the value created must be captured. In the third stage the value created is evaluated by the market and its potential is realized. Lean Benefits, both financial and non-financial are received by the organization reflecting that the right lean-based activities were pursued - the organization is not merely efficient, but is effective – and marketplace advantages have been attained. Value created in the initial phases is finally captured by both the customer and the organization. The greater the level of LM Competence possessed by the organization, the more likely that it will result in a greater level of Lean-Based Benefits (both for and from customers). While a LM Competence directly results in Lean-Based Benefits, the organization will encounter some degree of Environmental Uncertainty as it brings the PT and QT outputs of its LM initiatives to the marketplace. Low levels of value capture can result from mitigating environmental factors (Shimizu & Hitt, 2004). This uncertainty will adversely affect the realization of value as offerings thought to meet consumer utility or economic needs and/or requirements are affected by factors such as market unpredictability or instability, resource munificence or environmental complexity (Dess & Beard, 1984). Thus all value created through LM efforts may not be captured for or from customers. Therefore this relationship between Lean
Competence and Lean-Based Benefits is negatively moderated by Environmental Uncertainty (E.G. greater amounts of change in customer expectations negatively impact the organization’s ability to meet their needs). Higher levels of uncertainty will facilitate a lesser degree of value capture and thus the realization of value created from a LM Competence.

Thus I conceptualize that value is generated through a multi-phased LM deployment approach. My Lean Management Deployment Conceptual Model (see Figure 1.2), which separates out the lean-based value generation journey in terms of design, delivery and capture elements, highlights the distinctions between the development and subsequent possession of LM preparation and LM implementation capabilities and the LM competence resulting from the leveraging of these capabilities. LM Competence reflects the work efforts of the firm, and its ability to efficiently leverage comparative resource advantages to achieve functional outputs from its lean-based initiatives. Lean-Based Benefits are the valued outcomes achieved from marketplace advantages derived from the firm’s lean-based initiatives.

**FIGURE 1.2: LEAN MANAGEMENT DEPLOYMENT CONCEPTUAL MODEL**
1.4 Explanatory/Descriptive Research Model

When examining LM, two perspectives have traditionally been taken (Shah & Ward, 2007):

(I) a philosophical one using guiding principles and overarching goals (Womack & Jones, 1996; Spear & Bowen, 1999; Liker & Hoseus, 2008; Liker & Franz, 2011) or,

(II) a practical one focused on sets of tools, concepts and practices that can be directly observed (Shah & Ward 2003; Li, Rao, Ragu-Nathan & Ragu-Nathan, 2005).

My study approaches LM from both the principles (I) and practices (II) orientation. While focusing on principles like visualization, standardization and simplification that enhance both the generation of apt PT and apt QT, I utilize both principles and practices to operationalize constructs.

The successful implementation of any management practice often depends upon the possession of certain organizational characteristics (Galbraith, 1977; Shah & Ward, 2003). While LM is principally about productivity through improvement; the pursuit of decision making and action relative to PT and QT functions of the system, LM tools, concepts and practices exist to facilitate continuous improvement initiatives and the attainment of operational PT and QT objectives. An organization possessing LM resources and capabilities, and thus a LM Competence will excel at achieving QT and PT objectives and maximize its value creation potential. But, while operations scholars have generally agreed that the primary basis for organizations to compete is through the development of unique operational capabilities (Flynn, Wu & Melnyk, 2010), research into the requisite capabilities and the bifurcation of capabilities into constitutive preparation and implementation elements has been lacking. By invoking an
integrative and strategic theorization perspective and argumentation process surrounding LM, I will introduce in this thesis a novel conceptualization and argumentation as to how organizations can develop lean-based comparative resource advantages through the mindful and purposely strategic readying of their organizations and marketplace positioning competitive advantages through the application of a LM competency. I refer to this mindful and purposeful method as the “strategically ready” approach throughout this thesis in contrast to the “just do it” approach so often deployed by managers unwilling to invest the time and effort to cultivate the requisite capabilities.

In the first stage of lean value generation (value design), I conceptualize an organization’s ability to strategically ready itself (its Lean potential) as a LM Preparation Capability. It is reflected by its possession of five co-varying resources bundles: LM Skills, LM Executive Leadership, LM Supervision, LM Climate and LM Culture. At this stage, LM’s value is merely conjectured value based on what the organization believes it can obtain from the successful deployment of these resources (Pitelis, 2009). LM Preparation Capability, is a term used to reflect the bundling of complementary and co-varying dimensions (Venkatraman, 1989) related to the firm’s LM Skills, LM Executive Leadership, LM Supervision, LM Climate and LM Culture associated with a strategically readiness approach to LM deployment. LM Preparation Capability is a multidimensional, higher order latent construct that is represented by a system of five interrelated and complementary dimensions possessed by the organization. LM Preparation Capability is possessed by the organization as a result of the synergistic co-alignment (Venkatraman, 1989) of the five related variables and can be thought of as a parsimonious representation of the pattern of co-variance reflecting the fit between the five complementary...
dimensions. These dimensions are each necessary, but not individually sufficient, to create a LM Preparation Capability.

The second, yet distinct stage of Value Creation is the Value Delivery stage. The potential of the LM Preparation Capability (and the organizational resources) is leveraged through the implementation of a systematic and structured approach to process improvement (e.g., the four-stage Plan, Do, Check, Act/Adjust (PDCA) [Shewhart, 1939; Deming, 1986; Imai, 1986] lean problem solving mechanism). Possessing the ability to consistently apply and execute a structured methodology within the organization forms a LM Implementation Capability. The productive deployment of a LM Implementation Capability is an important aspect of the organization’s performance because resources and marketplace offerings do not add value unless properly implemented (Noble & Mokwa, 1999; Heide, Grønhaug & Johannessen, 2002). As an example, when utilizing a PDCA methodology, the continuous improvement initiative must correctly:

(I) identify and define a problem,

(II) develop and select the right counter measure,

(III) run an experiment,

(IV) closely monitor and analyze what is going on in the experiment.

Lessons must be learnt about what happens and turn them into further action, effective counter measures must be standardized and areas identified for further improvement (Liker & Franz, 2011). While it appears that there is an advantage to be gained even if a well-designed collection of resources are implemented poorly or a set of low quality resources are capably deployed (Hahn & Powers, 2010), no matter how good the resources, without optimal execution of all aspects of a structured problem solving methodology, the full value potential will not be realized.
and the potential value adding utility or price reductions gained through the continuous improvements will never reach the market.

It is through the application of the organization’s LM Implementation Capability (through value delivery) that its LM Preparation Capability potential is realized and a LM Competence developed; thus value design is a pre-condition of value delivery. Value design remains dormant without activation through value delivery. While directly affected by LM Preparation Capability, not all value design is completely delivered. Expected versus realized value creation can be an issue as fidelity is lost through poor implementation. “I have seen many cases where the action plan is poorly implemented and the lean effort degenerates into a program in name only” (Liker & Franz, 2011: 264). Value potentially generated may not be realized as LM Implementation Capability could possibly be insufficient to deliver on the counter measures developed. I conceptually define my LM Competence construct as the firm’s internal expertise - or capacity - to cultivate and deploy resources to effect a desired improvement that creates potential incremental value for the firm and its customers; in essence, the ability to do lean-based activities in the right way.

I hypothesize that the growth of LM Preparation Capability is positively related to LM Competence and moderated by LM Implementation Capability. Moderation implies that the impact of the predictor variable (LM Preparation Capability) on the dependent variable (LM Competence) is influenced by an interaction between the predictor and another variable (LM Implementation Capability). This other variable is designated as the moderator (Kroes & Ghosh, 2010). LM Implementation Capability does not directly affect LM Competence; without LM Preparation Capability there is no lean counter measure to implement and thus no LM Competence for the organization to possess. Any application of a structured problem solving
mechanism without LM Preparation Capability is not LM. It is the interaction between LM Preparation Capability and LM Implementation Capability that best explains the impact of LM Competence on the performance of the organization. LM Implementation Capability positively moderates the effect of LM Preparation Capability on LM Competence. The greater the organization's capability to implement, the more value design that is delivered, and thus value creation is enhanced.

From a customer perspective, value creation means achieving the best design and delivery outputs at the lowest possible costs (Porter & Lee, 2013) as they seek to satisfy personal needs and extract value from the operational system through increased utility, lower prices, or ideally both (Cox, 2004). However, value creation through LM must enable the sharing of value capture by the provider and the customer, or incremental profit opportunities will not exist. “Firms exist to create value for others where it is neither efficient nor effective for buyers to attempt to satisfy their own needs” (Smith & Colgate, 2007: 7). An organization that demonstrates a lean-based proficiency in the functions related to value creation is said to possess a LM Competence (the ability of the organization to functionally perform lean-based activities efficiently) and thus the potential to create valued offerings that potentially result in LM Benefits. The degree of effectiveness of the lean-based proficiency is determined by the consumer and results in the greater levels of value capture and LM Benefits.

Through the systematic paring of non-value adding waste from operational systems, LM can both improve PT and QT flows, and increase the value-add ratio of all work activities on an ongoing basis in pursuit of increasing value for and from customers. But the benefits derived from these efforts must be worthwhile for the organization and the customer or marketplace realization of value will not occur. This realization of value capture is manifested in the LM
Benefits construct formed by three categories of value: cost value, functional value and experiential value (Smith & Colgate, 2007). Each benefit category represents a distinct form of value:

(I) Cost value is concerned with “the minimization of costs and other sacrifices that may be involved in the purchase, ownership and use of a product.” (Smith & Colgate, 2007: 13),

(II) Functional value is concerned with “the extent to which a product (good or service) has desired characteristics, is useful, or performs a desired function” (Smith & Colgate, 2007: 10), and

(III) Experiential value is concerned with “the extent to which a product creates appropriate experiences, feelings, and emotions for the customer” (Smith & Colgate, 2007: 13).

While directly affected by the LM Competence, slippage can occur when an organization attempts to capture all value created in the third stage of the value generation system. Intended value capture is impacted not only by internal operations misinterpreting customer needs, but by uncertainties that exist in the environment. Complexity, dynamism and munificence can impact Environmental Uncertainty and thus an organization’s ability to attain the desired objectives of their LM efforts manifested in a LM Competence. I hypothesize that the growth of LM Competence is positively related to LM Benefits and moderated by Environmental Uncertainty. Like the prior moderating relationship explained above, moderation implies that the impact of the predictor variable (LM Competence) on the dependent variable (LM Benefits) is influenced by an interaction between the predictor and another variable (Environmental Uncertainty). Environmental Uncertainty does not directly affect LM Benefits; without LM Competence there
is no counter measure to offer to the market and thus no LM Benefits for the organization to achieve. It is the interaction between LM Competence and Environmental Uncertainty that best explains the performance of the organization. Environmental Uncertainty negatively moderates the effect of LM Competence on LM Benefits; the greater the environmental uncertainty, the less value that will be captured by the organization. The higher the Environmental Uncertainty, the more likely that the organization will introduce counter measures to the marketplace that are no longer valued by customers, or fail to assess competitive pressures appropriately. This uncertainty leads to higher probabilities of the organization missing its intended objective, invoking value slippage or a lower share of the value captured.

1.5 Research Questions

Based on the preceding discussion, focusing on the organization’s LM resource preparation and implementation capabilities is both prescient and critical to the development of theory on LM and an organization’s competitive resources and comparative marketplace advantages. I examine LM’s impact on organizational performance by breaking down the value generating process into three stages:

(I) Cultivation – the strategic development of a value design proficiency as represented by LM Preparation Capability generated through the application of operational strategic readiness and resource orchestration,

(II) Activation - value delivery as represented by LM Competence generated through operational efficiency and measured by operational system performance, and

(III) Realization - value capture represented by Lean-Based Benefits generated through operational effectiveness and measured by organizational system performance.
I propose that the organization’s LM Preparation Capability is reflected in the synergy and congruence amongst LM Skills, LM Executive Leadership, LM Supervision, LM Climate and LM Culture. LM Implementation Capability moderates the effect of LM Preparation Capability on LM Competence, and Environmental Uncertainty moderates the effect of LM Competence on Lean-Based Benefits.

The Descriptive Research Model investigated is offered in Figure 1.3. LM Skills, LM Executive Leadership, LM Supervision, LM Climate and LM Culture, LM Preparation Capability, LM Implementation Capability, LM Competence, Environmental Uncertainty and Lean-Based Benefits are all latent constructs to be defined in more detail in Chapter Four.

FIGURE 1.3: STRATEGICALLY READY LM - DESCRIPTIVE RESEARCH MODEL

The research questions and hypotheses (outlined in Chapter Four) studied in this thesis originate from the following three propositions:
(I) Greater levels of LM Preparation Capability, LM Implementation Capability and LM Competence are necessary and likely with the “strategically ready” LM deployment approach than with the “just do it” LM approach.

(II) A greater level of LM value creation is likely to be realized with a “strategically ready” LM deployment approach than with the “just do it” LM approach. Under the strategically ready LM deployment approach, (i) a greater level of LM Preparation Capability likely results in a greater level of LM Competence and (ii) the degree of this likelihood is positively moderated by the level of LM Implementation Capability.

(III) A greater level of LM value capture is likely to be realized with the “strategically ready” LM deployment approach than with the “just do it” LM approach. Under the “strategically ready” LM deployment approach, (i) a greater level of LM Competence likely results in a greater levels of Lean-Based Benefits, though (ii) the degree of this likelihood is negatively moderated by the degree of Environmental Uncertainty the firm encounters.

The critical contributions I make are threefold:

(I) The development of measurement scales for Lean organizational resources and capabilities,

(II) The decoupling of traditional LM into a Lean resource cultivation stage and a Lean resource activation or implementation stages, and

(III) The emphasis on LM Preparation Capability as a key driver of LM Competence and subsequent Lean-Based Benefits for the organization.

Specifically my research thesis examines four overarching research questions:
**RQ1:** In what way is LM Preparation Capability distinct from LM Implementation Capability with respect to LM pursuits of operational performance?

**RQ2:** What is the pattern of co-variation of LM Skills, LM Executive Leadership, LM Supervision, LM Climate and LM Culture and their respective determination of LM Preparation Capability?

**RQ3:** To what degree does a LM Preparation Capability impact LM Competence and what is the moderating effect of an organization’s LM Implementation Capability on its ability to optimize the operational functionality potential of its LM Preparation Capability in a LM Competence?

**RQ4:** To what degree does a LM Competence impact Lean-Based Benefits and what is the moderating effect of Environmental Uncertainty on an organization’s attainment of Lean-Based Benefits from its LM Competence?

### 1.6 Research Context

While LM is defined as an organizational philosophy, it is typically deployed at a departmental level. While the reliance on other departments influences and impacts deployment and subsequent results of the LM deployment approach, capabilities are initially developed and cultivated at the departmental level of an organization. Thus the unit of analysis for this research study will be the LM program of a department within an organization as represented by the portfolio of LM projects the department undertakes as part of its LM program. A single industry is chosen to minimize intra-industry and inter-market effects that could confound the results of this study, while a single country is chosen to minimize the potential effects of inter-cultural and healthcare systematic differences.
United States (US) health care costs have tripled from $0.7 trillion in 1990 to over $2.3 trillion in 2008 (IHI, 2011). US hospitals today are filled with advances in technology and treatments, yet are mired in inefficiencies, errors, spiraling costs and resource constraints (Pocha, 2010). “At the same time, the health care quality improvement movement has reached a critical point in terms of reach, public consciousness, provider conscientiousness, and impact on patient care. There have never been so many convergent pressures to improve access, quality and throughput with fewer resources” (IHI, 2011: 1). Many hospitals have become rather skilled at achieving project level improvements; however the difficulty of achieving organizational level results has proven to be much more challenging (IHI, 2011). Exemplar hospitals such as the Cleveland Clinic, Virginia Mason Medical Center, Children’s Hospital of Wisconsin, Intermountain Healthcare, and Denver Health (Denver Post, 2010) demonstrate that the success of a hospital’s LM program is the result of the existence of a specific Lean Competency founded in its operational resources and capabilities (Black, 2008; Kenney, 2011). Those administrators who have attempted to adopt LM tools, concepts and practices to address patient value provisioning have encountered a number of notable difficulties (Poksinska, 2010; Pocha, 2010). These difficulties have not only shed light on the challenges of true LM adoption and institutional resistance to change, but additionally highlighted the necessary resources and capabilities requirements for successful deployment of a LM program in a hospital environment.

The complexity of a hospital’s social organization and the varied stakeholders involved present unique challenges (Hopp & Lovejoy, 2012); thus hospitals have been slower than other industries to adopt LM approaches. These complexities, in combination with a lack of external economic pressures, have led to slower adoption of LM approaches (relative to other industries) to both the clinical and non-clinical aspects of their organizations in hospitals. But, given current
environmental and organizational demands and challenges, many hospital administrators are considering, or are in the midst of adopting a LM approach to managing operations in an effort to enhance efficiency, stem rising costs and generate more value for and from consumers. Emergency Departments are often the start of LM in hospitals and thus will be the focal department level studied in this thesis. Despite a clearer understanding for what should be worked on to achieve these organizational objectives, increasingly hospitals are seeking answers to how they should go about instituting and sustaining an organizational-level culture of systematic improvement (IHI, 2011); in essence, what capabilities should a hospital cultivate and leverage in the pursuit of developing, embedding and sustaining a process improvement competence? The debate persists as to whether LM can be successfully deployed in a US hospital environment (Radnor & Boaden, 2008; De Souza, 2009) with the claim “little evidence of the complete lean philosophy being applied in the healthcare system” (Poksinska, 2010: 321) providing fertile context for the study of LM deployment.

Based on the current economic situation and state of LM adoption within the hospital industry, studying the deployment of LM in Emergency Departments within US Hospitals is ideal. The results from my thesis should both inform managerial practice with regard to LM deployment in US healthcare, as well as provide a suitable environment for examining my hypotheses.

1.7 Thesis Overview

Having provided the thesis research focus and questions, general research model, and industry context that the phenomenon will be examined within, the remainder of this thesis is partitioned into seven additional chapters. Chapter Two provides a more in-depth discussion of the underlying literature and a critique of the extant LM literature with respect to operations
management research on preparation and implementation for the realization of organizational value through LM. In Chapter Three, the methodology and results from the exploratory four case studies I conducted will be discussed. These case studies along with existing literature provided the material for Chapter Four where the theoretical framework underlying the descriptive research model is presented along with my research hypotheses and constitutive definitions of the latent constructs. Chapter Five provides a more detailed background into the operationalization of my research model constructs and the associated survey items through two rounds of pretesting. Chapter Six describes my survey methodology, analysis and results from my sampling of 201 US emergency room nurses that had participated in a LM initiative; measurement model and structural model results are presented and hypotheses examined through the empirical data collected. Chapter Seven discusses my research findings and in Chapter Eight my conclusions, research limitations and potential future research are outlined.
CHAPTER 2 – LITERATURE REVIEW

This chapter will provide a more in-depth discussion of the underlying literature and a critique of the extant Lean Management (LM) literature with respect to operations management research on organizational preparation and implementation for the attainment of operational and organizational objectives. While the seminal books on the Toyota Production System (TPS) and LM emphasize both the tools, practices and concepts of the approach, as well as the respect for people aspects, the former has received the bulk of attention in the academic literature. Although reference to human resource management has been made in certain studies (e.g. Shaw & Ward, 2003), and certainly leadership, training and culture have been mentioned, a comprehensive and robust empirical study of the antecedent organizational and operational dimensions required for developing a lean competence has not been conducted. My objective is to frame the contribution I intend to make to the body of knowledge by investigating the lean-based preparation and implementation considerations (both operational and organizational dimensions) that need to be established in the institution and its individuals for LM capabilities and a lean competence to be entrenched.

2.1 Origins and Pillars of Lean

It is necessary to briefly recap the meaning of the LM paradigm, because there are many differing and often conflicting definitions of LM (Buzby, Gerstenfield, Voss & Zeng, 2002). In the literature, LM has often been considered as closely related to a variety of other concepts such as: world class manufacturing, total quality management (TQM), agile manufacturing, or just-in-time (JIT). There is often overlap between LM and the domains these concepts (and others) cover, and as such, some of the concepts covered in this thesis may apply to these other related concepts as well. Take for example TQM; although there are similarities in the definition, focus,
outcomes and approach, TQM and LM are distinctly different (see Table 2.1). While TQM principally takes an episodic approach focused on quality outputs for external customers, LM takes a continuous approach focused on the improvement of processes (work flows and efforts) to enhance value for internal and external customers.

**TABLE 2.1: SYSTEMATIC OPERATIONAL IMPROVEMENT APPROACHES - DIFFERENTIATING LEAN MANAGEMENT FROM TOTAL QUALITY MANAGEMENT**

<table>
<thead>
<tr>
<th>Lean Management</th>
<th>Total Quality Management</th>
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<tr>
<td><strong>Definition</strong></td>
<td><strong>Definition</strong></td>
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<tr>
<td>The lean management approach involves the systematic, relentless, problem-focused, facts-driven, and team-based paring of waste (and its sources) from operational systems in order to (1) improve throughput-focused work flows and (2) increase the productivity and value-add ratio of all work efforts on an ongoing basis.</td>
<td>The total quality management approach entails managing the entire organization so that it excels in all dimensions of products and services (i.e., outputs) that are important to the customer.</td>
</tr>
<tr>
<td><strong>Focus</strong></td>
<td><strong>Focus</strong></td>
</tr>
<tr>
<td>Quality of processing-based work efforts and work flows.</td>
<td>Quality of outputs (viewed as proxies of the quality of work efforts) and their financial implications.</td>
</tr>
<tr>
<td><strong>Outcome (Motivation)</strong></td>
<td><strong>Outcome (Motivation)</strong></td>
</tr>
<tr>
<td>Reduce processing flow variability [mura] (and associated work effort waste [muda] and burden [muri]) to increase operational/organizational learning and problem solving capabilities.</td>
<td>Reduce processing outputs variability to lower operational costs.</td>
</tr>
<tr>
<td>Improve the flow of both internal and external customer value creation and capture.</td>
<td>Increase external customer satisfaction (i.e. an outcome).</td>
</tr>
<tr>
<td>Continuous experimentation- and facts-based visual improvement to daily work efforts and work flows by an engaged “all” in the organization.</td>
<td>Episodic, structured, project- and data-based analytical improvement of outcomes by a trained “select few” in the organization.</td>
</tr>
</tbody>
</table>
While the underpinnings and the constitutive elements of LM have its origins in the Toyota Production System, the descriptor “lean manufacturing” originated from researchers (including John Krafcik) of the Massachusetts Institute of Technology’s International Motor Vehicle Programme who focused on the significant performance gap between Western and Japanese automotive manufacturers (Bhasin & Burcher, 2006). The term LM (Krafcik, 1988) or lean thinking (Womack & Jones, 1996) is a managerial philosophy for strategic process improvement that aims to improve quality throughput (QT) and productive throughput (PT) of an organization. Although use of the term lean originated with Krafcik (1988) as a way to contrast the approach to mass production, the concept of lean has roots long established before that time or the publishing of seminal book *The Machine That Changed the World* (Womack, Jones & Roos, 1990). In the early 1900’s, Frederick Taylor developed a set of principles to maximize the productivity and minimize soldiering behavior based on scientific techniques – labelled scientific management (Taylor, 1911). Hamel in regards to Taylor’s *Scientific Management* highlighted his thinking and its congruence with LM, (The Globe and Mail, 1995: B26); “If you read Frederick Winslow Taylor from the beginning of the century, there are three fundamental things he taught:

1. Find the best practice wherever it exists. Today we call it benchmarking.

2. Decompose the task into its constituent elements. We call it business process re-design.

3. Get rid of things that don't add value. Work out, we call it now”

In deploying these principles Taylor wanted to increase productivity capacity for the good of workers and the organization and also to create improved harmony and cooperation between
workers and managers (Emiliani, 2011). Many mistakenly perceived his attempt as anti-humanistic principles designed to exploit and oppress labor class. Taylor himself was frustrated that most senior managers and consultants mistakenly understood, and applied his work to solely benefit the organization, often at the expense of employees; and prompted his famous 1912 congressional testimony statement “It ceases to be scientific management the moment it is used for bad.” Taylor’s intent was to standardize work, train workers, and makes it less difficult for workers while simultaneously benefiting enterprises, management and workers (Emiliani, 2011). Although Taylor did not rely as much as Lean practitioners on frontline workers for problem solving, he realized that continuous improvement in an organization could not occur without the organization respecting its people.

The origins of the “lean” approach can be found on the shop-floors of Japanese manufacturers and, in particular, innovative philosophies, principles and practices utilized at the Toyota Motor Corporation (Ohno, 1988; Womack, Jones & Roos 1990). These innovations, resulting from a scarcity of resources and intense domestic competition in the Japanese market for automobiles, included the just-in-time (JIT) production system, the “kanban” method of pull production, respect for employees and high levels of employee problem-solving/automated mistake proofing. Lean can be traced back to 1935, when Kiichiro Toyoda spun off the Toyota Motor Company from his loom works company (Holweg, 2007). For four decades Toyota developed its Toyota Production System (TPS), gradually discovering ways to use small-lot production in combination with economies of scale to produce a relatively large volume of cars at competitive costs (Holweg, 2007). Yet no documentation of its principles, methods or capabilities were published (in English) until in 1977 when Sugimori, Kusunoki, Cho, & Uchikawa published *Production System And Kanban System; Materialization Of Just-In Time*
And Respect-For-Human System, in the International Journal of Production Research. Although Toyota documented for its suppliers its Kanban system when it rolled it out throughout its supply chain in 1965, for the most part, TPS was an undocumented, implicitly instructed method of operations that went unnoticed for years (Holweg, 2007). Still, until the performance gaps between Toyota and other North American carmakers were highlighted by Womack, Jones & Roos (1990) in their seminal book The Machine that Changed the World, minimal interest and study had been taken of lean by the western manufacturing community or scholars.

The seminal works by Ohno (1988) and Suzaki (1987, 1993) stressed the importance of two key, integrated aspects of success for Toyota: respect for people and kaizen. While kaizen (translated as change for the better) represents the process mechanism used to surface, identify, solve, implement and standardize continuous improvement ideas, respect for people represents the social elements of the organization necessary to establish and entrench a lean culture. Kaizen represents the tools, concepts and practices of LM, and respect for people represents the organization’s approach to supporting and developing every employee’s problem solving capabilities and instilling an empowering and safe culture. These two pillars of Toyota (Liker & Hoseus, 2008) are what the LM approach should be built upon; “both culture and strategy should go in parallel to reach the required results” (Anvari, Norzima, Hojjati & Ismail, 2010: 79).

2.2 Definition of Lean Management

Many definitions of Lean have been used over the decades (see Table 2.2). Initially Lean was best known outside of Japan for its tools (Duncan & Ritter, 2014). Over time this superficial understanding evolved into improved understanding and appreciation of its underlying management principles. While Lean typically refers to the concepts, tools and practices associated with the management approach, LM refers to the management of the approach. For
purposes of this study I adopt the following definition of LM: The lean management approach involves the systematic, relentless, problem-focused, facts-driven, and team-based paring of waste (and its sources) from operational systems in order to (1) improve throughput-focused work flows and (2) increase the productivity and value-add ratio of all work efforts on an ongoing basis. This is my preferred definition because relative to others provided in the literature, this definition provides an enhanced explanation of the desired operational outputs and a better indication of what some of the institutional and individual considerations are to deploy a LM system.

**TABLE 2.2: A SAMPLING OF LEAN AND LEAN MANAGEMENT DEFINITIONS**

<table>
<thead>
<tr>
<th>Definition</th>
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<tbody>
<tr>
<td>The term “Lean” means a series of activities or solutions to minimize waste and non-value adding activities and improve the value added process.</td>
<td>Karim &amp; Arif-Uz-Zaman (2013: 171)</td>
</tr>
<tr>
<td>LM is an integrated socio-technical system whose main objective is to eliminate waste by concurrently reducing or minimizing supplier, customer, and internal variability</td>
<td>Shah &amp; Ward (2007: 791)</td>
</tr>
<tr>
<td>LM is a practice based on the philosophy of continuously improving processes by either increasing customer value or reducing non-value adding activities (muda), process variation (mura), and poor work conditions (muri)</td>
<td>Radnor, Holweg &amp; Waring (2012: 365)</td>
</tr>
<tr>
<td>LM comprises a set of operating practices that aims at reducing non value-added activities within the organization</td>
<td>Hajmohammad, Vachon, Klassen &amp; Gavronski (2013: 89)</td>
</tr>
<tr>
<td>LM is the extent to which a firm engages in activities to eliminate waste and achieve cost reduction in the internal supply chain through flexibility, worker empowerment, and process simplification</td>
<td>Hong, Dobrzykowski &amp; Vonderembse (2010: 568)</td>
</tr>
<tr>
<td>Lean production is a manufacturing system whose objective is to streamline the flow of production while continually seeking to reduce the resources (e.g., direct and indirect labor, equipment, materials, space, etc.) required to produce a given set of items; any slack in the system is referred to as “waste”</td>
<td>de Treville &amp; Antonakis (2006: 101)</td>
</tr>
</tbody>
</table>
2.3 Principles of Lean

A LM approach is focused on the elimination of waste and excess from product flows and work efforts and represents an alternative model to that of the preeminent capital-intense mass production model (Hines, Holweg & Rich, 2004). Womack, Jones & Roos (1996) summarized the LM approach based on five key principles (see Table 2.3) (adapted from Hines et al., 2010; Parry et al., 2010). Although these principles appear straightforward, institutions and individuals have found it challenging to appropriately allocate effort and focus on all principles simultaneously. A balanced approach to embracing these principle requires adaptation, not simply adoption of the concepts, tools and practices to properly address work efforts and work flows.

**TABLE 2.3: FIVE KEY PRINCIPLES OF LEAN**

<table>
<thead>
<tr>
<th>Principle</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Specify value</td>
<td>Value can only be defined by the ultimate customer. It is specified in terms of satisfying customers' needs by providing products and/or services with desired capabilities at a competitive price and lead time.</td>
</tr>
<tr>
<td>2. Identify the value stream</td>
<td>The set of all of the actions required to bring a product through problem-solving, information management, and physical transformation tasks. Here, value refers to the nature of activity being carried out. The value stream is the set of actions that transform a product or service.</td>
</tr>
<tr>
<td>3. Make the value flow</td>
<td>By reducing cycle times and batch sizes to the absolute minimum, ensuring each operation is visible, defined, and has a visible status to eliminate possible stoppages in the production process.</td>
</tr>
<tr>
<td>4. Let the customer pull</td>
<td>Processes or products are to be produced and delivered on-demand from the customers.</td>
</tr>
<tr>
<td>5. Pursue perfection</td>
<td>Even if the other four LM principles are followed, if the mindset for pursuing perfection has not been developed across the enterprise, any improvement will only deliver a one-off benefit.</td>
</tr>
</tbody>
</table>


Although a series of books and articles had been published post Sugimori et al., (1977) (e.g. Abernathy, Clark & Kantrow, 1981; Hayes, 1981; Monden, 1983; Shingo, 1981; Schonberger, 1982; Hall, 1983; Altshuler, Anderson, Jones, Roos & Womack, 1984) limited
scholarly or practitioner attention was placed on TPS. These early books and articles focused primarily on the application of shop floor tools and less on the social/organizational wide aspects of LM with the exception of Cusumano (1985). By the time, Womack, Jones & Roos (1990) was published, exposure to and knowledge of the TPS was evident, however most applications were confined to the automobile industry (Holweg, 2007; Moyano-Fuentes & Sacristan-Diaz, 2012). Womack, Jones & Roos (1990) was a tipping point for LM; it triggered numerous studies into the adoption of LM, originally confined to the automotive industry, but now evolving into other manufacturing and even service industries (Hines, Holweg & Rich, 2004). Many of these academic papers focused on one or more of the five principles outlined by Womack, Jones & Roos (1990) and emphasized the management of internal organizational aspects of LM (E.G. Cusumano, 1994; Karlsson & Ahlstrom, 1996; Richards, 1996; Soriano-Meier & Forrester, 2002; Suzaki, 2004; Shah & Ward, 2007) or Just-in-Time (JIT) (E.G. Safayeni & Purdy, 1991; Sakakibara, Flynn & Schroeder, 1993; Sakakibara, Flynn, Schroeder & Morris, 1997), Total Quality Management (TQM) (E.G. Dean & Bowen, 1994; Sitkin, Sutcliffe & Schroeder, 1994; Flynn, Sakakibara & Schroeder, 1995a, Harris & Purdy, 1998) and the relationship between both (E.G. Flynn, Sakakibara & Schroeder, 1995b). This phase of LM research primarily concentrated on the application of organizational specific tools, concepts and practices and the linkage with their presence within the organization and their respective impact on operational and/or financial performance. In this period, the prevailing scholarly work was principally focused on measuring the effect of an isolated tool or practice on performance, and not investigating the organizational capabilities necessary to enable efficient use of the tool, practice and/or concept and to embed the principles and the creation of an enduring lean enterprise. Thus, much of the early lean research was focused on the operational level and practice deployed (Holweg & Pil, 2004); for
example the well cited Shah & Ward (2003) outlined examples of prior research on lean production practices conducted from 1977-99 (see Table 2.4) and subsequently studied the impact unions, plant size and plant age on the likelihood of implementing 22 manufacturing practices of lean production systems. These practices were bundled into four groups of “inter-related and internally consistent bundles” (pg. 129) of TQM, JIT, total preventive maintenance (TPM), and human resource management (HRM) on financial performance. They found that the combination of these bundles accounted for 23% of variability in plant operating performance after accounting for contextual and industry effects. Notice that Shah & Ward (2003) continue to extend the study of LM based on practices (now bundled) linked to performance, yet do not focus on the underlying capabilities that facilitate the efficient and effective deployment of these practices.

### Table 2.4: Literature Examples of Practices Comprising Lean

<table>
<thead>
<tr>
<th>Lean practice</th>
<th>Sources</th>
</tr>
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<tbody>
<tr>
<td>Bottleneck removal (production smoothing)</td>
<td>*</td>
</tr>
<tr>
<td>Cellular manufacturing</td>
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<tr>
<td>Competitive benchmarking</td>
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<tr>
<td>Continuous improvement programs</td>
<td>*</td>
</tr>
<tr>
<td>Cross-functional work force</td>
<td>*</td>
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<tr>
<td>Cycle time reductions</td>
<td></td>
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<tr>
<td>Focused factory production</td>
<td>*</td>
</tr>
<tr>
<td>JIT/continuous flow production</td>
<td></td>
</tr>
<tr>
<td>Lot size reductions</td>
<td>*</td>
</tr>
<tr>
<td>Maintenance optimization</td>
<td></td>
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<tr>
<td>New process equipment/technologies</td>
<td>*</td>
</tr>
<tr>
<td>Planning and scheduling strategies</td>
<td></td>
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<tr>
<td>Preventive maintenance</td>
<td>*</td>
</tr>
<tr>
<td>Process capability measurements</td>
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<tr>
<td>Pull systems/kanban</td>
<td>*</td>
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<tr>
<td>Quality management programs</td>
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<tr>
<td>Quick changeover techniques</td>
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<tr>
<td>Reengineered production process</td>
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<tr>
<td>Safety improvement programs</td>
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<tr>
<td>Self-directed work teams</td>
<td></td>
</tr>
<tr>
<td>Total quality management</td>
<td></td>
</tr>
</tbody>
</table>

(1) Sugimori et al. (1977); Monden (1981); Pegels (1984); (2) Wantuck (1983); (3) Lee and Ebrabimpour (1984); (4) Suzuki (1985); (5) Finch and Cox (1986); (6) Voss and Robinson (1987); (7) Hoy (1988); (8) Bicheno (1989); (9) Chan et al. (1990); (10) Piper and McIachlin (1990); (11) White (1993); (12) Shingo Prize Guidelines (1996); (13) Sakakibara et al. (1997); (14) Koufteros et al. (1998); (15) Flynt et al. (1999); (16) White et al. (1999).

“It is necessary to separate lean production as an outcome from the organisational initiatives that are traditionally associated with it as a change process” (Lewis, 2000: 959). Researchers have long argued that LM is comprised of “a set of inter-related, complementary and mutually reinforcing operating practices” (Hajmohammad, Vachon, Klassen & Gavronski, 2013: 87) aimed at reducing or eliminating waste throughout a product or service’s entire value stream (Shah & Ward, 2003, 2007; Narasimhan, Swink & Kim, 2006). The efficient and effective use of these practices as orchestrated bundles is associated with higher operational performance; reductions in customer lead time, cycle times, lower costs, and improvements in labor productivity and quality (Hopp & Spearman, 2004; de Treville & Antonakis, 2006; Scherrer-Rathje, Boyle & Deflorin, 2009). But, up to 2007, the majority of LM research continued to focus on the management of internal operational factors to attain LM goals and objectives (Moyano-Fuentes & Sacristan-Diaz, 2012). More contemporary research on LM has evolved into a focused evaluation of the strategic approach; a more systematic perspective that integrates other aspects of the value chain outside of production and the adaption of lean principles to service industries including healthcare. Ohno (1988) and Suzaki (1987, 1993) stressed the importance of two key, integrated aspects of success for Toyota: respect for people and kaizen. While these LM pillars are easily identifiable, precisely how to cultivate and subsequently leverage those pillars for development of a lean competence that improves operational and organizational performance is distinctly challenging.

2.4 Lean Beyond the Plant

The success of the Japanese transplant operations in the U.S. (Abernathy, Clark & Kantrow, 1981) and collaborations like NUMMI (Adler, 1993) demonstrated that lean practices not only yielded superior performance, but that these practices were not culturally bound to
Japan and thus indeed transferable to other industries, countries and organizations (Holweg, 2007). Lean, no longer exclusive to the automotive industry, is now widely applied in other industry sectors including service (e.g. Bowen & Youndahl, 1998; Cuatrecasas, 2004; Alsmadi, Almani, & Jerisat, 2012; Suarez-Barraza, Smith, & Dahlgaard-Park, 2012) and specifically the healthcare industry (E.G. Lummus, Vokurka, & Rodeghiero, 2006; Fillingham, 2007) as many executives and managers in an effort to improve operational performance have turned to LM as a potential solution to their organization’s efficiencies and effectiveness woes.

LM has always been considered as more than just the application of lean tools, practices and concepts. Establishing a lean enterprise typically requires a longer-term shift in organizational and operational behaviours, not just a short-term, episodic process improvement initiative (Emiliani, 2011). It requires time, education, training, dedication, commitment, resources and engaged leadership (Ohno, 1988; Suzaki, 1993; Black, 2008) that enables ongoing facts-based and continuous experimentation to address work efforts and work flows problems. Therefore, the true adoption of LM is no quick fix or silver bullet solution for improving operational systems (Gregory, 2002; Emiliani, 2003; Liker & Hoseus, 2008).

The application of LM in the service sector has been underway for several years (Bowen & Youngdahl, 1998; Atkinson, 2004; Abdi, Shavarini & Hoseini, 2006), but there still exists a lack of research in lean services (Hines et al., 2008; Piercy & Rich, 2009). While a criticism of LM has been that it can only be implemented successfully in environments with stable demand patterns or where unstable demand can be buffered (Schmenner & Swink, 1998; Cooney, 2002; Hopp & Spearman, 2004), it has been demonstrated that lean principles can be implemented successfully in variable and unpredictable demand settings; in particular in a service/healthcare environment (Shah et al., 2008). This is not revolutionary, but was preached from Womack,
Jones & Roos (1990); “We believe that the fundamental ideas of lean production are universal-applicable anywhere by anyone” (pg. 9). Scholars and practitioners are now shifting focus from the plant to new frontiers and other aspects of LM deployment.

LM has been successfully deployed in certain service focused industries (e.g. hospitals, professional services, fast food, and airlines); however, the rate of implementation has been slower than in manufacturing (Moyano-Fuentes & Sacristan-Diaz, 2012). Reasons for the slower adoption include process standardization challenges, lagging technology adoption, and demand management difficulties (Bowen & Youngdahl, 1998; Cuatrecasas, 2002; Hines, Silvi & Bartolini, 2002). While, Liker & Meier (2006) point out that the TPS can be applied to services by standardizing design, processes and human skills, empirical studies have shown this to be more challenging than anticipated (Moyano-Fuentes & Sacristan-Diaz, 2012). Those service firms seeking LM-based "silver bullet" solutions that generate rapid beneficial results quickly find their romance with LM disappears when faced with the LM deployment reality that challenging preparation and implementation work is required for entrenching a truly lean culture. Customization is likely required as each organization faces its own unique set of internal and external circumstances, requiring organizational learning and interpretation to maximize potential benefits of LM (Lee & Jo, 2007). When examining new idea adoption, Rogers (1999) emphasized that even when an idea has clear apparent advantages, adoption is often very difficult, normally takes an extensive period of time, and could still potentially fail in the process of adoption. The embedding of superior best practices such that they are likely to be sustained requires the commitment and orchestration of considerable resources (Sirmon, Hitt, Ireland & Gilbert, 2011) and the involvement of many individuals within the organization (Zeitz, Mittal & McAulay, 1999).
For many organizations, the decision to adopt a LM approach to facilitate improvements in business performance is often an easy one to justify. The belief, or for many received wisdom, that LM is a critical best practice for ensuring firm competitiveness runs pervasive across many firms and industries (Liker & Meier, 2006). Porter (1996) highlighted both the strength and weakness of this best practice view of LM. He observed that systematic operational effectiveness and improvement methods such as TQM and LM may improve performances of adopting organizations in the short-term; however these short-term advantages will prove unsustainable given that their eventual adoption by all organizations results in competitive convergence for all adopting firms. Implicit to Porter’s reasoning is the belief that once a systematic operational best practice approach is adopted then its effective deployment and optimum performance is a given; yet deployment of lean concepts, tools, and practices is anything but a given in practice. In practice, the deployment of LM in any operational environment is extremely difficult (Shah & Ward, 2007) and differs across settings due to contextual differences (de Treville & Antonakis, 2006: Taylor & Taylor, 2008), making LM implementation in reality a complex process (Hong, Dobrzykowski & Vonderembse, 2010). Beyond adoption and deployment of LM, diffusion of LM has frequently been noted for its unevenness, with more often than not, less than comprehensive adoption within an organization (Cooney, 2002). While the basics of LM can be readily identified, it has been suggested that it takes at least ten years of practice under expert guidance for an organization to achieve expertise in being lean (Womack & Jones, 2003). This implies that deployment is hardly a given.

The choice to apply the technical elements of LM (see Table 2.5) is a short-term fix; the willingness to invest in the social elements that prepare the organization for embedding LM and building a Lean enterprise is a more taxing solution to employ for improving operational systems
(Gregory, 2002; Emiliani, 2003; Liker & Hoseus, 2008). A longer-term approach to embedding the philosophy and developing lean competence requires investments in social capabilities. While tools, practices and concepts can be utilized for short-term capture of “low hanging fruit” waste, a truly Lean enterprise must institute the second, more socio-cultural based, lean pillar of respect for people in order to diffuse and sustain a LM approach.

**TABLE 2.5: LEAN MANAGEMENT - A COLLECTIVE SAMPLING OF CONCEPTS, TOOLS AND PRACTICES**

<table>
<thead>
<tr>
<th>Production Control Focused</th>
<th>Lean Management Concepts</th>
<th>Quality Control Focused</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Just-in-time</td>
<td>Muda, mura, muri</td>
</tr>
<tr>
<td></td>
<td>Heijunka</td>
<td>Gemba, gembutsu, jujitsu</td>
</tr>
<tr>
<td></td>
<td>Takt time</td>
<td>Standard work</td>
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<td></td>
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<td>Visual management</td>
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<td></td>
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<td>Voice of the customer</td>
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<td></td>
<td></td>
<td>Nemawashi</td>
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<td></td>
<td></td>
<td>Yokoten</td>
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<tr>
<td></td>
<td></td>
<td>Kaizen</td>
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<tr>
<td></td>
<td></td>
<td>Jidoka</td>
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<tr>
<td></td>
<td></td>
<td>Counter measures</td>
</tr>
</tbody>
</table>

**Lean Management Tools**

- Kanban
- 5S (seiri, seiton, seiso, seiketsu, shitsuke)
- Value stream mapping
- Ishikawa diagramming
- Poka yoke
- Total preventive maintenance
- A3 reports

**Lean Management Practices**

- Small batch production
- Pull method
- Mixed model assembly
- Work cells
- Close supplier ties
- Andons
- Flexible (skills) workforce
- Five whys?
- Autonomation
- Rapid process improvement workshops

2.5 **Socio-Cultural Elements of Lean Deployment**

LM is often described as an integrated socio-technical system (Ohno, 1988); early works from Toyota (Ohno, 1988; Suzaki, 1993) emphasized that you cannot have continuous improvement without first establishing respect for people (Emiliani, 2003, 2011). Koufteros, Vonderembse & Doll (1998) characterize employee involvement as an antecedent to adoption of
time-based, lean manufacturing methods, and Boyer (1996) finds that companies committed to lean production devote resources to train and empower their workforces. Furlan, Vinelli & Pont (2011) indicate that only those plants characterized by a significant implementation of human resource practices enjoy the complementary effects of Lean concepts on operational performance. Yet, in their deployment of LM, and “sparkled by the superior performance achieved by lean producers over the performance of traditional mass production system designs, western manufacturers emulated the shop-floor techniques, the structural parts of lean, but often found it difficult to introduce the organisational culture and mindset” (Hines et al., 2004: 995) required for embedding LM into their organizations. In order to derive the full benefit of LM, in any context, there simply is no shortcut to understanding its fundamental principles and underlying assumptions (Radnor et al., 2012). There is no "silver bullet" solution to cultivating a productive lean competence and circumventing the challenging social requirements to arrive at the end state of the truly lean (and learning) enterprise is improbable. Toyota’s "senior executives take great pleasure in explaining that other companies find it difficult to emulate Toyota because its management tools matter less than its mind-set" (Stewart & Raman, 2007: 74). Thus research that attempts to link the presence of lean practices, tools, techniques and concepts to (operational/business) performance without adequately considering the socio-technical aspects of LM or how resources are to be leveraged vis-a-vis capabilities/competencies is deficient.

In addition to a shift in focus from primarily manufacturing, to more service applications, research into the concept of LM has expanded beyond the tools, concepts and practices and into the socio-cultural elements of this management approach. While the technical elements of LM (E.G. concepts, tools and practices) expose problems, it is the social elements of LM that solve
problems (Liker & Hoseus, 2008). More recent LM research has emphasized that successful deployment requires change in the culture of an organization (E.G. Mann, 2005; Bhasin & Burcher, 2006; Dahlgaard, Pettersen, & Dahlgaard-Park, 2011). “If the principle of respect for people is not recognized, or is recognized but viewed as optional by senior managers, then failure is certain” (Emiliani, 2011: 14). This issue exists in non-western cultures as well; Aoki’s (2008) study of LM deployment in China found that social characteristics common to successful organizations included the active use of team-based over individual based suggestions schemes, multi-skills training and long-term employment of employees, a higher frequency of shop floor visits by senior managers to check on work processes, greater discipline, more self-initiative by frontline workers and greater cross-functional communication (Taylor & Taylor, 2008).

The pervasive deployment of LM has not been consistently linked to incremental improvements and there has been significant “confusion and inconsistency” (Shah & Ward, 2007: 785) about how LM works and more importantly how best to implement the approach to improve operational performance and achieve organizational objectives. Although the key tools of LM have proven relatively easy to grasp and implement in different contexts (Womack & Jones, 1996), in reality many organisations have not been able to transform themselves into Lean enterprises (Bhasin & Burcher, 2006; Liker, 2004) because of their inability to grasp the socio-cultural aspects of LM. So while many LM improvement programmes have yielded promising results initially, most have failed to sustain them over time (Mann, 2005; Hines, Found, Griffiths, & Harrison, 2011). Other organizations have reported significant gains from LM, but have been unable to diffuse best practices; the improvements remain contained to a specific organizational area, unable to be leveraged through transference of learning to other parts of the organisation.
(Adler & Cole, 1995). So many early lean efforts showed localised impact only, and fell short of their intended impact on the overall system’s long-term performance (Holweg & Pil, 2001).

Lean practitioners have identified distinct individual and institutional social elements critical to the successful deployment of LM within an organization (Ohno, 1988; Suzaki, 1993; Black, 2008). These socio-cultural elements enhance the complementary relationship between operational bundles (TQM and JIT) and their combined effect on performance (Furlan, Vinelli & Pont, 2011). However, these elements are multifaceted and interconnected in a complex social system that takes time to develop (Hines et al., 2004). Powell’s (1995) TQM study found that “potential TQM adopters may not appreciate that TQM success depends not only on adopting the TQM attributes, but also on the pre-existence of complementary factors apparently unrelated to TQM, yet more difficult to imitate than TQM itself” (Powell, 1995: 21). While LM differs in notable ways from TQM, organizations that choose to ignore the development of lean socio-cultural elements will likely encounter similar adoption challenges.

While development of a lean culture has been documented as a requirement to the development of an established lean enterprise, the importance of leadership has also been emphasized of late (E.G. Spear, 2004; Hines et al., 2008), but few studies (Liker & Convis, 2012) have empirically investigated and attempted to describe lean leadership. Research into the role of leadership in LM deployment (E.G. Emiliani, 1998; Flinchbaugh, Carlino, & Curtis-Hendley, 2008; Mann, 2009) is often based on ‘common sense’ and less on empirics or theory. Management commitment (Soriano-Meier & Forrester, 2002), conviction (Boyer, 1996) and leadership (Niepce & Molleman, 1996) are some social aspects of senior executives and managers that have been studied (Moyano-Fuentes & Sacristan-Diaz, 2012). Frontline employee or “worker” commitment (Cusamano, 1994; Gagnon & Michael, 2003; Suzuki, 2004), attitude
(Groebner & Mertz, 1994), psychological safety (Lee, Swink & Pandejpong, 2010) and motivations (Nepce & Molleman, 1996) are some of the employee elements that have been studied (Moyano-Fuentes & Sacristan-Diaz, 2012). In addition to the social skills of front-line workers, managers and executives, training and possession of technical analytic (E.G. mathematics) and lean specific skills (E.G. lean principles, value stream mapping), assignment to appropriate tasks based on those skills, the installation of reward systems and incentives to improve the likelihood of success have all been investigated (Moyano-Fuentes & Sacristan-Diaz, 2012).

2.6 Creating Value Via Resource Leveraging

LM has been defined as a “practice based on the philosophy of continuously improving processes by either increasing customer value or reducing non-value adding activities…” (Radnor, Holweg & Waring, 2012: 365). A customer focus is thus a central tenet of a lean philosophy. Closely related to the idea of customer focus is the notion of customer orientation (Bowen & Youngdahl, 1989). A customer-oriented firm is one that emphasizes customers’ expressed needs and develops superior solutions to meet those needs (Slater & Narver, 1998). Customer orientation under LM revolves around the notion of defining value from customer’s perspective (Shah, 2002).

Despite the undeniable centrality of the customers’ perception and assessment of value in LM, beyond tools, practices and concepts and the respect for employees, little attention has been paid to the first principle of Womack & Jones (1996); value specification and a the subsequent value agenda (Porter & Teisberg, 2006) of the value generating enterprise. In order to develop and deploy a lean system focused on value creation and subsequent capture, a series of tools and approaches have been developed which primarily fall into two categories: diagnostic/analytical
and implementation (Bicheno, 2001). Within the diagnostic/analytical area are the ‘value stream mapping tools’ (Hines & Rich, 1997; Rother and Shook, 1998; Hines & Taylor, 2000). Development of these diagnostic/analytical skills is an important aspect to ensuring that the lean problem solving skills (E.G. 5s, 5 whys) are available for utilization (Hines & Rich, 1997; Rother and Shook, 1998; Hines & Taylor, 2000). The diagnostic/analytical toolkit includes a wide variety of tools drawn from a variety of process improvement approaches and philosophies (Shingo, 1989). The specificity of the tool used to create value is less important than having an assortment of tools to select from and the experience and knowledge of how to choose and use the correct tool at the correct time.

Noble (1999) suggests that implementation research receives little attention in the literature because it is mechanistic, mundane and plain boring when compared to strategy formulation and because it is difficult to operationalize implementation constructs. Complex social interactions are necessary to effectively implement LM and thus make it challenging to study. It is often the case, as highlighted by Liker & Hoseus (2008), that only when the LM adopting organization`s personnel possess the will to undertake necessary preparatory effort that success at LM deployment is likely to occur. Implementation can be defined as “the system-wide action taken by firm members aimed at accomplishing formulated strategies. Implementation is important to firm performance because strategies do not add value unless properly implemented” (Hahn & Powers, 2010: 66). Process management can be defined as “structured approach to performance improvement that centers on careful execution of a company’s end-to-end business processes. Formally, a business process is an organized group of related activities that work together to create a result of value to the customer” (Hammer, 2002: 26). Effective implementation requires active management of the process, not simply the coordination of
activities; focusing human, financial and information resources on the right activities and managing them with unusual efficiency (Egelhoff, 1993). “Organizations can increase efficiency by adhering strictly to proven process templates, thereby rendering operations more stable and predictable” (Adler, Benner, Brunner, MacDuffie, Osono, Staats, Takeuchi, Tushman & Winter, 2009: 99). Deployment of resources in a structured fashion facilitates effective lean problem solving and the development of apt quality product and service offerings, which likely enable eventual value capture and marketplace positioning competitive advantage. An implementation capability involves hands-on management, not just coordination (Poksinska, Swartling & Drotz, 2013); a project manager is in control of the process while a project coordinator lacks control (Womack & Jones, 2007). In LM, "the establishment of standardized processes and procedures is the greatest key to creating consistent performance" (Liker & Meier, 2006: 111).

Not all organizations possess the same capabilities and thus successful deployment does not just happen once the strategic decision to adopt is made—a significant amount of individual and institutional preparation effort is still required to enable lean-based success. This contradicts Porter’s (1996) view of LM as an operational best practice whose successful deployment is a managerial given. A important tenet to be examined in this research study is that successful LM deployment is not a given; possession of the right resources does not guarantee the development of a resource comparative advantage; creation of a resource comparative advantage only occurs if the resources are managed effectively (Sirmon et al., 2011) and efficiently deployed (Adler et al., 2009). This organizational capability can be an independent source of sustainable competitive advantage (Collis, 1991); however it will not automatically lead to enhanced financial performance. A critical issue linking financial performance to a LM competence “appears to be the firm's ability to appropriate the value generated by any savings the firm can
make” (Lewis, 2000: 975). However, not all of the financial benefits from LM accrue immediately. If applied effectively to match consumer need, LM will create comparative advantages that drive superior financial rewards through increased revenues or margins in the short term, but non-financial rewards (customer engagement, customer and employee loyalty, brand equity, etc.) are other benefits of these efforts. Empirical evidence links customer perceptions of service directly to important customer loyalty responses such as patronage intention, increased share of purchase, and word-of-mouth (WOM) communication (Zeithaml, Berry & Parasuraman 1996; Keiningham, Perkins-Munn & Evans 2003). Thus, these non-financial rewards may not manifest themselves as financial rewards in the short run, but the financial benefits of them are assumed to be garnered at some time in the future (Said, Hassab-Elnaby & Wier 2003). It is anticipated that front-line employees and managers glean relevant insights from non-financial measures, providing more granular and actionable information that can be used by front-line employees and managers to improve their firms’ financial performance (Fullerton & Wempe, 2009).

The literature on the sequencing of LM deployment capabilities is mixed. Parallel (Hayes, 1988), sequentially (Womack & Jones, 1996) or simultaneous parallel and sequential (Ahlstrom, 1998) are all put forth with sound theoretical reasoning (Moyano-Fuentes & Sacristan-Diaz, 2012). Ferdows & Thurnheer (2011) introduce the concept of fitness and using ideas from the sand-cone model (Ferdows & DeMeyer, 1990) to sequence cumulative capabilities to improve safety, reduce process variability, codify and share tacit production know-how, improve responsiveness, and improve labor and machine efficiency. Although not Lean, they demonstrate that developing internal operational capabilities in a Lean-like manner could be effective at improving operational performance. While it may seem intuitive that
deploying a Lean process improvement without properly training employees, modifying the culture and having the proper leadership in place is a recipe for disaster, the pace of deployment and determination of capability developmental sequencing is likely context specific (de Treville & Antonakis, 2006).

2.7 LM Capabilities and LM Competence

One of the research objectives of this thesis is to assess how bundles of a firm’s resources are related and linked to each other and to examine the competitive implications of a given set of capabilities and a LM competence formed by the possession and orchestration of those resources. Developing capabilities and competencies is not simply a matter of assembling a portfolio of available resources. Coordination and orchestration of resources is required and is facilitated through repetitions, the development of routines and the interaction of multiple routines (Nelson and Winter, 1982). “Organizational routines are regular and predictable patterns of activity which are made up of a sequence of coordinated actions by individuals. A capability is, in essence, a routine, or a number of interacting routines. The organization itself is a huge network of routines” (Grant, 1991: 122). Management theorists have suggested that routines can be linked and integrated to increase the impact of their respective values (Milgrom and Roberts 1995). Embedding routines within systems of routines increases their potential value beyond their value in other contexts (Peteraf, 1993). Employee and organizational skills developed over a long period of time are more important to competitive success than things you can buy (Hayes & Upton, 1998).

Resources are stocks of factors (inputs into production or process) that are owned or controlled by a firm (Amit & Schoemaker, 1993) and are operationalized by the routines of the organization. A resource is something an organization has access to, rather than something it can
necessarily do (Grobler & Grubner 2006). Therefore, routines are a critical source of resource implementation and have become central to any research focused on operations capabilities (Peng, Schroeder & Shah, 2008). But, routines are not enough to guarantee implementation excellence. Clark (1996) observed that most instances of competitive advantage in operations are achieved through better execution. LM resources are not finite; many organizations can gain access to or develop the necessary resources – if they have the will and the capabilities to prepare. Competency and high performance are achieved through exceptional implementation of similar routines possessed by other organizations.

Meyer, Tsui & Hinings (1993) have defined configurations as any multidimensional constellation of conceptually distinct characteristics that commonly occur together. Although early empirical studies in LM were limited to one or two aspects of lean (E.G. JIT or TQM), more recent studies have started to include more than one aspect perhaps in recognition of the configuration perspective or the importance of a more holistic approach (Shah, 2000). A configuration based theory (Venkatraman, 1989) is the appropriate perspective to invoke in the context of this LM study, because a consensus about the characteristics underlying the LM system will be developed, however the relationships among the characteristics is neither explicit nor precise in terms of linearity or causality. This study will therefore identify and test hypotheses regarding the distinct LM dimensions/characteristics that occur together in a LM deployment. It has been stated that in reference to the future research in LM state that “nowhere, for instance, is the debate as to the relative merits of the trade-off and cumulative capabilities models of operations strategy (Boyer and Lewis, 2002; Flynn and Flynn, 2004) more relevant, as academics work to determine whether, and how, to effect simultaneous improvements across multiple dimensions” (Taylor & Taylor, 2008: 481). LM has multiple complementary
components adding to its complexity and the challenges of managing so many moving parts while ensuring that momentum continues towards the lean objectives (Schonberger, 2007). Conceptual research continues to stress the empirical investigation of the effect of multiple dimensions/characteristics/resources of LM simultaneously (Roth & Miller, 1992; Imai, 1997) and their impact on the development of an organization’s lean competence.

### 2.8 LM in Healthcare and Focus on Hospitals

“There has never been a more opportune time for people with analytical skills to provide decision-making guidance to improve the healthcare delivery system” (Green, 2012: 488). Delays for care, quality problems, increasing costs, variability of care and outcomes, capacity constraints are some of the challenges faced by the US healthcare system (Green, 2012). Within the US healthcare system, the largest category of expenditures is associated with hospital care; greater than 30% of all costs (Schoenman & Chockley, 2011). Within the hospital industry, inefficiency, waste and lack of quality are avoidable factors, which are partly responsible for the increasing costs. These drivers of poor QT and PT can be measured, managed and improved through the development and effective deployment of LM competence (Koning, Verver, Heuve, Bisgaard & Does, 2006); thus poor QT and PT are preventable. Policy makers and hospital administrators are seeking methods to make more efficient and effective use of resources to address these continuing challenges. LM has become one of those methods many hospitals are attempting to utilize.

Hospitals are very complex service providers with a very low tolerance for failures, and traditional hierarchies and social structures that complicate LM deployment. Despite these challenging deployment conditions, there is evidence of some exemplary LM initiatives in health care (E.G. Cleveland Clinic, Virginia Mason Medical Center, Children’s Hospital of Wisconsin,
Intermountain Healthcare, and Denver Health) (Denver Post, 2010). A lack of academic research in the field of health care operations management still exists (Shah et al., 2008; Aronsson, Abrahamsson & Spens, 2011). Limited research to date has primarily evaluated whether the LM approach transfers successfully into healthcare and what impact a LM approach has on operational performance; PT and QT (Radnor, Walley, Stephens & Bucci, 2006). A multitude of qualitative case study literature exists examining why LM can work in a health care context (e.g. Miller, 2005; Fine, Golden, Hannam & Morra, 2009; Poole, Hinton, & Kraebber, 2010) and the challenges to implementation of LM in health care (E.G. Walley, 2003; Spear, 2005; McCarthy, 2006). However, an empirical examination of the operational and organizational capabilities necessary to enable deployment of LM in hospitals has not been published.

The greater body of research into LM in health care has focused on the flow of patients through the treatment process. This research has treated patients as products, being moved through a transformation (treatment) similar to a product through an assembly or production process. Flow is examined as patients are seen as entering the process, having specific operational activities performed on them (such as admission, initial assessment, treatments, recovery, discharge) with an output being produced (a person cured or otherwise) (Piercy & Rich, 2009). This approach to examining patient flow has allowed the application of established lean tools such as mapping techniques and waste reduction (Seddon & Lewis, 2003).

The overarching contribution of this thesis will be to offer both explicating and envisioning contributions to advance scholarly theorizing and managerial understanding on LM deployment in organizations. The explicating contribution I will offer clarifies that the LM deployment effort requires the cultivation and leveraging of both an organization's LM Preparation Capability and its LM Implementation Capabilities in order to generate a beneficial
lean competence. The envisioning contribution I will make is to provide clarification of the operational capabilities and competence underpinnings (the dimensions of those required capabilities) of lean which allows me to put forward a more precisely encompassing definition of LM that can better highlight what is the focus, motivation, and overarching approach associated with being lean. While this study takes place within the context of the United States hospital industry, the objective is to initiate a stream of research that’s findings should eventually be generalizable outside these hospital contextual parameters.

2.9 Conclusion

New (2007) upon reflecting on the investigation of TPS and LM stated that “after 30 years, we can now be reasonably certain that whatever Toyota have got, it isn’t a trivial task to bottle it and sell it on” (pg. 3547). More subtle understandings of operations management are being sought that considers its practice in relation to strategy, context and resources (Pilkington & Fitzgerald, 2006). “Returning to the Sugimori et al., (1977) article which fuelled many of the original studies…… detailed perusal of the article seems to confirm this view in terms of the straightforward, almost superficial, treatment of the issue of respect for workers through elimination of waste movements, concern for worker safety, and full utilisation of worker capabilities. Nonetheless, adoption of Japanese manufacturing techniques continues to require careful attention to human resource management issues (Jayaram et al., 1999) and remains an under-researched area” (Taylor & Taylor, 2008: 487).

Much of the existing LM research has focused on the application of LM concepts, tools and practices and their impact on organization or operational performance. Largely missing in the scholarly literature is meaningful conceptualization around, theorization on, and empirical research on the requisite organizational and operational capabilities that underpin a productive
LM approach for the organization, or a lean competence and an emphasis on value generation for and from the customer. While understanding LM holistically requires an operational level comprehension, it is only through combining that operational comprehension with strategic and capabilities comprehension that a holistic understanding will be near completion (Hines, Holweg & Rich, 2004). A more contemporary research approach takes a capabilities perspective, in particular the socio-cultural elements, and as such, is foundational to my investigation of LM deployment in hospitals.

Generally, the adoption of any operational best practice without adequate institutional and individual preparation will not automatically result in the attainment of the benefits typically associated with that best practice. Linkages between an organization’s capabilities and its operational performance are well documented (Peng, 2003), but the relevant identification and rigorous measurement of operational capabilities in general, and LM operational capabilities specifically, continues to vex operations management scholars. This is troublesome given that operational capabilities provide the means for managers to leverage the firm’s resources (Wu et al., 2010). While, Anvari, Norzima, Rosnah, Hojjati & Ismail (2010) touched on the decoupling of implementation and preparation in their three phase approach to Lean Manufacturing Implementation, they fail to make the linkage to value generation or create measurement instruments to verify their conceptualization of critical success factors. The explicating contribution I will offer is to provide a more coherent and compelling framing of LM deployment in terms of operational and organizational capabilities in addition to a value realization (or “generation”) endeavor for both the firm and its customers. In addition, I will measure the respective effects on the organization’s ability to realize Lean-Based Benefits from their efforts. The expected value of this contribution is to clarify that the success of a LM
deployment effort, as reflected by the adopting firm’s LM Competence, requires the leveraging of both an organization’s Lean Preparation and Lean Implementation Capabilities.

While the identification and operationalization of the appropriate and distinctive LM operational capabilities, and examination of their associations with operational outputs and business outcomes will prove challenging, it is anticipated that my research findings will produce a number of meaningful conceptual and empirical insights that should inform both scholarly theory and managerial understanding of the LM deployment phenomenon. As such, I expect that this more comprehensive view of LM deployment will motivate scholars to examine LM deployment capabilities more thoroughly and practitioners to take a more structured and measured approach; one that develops a lean competence through the cultivation of lean resources and leveraging of both lean preparation and lean implementation capabilities.

The goal of this chapter was to frame the contribution I intend to make to the body of knowledge by providing a more in-depth discussion of the underlying literature on LM and a critique of the extant literature on LM with respect to operations management research on organizational preparation and implementation for the attainment of operational and organizational objectives. In particular, gaps in the current LM research have been identified, and argumentation for a resource/capability/competence view of LM deployment and a multi-dimensional, co-varying and congruent representation of those capabilities has been justified. I have established the underpinning for my Explanatory/Descriptive Research Model and the investigation of the lean-based preparation and implementation considerations (both operational and organizational dimensions) that need to be established in the institution and its individuals for LM capabilities and a LM Competence to be entrenched in the organization. In Chapter
Three, I will chronicle my exploratory case study research that further enhanced my understanding of the phenomenon and the development of my research model.
CHAPTER 3 – EXPLORATORY CASE STUDY RESEARCH

3.1 Introduction

Chapter Two provided a more in-depth discussion of the underlying literature and a critique of the extant Lean and LM literature with respect to operations management research on preparation and implementation for the realization of organizational value through LM. Having established the need for more empirically-based research of operational and organizational capabilities that underpin productive LM deployment (Hines, Holweg & Rich, 2004; Taylor & Taylor, 2008; Wu et al., 2010) I commenced my empirical research with four case studies.

This was an early stage, exploratory (primarily descriptive in nature) study intended to further my understanding of the phenomenon (greater contextual understanding and comprehension of operational and organizational systems, change management, process improvement etc.). The objective of this case study research is not to answer a specific question per se, but to realistically and precisely chronicle the LM deployment efforts that can serve as a representative illustration of systematic operational improvement efforts in a health care setting. Understanding the LM phenomena in a hospital setting from the perspectives of the research key respondents; and for examining, documenting and articulating key inputs to implementation success informed the generation of ideas for the my second phase of research. Qualitative analysis of themes and meanings in a search for patterns and the dimensions, beliefs, behaviours and “rules” that help shape them was conducted. Through my chronicling, experiences and observations, I was able to form a more holistic, systemic “big picture” perspective to utilize in the refinement of my research and subsequent quantitative study of the phenomenon.

Field data from key respondents was collected in order to obtain a more rigorous understanding of the managerial issues and challenges faced during the LM deployment journey.
The objective of these case studies was not to collect empirical data to test hypotheses, but to enhance my comprehension of the research topic and inform development of measurement items for a second phase empirical survey instrument. Through interviewing 70 hospital employees involved in lean-based initiatives in a variety of settings, I sought greater understanding of the phenomenon and the context of my research.

This chapter outlines the detailed methodological descriptions of the qualitative exploratory case study research I conducted in four hospitals. The results led to the evolution of the basic conceptual model (see Figure 3.1) I originated my doctoral studies with, to the descriptive model outlined in Figure 3.6. Through case study data analysis, reflection and sharing of my model with interviewees, I revised my conceptual model for subsequent testing in hopes of better answering my research questions. In addition to guiding the reformulation of my conceptual model, the results of these case studies helped inform the initial development of measurement scales for my qualitative survey. Given the more contemporary research approach I take (using a capabilities perspective, in particular the socio-cultural elements) towards the deployment of LM, a case-based qualitative study was foundational to my understanding of and subsequent investigation of LM deployment in hospitals.

**FIGURE 3.1: INITIAL CONCEPTUAL RESEARCH MODEL**
3.2 Case Studies Details

3.2.1 Background and Methods

The study population for my research on LM is the United States hospital industry; specifically emergency departments. Since a strong contextual understanding is important when studying organizational change processes (Pettigrew, 1990) and capabilities (Ethiraj et al., 2005), studying a single industry within a single country allows me to devote sufficient time to understanding the complex social, cultural, operational and financial processes more deeply (Yin, 2009) and facilitate comparisons among multiple organizations (Fox-Wolfgramm, Boal & Hunt, 1998). While the study is focused in one industry and in one country, the hope is that further research in other industries and cultures will follow as part of a greater research stream of study post-thesis and permit enhanced analytical generalization to other areas of LM adoption.

Since I am exploring a relatively new research area, and not specifically attempting to determine causality between variables at this initial stage of my research, case studies are an appropriate methodology (McCutcheon & Meridith, 1993; Yin, 2009). “Case research has consistently been one of the most powerful research methods in operations management, particularly in the development of new theory.” (Voss et al., 2002); case study research lends itself well to building new theory and elaborating existing theory (Eisenhardt, 1989; Lee, Mitchell & Sablynski, 1999; Eisenhardt & Graebner, 2007; Yin, 2009). Since I had a pre-conceived idea of my descriptive model a priori to my case study research, the objective of this research phase was not purely inductive. However, my intention was to learn from interviewees to either confirm or refine the a priori model, thus an aspect of theoretical induction was a key objective of this research phase. Therefore, as a basis for inductive theory development, I used a multi-site case study design as a first stage in my research.
Building on both Eisenhardt’s (1989) and Yin’s (2009) approaches to designing and building theory from case studies, I utilized a non-probability, information-oriented sampling (Flyvbjerg, 2006) of hospitals. The goal of information-oriented sampling is not the representative capture of all possible variations, but to gain a deeper understanding of critical cases to facilitate the development of a descriptive framework for the research under study. Information-oriented sampling can be viewed as a technique of data triangulation: using independent pieces of information to get a better fix on something that is only partially known or understood (Ragin, 1994). Information-oriented sampling enables the obtaining of information on unusually extreme or strategically (in relation to the phenomenon under study) critical cases and improves the understanding of the limits of existing theories (Flyvbjerg, 2006). This design explicitly captures the viewpoints of multiple stakeholders and controlled for potential biases from a single data type (Jick 1979; Eisenhart 1989; Yin 2009).

I conducted 70 one-hour interviews utilizing a semi-structured interview guide (see Figure 3.2) with actors (differentiated hierarchal standing, functional or departmental area, role in project, and experience in hospital) who had experienced diverse perspectives of the LM initiatives within their respective organizations. These interviews were the primary source of the case study data I collected. While I was not developing theory in a purely grounded theory method, the fundamental tenets (Corley & Gioia, 2011) of grounded theory (Glaser & Strauss, 1967; Corbin & Strauss, 1990) were followed permitting the gradual discovery of enhanced theory from the data (Glaser & Strauss, 1967). I continually searched to find consistencies and constancies within and across cases as a means to generate meaning from the data. I generated representative understanding and analytically generalizable insights that led, along with scrutiny of the scholarly literature, to theoretically-supported hypotheses and improvements to my basic
FIGURE 3.2: CASE STUDY INTERVIEW GUIDE

What has been your role in the lean initiative at the organization?

How long have you been involved?

How many hours per month have you dedicated to the initiative? In what way have those hours been allocated? How has your direct supervisor supported your efforts?

How would you describe your experience in the initiative to date?

How has this experience differed from other similar initiatives you have participated in or been effected by in the past?

In your own words, what are the key objectives of the Lean initiative at the organization?

How do the projects you have participated in contribute or fit in with those higher level objectives?

Describe the process of the initiative you were involved in from opportunity identification to potential solution?

How is the effectiveness of the overall initiative and your project evaluated or assessed?

How was the solution implemented or deployed? Was this effective?

What or who are the enablers of deployment? What or who are the barriers or inhibitors of successful implementation?

What is the plan or strategy for ensuring the successful ongoing longevity of the initiative?

How involved or visible has the senior management team been in the lean initiative? How involved is your own direct supervisor?

How has the patient experience been impacted by your project? What are the financial benefits of your project? What other tangible benefits are there?

What suggestions would you have to improve the speed of deployment? Ease of implementation? Long-term sustainability of the initiative?

Why is lean important to your hospital?

How has your involvement in this initiative shaped your thinking and approach to opportunity identification and problem solving?
conceptual model. “Theory is emergent in the sense that it is situated in and developed by recognizing patterns of relationships among constructs within and across cases and their underlying logical arguments” (Eisenhardt & Graebner, 2007: 29). Implicit in grounded theory tenets is the assumption “that the people constructing their organizational realities are ‘knowledgeable agents,’ namely, that the people in organizations know what they are trying to do and explain their thoughts, intentions and actions” (Gioia, Corley & Hamilton, 2013: 17). The ultimate measure of the quality of my case study research (and the interviewees’ knowledge) rests on the fit between the empirical observations and the conceptual categories I report as informed by the data (Locke, 2001). This case study research enhanced my understanding and explanation of constructs, their relationships to each other and built a natural bridge to the confirmatory phase of my research where I empirically tested those hypotheses utilizing a larger sample surveying approach and structural equation modeling to generate findings.

I treated each individual case study location as a separately (Eisenhardt, 1989; Yin, 1989), yet as I progressed through the interviewing process, thematic patterns began to emerge which informed potential adaptation of my descriptive model. By conducting interviews at hospitals that were at various experiential stages of LM program deployment and with individuals with a variety of roles and exposures in those programs, I was able to observe diversity in viewpoints that informed a more well-rounded perspective of the phenomenon. After the first three hospital case studies, I modified my conceptual research model. At the fourth and final case study, I used the same interview guide, but shared the proposed model at the end of the interview to gain additional perspectives on my emerging theory.

All hospitals and all interviewees were promised anonymity (Gioia, Corley & Hamilton, 2013) and as such I will not divulge their identities in this thesis. Letters of consent were signed
by all interviewees prior to the interview and the promise of anonymity within the research and with their fellow hospital employees was guaranteed. Prior to consent being given, a researcher bio and letter of information (see Appendix A) was sent to all interviewees along with a copy of the consent form (see Appendix A) to be collected at the start of the interview. Consent forms were stored separately without any coding information on them. Interviewee identities and contact information was securely stored for potential subsequent communication purposes but not shared with anyone within the organization. I did not record the interviews (owing to confidentiality concerns), but I took extensive notes and subsequently transcribed them to electronic format (Microsoft Word) as soon as possible after the interviews. Data recorded electronically was subsequently stored on a password protected account on Ivey School of Business PhD server. A separate file with respondent position, initials and name was stored on my personal hard drive without data. Field notes were secured in locked office until backed up electronically and then shredded. These electronic interview notes are the case study exploratory data for my analysis.

3.2.2 Case Study I

The first case study was conducted in a hospital where I had previously worked as a management consultant. This well established not-for-profit teaching hospital (Hospital A) was located in a competitive Northeastern US urban market and had an ethnically and economically diverse patient mix. The hospital was in the early stages of adopting a LM program and had hired a Director of Lean who had just completed training two dozen ‘green belts’ across the organization. I had a pre-existing relationship (from my consulting work) with both the Chief Executive Officer (CEO) and the Chief Operating Officer (COO) (a former General Electric trained Six Sigma Black Belt) that assisted in my gaining access to this site. I used a semi-
structured interview process (utilizing an interview guide) conducted onsite, over a three week period. Based upon the recommendations of the COO, Director of Nursing and Director of Lean, an initial list of potential interviewees was established that was later expanded based on a snowball sampling technique as the initial interviews identified additional potential key respondents. Participation was always optional. I was provided with an email introduction and then I subsequently followed up with potential respondents to arrange one hour interview appointments. In total, twenty one interviews were conducted. In addition, I sat in the audience and observed a new employee orientation day where part of the program was a presentation by the COO on the LM initiative at the hospital.

3.2.3 Case Study II

The second case study was conducted at a well-established Canadian urban hospital (Hospital B) known as a preeminent leader in its area of specialty. As a Canadian hospital, it is essentially a government entity; all employees are employed by the Province in which it is situated and funding is provided by the Province. Although my research is focused on emergency departments of US hospitals, I wanted to conduct a case study in Canada to see if there were material differences from an operations perspective between the US and Canada based on their different approaches to healthcare funding and hospital ownership. After conducting site visits and research on US lean hospital exemplars (e.g., Virginia Mason, Thedacare), it had just commenced its initial foray into LM with an initiative that spanned the emergency department and one on its ambulatory inpatient departments. They had brought in external consultants (paid for by the Province) to kick start their program, but had now established a small internal LM support office. I gained access to this hospital through an acquaintance who was one of the emergency department physicians. He assisted me in setting up a meeting with the head of
emergency medicine and I was able to convince him to grant me access. I used a similar methodology and sampling technique as in hospital A. In total, I conducted thirteen interviews over a four day period.

3.2.4 Case Study III

The third case study was conducted at a world renowned mid-western US not-for-profit teaching hospital (Hospital C). This hospital has been actively involved in process improvement since its initial formation and has a well-entrenched continuous improvement program. Process improvement is part of its DNA; as such they have a large and long established systems engineering group within the hospital network with several teams that act as a support groups to any department seeking to improve their work processes. Monthly showcases of LM projects are conducted so that success stories and lessons can be shared amongst the hospital community (I witnessed this during my site visit). This hospital had several buildings within the mid-sized city and a network of clinics across the US. I gained access to this site through a contact I had made at a healthcare systems engineering conference a year prior to the case study. I was provided with a key contact in the internal systems engineering group who made contact on my behalf with potential interviewees. Once they agreed to be interviewed, I contacted them directly to schedule an appointment. I conducted fourteen interviews over a three day period.

3.2.5 Case Study IV

Prior to my final case study I created a draft of a descriptive research model based on the existing literature and a cursory assessment of the data I had collected through my first three case studies (see Table 3.1). The descriptive research model was based on both the literature review and themes emerging from the first three case studies. Internal validity or causality of the
### TABLE 3.1: INITIAL THREE CASE STUDY DATA ASSESSMENT

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Key Points</th>
</tr>
</thead>
</table>
| Support exhibited for planning and execution capabilities distinction   | ➢ Differences between required analytical skills in early planning phase of LM and necessary influence and persuasion skills required to get plans executed  
  ➢ While one project team could possess both sets of capabilities and potentially provide project continuity, usually a change in personnel occurred during hand-off between planning and implementation phases  
  ➢ Planning considered foundational to create value potential, while implementation considered moderator of project success and the realization of value                                                                 |
| Visible, persistent executive leadership and commitment to the initiative is required to optimize success of value potential development | ➢ Executives who disengage from the process put success at high risk  
  ➢ Consistent and highly visible support reinforces the perception that the LM initiative is a high priority within the organization  
  ➢ Encouragement and support of an open and trusting environment by leaders is a positive attribute                                                                                                                                                                                                 |
| An organization that has prepared itself for change is able to develop more lean potential (Holt et al., 2007) | ➢ Incentive systems in place that align with LM organization goals  
  ➢ Change management cultural preparations have been made or are in place to support change  
  ➢ Commitment to job security so employees don’t perceive LM as a way for management to downsize and reduce jobs                                                                                                                                                                                                                                                                 |
| Despite being able to efficiently plan and implement lean solutions, environmental certainty impacts the level of beneficial outcomes attained | ➢ Efficiency does not guarantee effectiveness and patient satisfaction  
  ➢ Stability in the environment enables more accurate matching of benefits of value realization operational objectives to patient needs  
  ➢ Consumer complexity and competitive dynamism key attributes                                                                                                                                                                                                                                                                 |

relationships between variables, at this preliminary stage was still uncertain. By visually presenting a preliminary model, I was attempting to get input from subjects on the relationships between variables and potential confounding factors not considered at this point in the study. The validity of the conceptual constructs or the accurate operationalization of the variables was still rudimentary at this point. Construct validity can be especially problematic in case study research.
because of potential investigator subjectivity (Yin, 2009). One of Yin’s (2009) three proposed remedies is using multiple sources of evidence. I used documents, interviews and observations to gather evidence and a disciplined method of recording and storing evidence. I used a semi-structured interview guide and consistent language used to explain the meaning of the variables and the causality when explaining the model to subjects. The intention of sharing this preliminary descriptive model with Case Study IV subjects was to solicit feedback to assist in next stage constructs evolution and to enhance construct and internal validity in future model iterations.

The fourth and final case study (Hospital D) was conducted at a network of thirteen varying sized hospitals in the southeastern region of the US. I gained access to this hospital group through the CEO, who I had approached at the World Healthcare Congress conference in Washington, DC in April, 2012. The non-profit hospital group was comprised of the main teaching hospital, and a network of twelve broadly disbursed hospitals of varying sizes, service populations and managerial structures within the state. This presented unique coordination and cooperation challenges relative to a single hospital setting. This potential coordination complexity was one of the main reasons I selected this location. This hospital group had created an internal LM team five years prior to the case study. The LM team had started with one individual and some small successes, gained a solid reputation in the hospital through successful facilitation of LM projects and was now expanding in size as internal requests for their services were increasing. The CEO put me in touch with the Director, Process Improvement Group (the original LM team member) who helped me establish contact with various employees he felt would be good interviewees. I scheduled appointments once I received word that they were willing to participate. I conducted twenty two interviews over a four day period and sat in on a
project LM team meeting in the cervical surgery group. I used the same interview guide, but
shared my descriptive model at the end of the interview to gain additional perspective on my
emerging theory.

3.2.6 Case Study Background and Methods Summary

Table 3.2 provides a summary of the four case study locations and select organizational
attributes.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Hospital A</th>
<th>Hospital B</th>
<th>Hospital C</th>
<th>Hospital D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geography</td>
<td>• Northeast</td>
<td>• Canada</td>
<td>• Midwest</td>
<td>• Southeast</td>
</tr>
<tr>
<td></td>
<td>• Large city</td>
<td>• Large city</td>
<td>• Small city</td>
<td>• Varied</td>
</tr>
<tr>
<td>Locations</td>
<td>• One</td>
<td>• One</td>
<td>• Two – with a large network</td>
<td>• Thirteen of varying sizes</td>
</tr>
<tr>
<td>Lean Experience</td>
<td>• Two years</td>
<td>• One year</td>
<td>• Decades</td>
<td>• Five years</td>
</tr>
<tr>
<td>PM Organization</td>
<td>• Small in-house team</td>
<td>• External consultants &amp; developing in-house team</td>
<td>• Several very large in-house teams</td>
<td>• In-house growing team</td>
</tr>
<tr>
<td>Ownership</td>
<td>• Not for profit teaching</td>
<td>• Not for profit government</td>
<td>• Not for profit teaching</td>
<td>• Not for profit teaching</td>
</tr>
</tbody>
</table>

The existing literature on LM did not contain enough empirical findings to enable me to
effectively develop research hypotheses related to my research questions (Edmondson &
McManus, 2007) to be tested with a quantitative survey instrument. In search of greater
phenomenological understanding, I conducted a series of four case studies in an effort to enhance
the quality of my phase two, quantitative research. Utilizing the principles of theory building
based on case studies (Eisenhardt, 1989; McCutcheon & Meridith, 1993; Miles & Huberman,
1994; Yin, 2009; Gioia, Corley & Hamilton, 2013), within-case analysis was coupled with cross-case analysis to enhance analytical rigor and uncover subtle similarities and differences between
cases leading to a more sophisticated level of comprehension (Eisenhardt, 1989; Yin’s 2009) and refinements to the initial descriptive research model and hypotheses development.

I used a two cycle coding methodology (Saldana, 2013). The first cycle involved assigning descriptive codes to data chunks from each interviewee. I used ATLAS.ti version 7.1.7 software to analyze the data. I used deductive coding (I.E. a provisional list of codes) to start my analysis (Miles, Huberman & Saldana, 2014). This method is appropriate for qualitative studies that build on prior investigations or research (Miles, Huberman & Saldana, 2014). This provisional list of codes (see Table 3.3) was descriptive and based on my prior experience in the hospital industry, review of the literature and reflections from my interviews. Simultaneous coding of data chunks with multiple codes was utilized.

The second cycle of data coding involved grouping the initial descriptive codes into clusters of emergent themes or patterns to enhance clarity of the phenomenon (Miles, Huberman & Saldana, 2014). This second cycle permitted the condensing of large amounts of data into smaller analytical units and the elaboration of my understanding of the phenomenon. These thematic clusters of related codes eventually became the constructs of my descriptive research model and the emerging relationships between them became my hypotheses.

While my information-oriented sampling approach enabled the obtaining of information from diverse cases (Flyvbjerg, 2006) and increased analytical generalizability within hospitals, patterns emerged from the coding that were common to all settings. Thus, while each iterative hospital case study was a distinct study that stood on its own as a unit of analysis, a comprehensive understanding of the phenomenon was achieved through the analysis of all 70 interviews collectively. This understanding helped to inform conceptualization of constructs and hypotheses embedded in rich, empirical evidence.
### TABLE 3.3: DESCRIPTIVE CODES

<table>
<thead>
<tr>
<th>Accountability</th>
<th>Active Project Management</th>
<th>Analytical Skills</th>
<th>Belief in Lean as Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Champion of Change</td>
<td>Change Required</td>
<td>Communication of Vision</td>
<td>Day-to-Day Guidance</td>
</tr>
<tr>
<td>Fact Based Decisions</td>
<td>Job Security</td>
<td>Instruction</td>
<td>Lean Training</td>
</tr>
<tr>
<td>Limited Hierarchical Behavior</td>
<td>Managerial Conviction</td>
<td>Marketing &amp; selling Lean</td>
<td>Motivation</td>
</tr>
<tr>
<td>Not Change Fatigued</td>
<td>Patient Centered Care</td>
<td>Project Management Skills</td>
<td>Project Plan &amp; Timeline</td>
</tr>
<tr>
<td>Safe Conflict</td>
<td>Supervision</td>
<td>Supervisory Skills</td>
<td>Structured Methodology</td>
</tr>
<tr>
<td>Teaching</td>
<td>Value Stream Mapping</td>
<td>Visibly Involved</td>
<td>Well-Functioning Teams</td>
</tr>
</tbody>
</table>

### 3.3 Exploratory Qualitative Case Study Results

#### 3.3.1 First and Second Cycle Coding

Initial coding was conducted using a provisional list of descriptive codes. I would code chunks of data with more than one code if appropriate (simultaneous coding). Upon completion of first cycle coding of all 70 interviews, I grouped codes into clusters of six themes that emerged. This second cycle of coding permitted greater clarity of the distinction between preparation and implementation dimensions of the lean-based initiatives described by the interviewees. I referred back to my interview notes to draw out representative comments from interviewees regarding each code. My provisional list of codes can be seen in Table 3.4 to Table 3.9. Codes are grouped by construct and selected interviewee quotes are provided for explanatory purposes. Negative and positive comments from interviewees are intermingled, yet add to the explanatory aspects of the codes. My goal was to focus on the variability of each item of interest along with its thematic relationship to other items. Figure 3.4 illustrates themes as the
hubs (white print, black background) and related descriptive codes linked by spokes to the thematic hub (e.g. analytical skills code to ability theme).

**FIGURE 3.3: CASE STUDIES CLUSTERING OF THEMES**

![Diagram showing the clustering of themes in case studies.](image-url)
# TABLE 3.4: ABILITY THEME

<table>
<thead>
<tr>
<th>Theme: Ability</th>
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</thead>
</table>
| **Analytic Skills** | - Performance improvement group brings expertise – analytics, data collection, use of algorithms and ask good questions  
- People are starving for tools  
- A doctor that was on the decision committee thought ROI and payback analysis were the same thing and would not back off  
- Training in basic Excel illustrative tools (graphs and charts) was provided, but no analytics  
- Most managers are nurses and have limited business knowledge and training  
- There is a lack of analytical skills in the organization - request for someone to create run charts was met with an answer that there was nobody in the hospital who could do them |
| **Lean Training** | - Formed a training team to diffuse knowledge throughout the network of hospitals  
- COO justification not about financial statement impact but about cultural change – believes in developing a grassroots movement of skills while simultaneously educating project champions and physicians  
- Training is about improving the skills of all to increase the overall contribution to the hospital  
- Project sponsor (COO) emphasized the need to create and instill internal capabilities - build core skills to ensure long term sustainability of efforts - cultural shift will not be temporary but sustainable  
- Made a conscious decision to build capabilities internally – “how do you get it to stick”  
- Teach teams how to fish and hope later projects they are more self sufficient |
| **Supervisory Skills** | - Coaching continued over two years - groups are now leading themselves and ownership within of the improvement process  
- Nurse manager training program given over one week with nurse clinical lead, management skill lead and process improvement lead all coaching nurse managers  
- Directors trained, but no instruction provided on how to disseminate knowledge down into their respective departments  
- Prior command style of implementation less costly and easier, but results not as good  
- Required consensus building skills not dictator skills |
| **Value Stream Mapping** | - Sometimes a process change is attempted without fully understanding the existing process and stakeholders involved  
- Change is tried on an element of, or the entire process that is not broken - alienated people - need some knowledge of the process  
- Team walked the patient experience; broke experience into smaller, more manageable pieces  
- Challenge was to unwind the entire system because changing only one would upset the rest of the system  
- Lack an understanding of linkages of value stream under study to other value streams - complexity discovered too late and project jeopardized as well as credibility - change broke other systems we were unaware of |
| **Project Management Skills** | - Staff typically do not have project management skills - don’t know what to measure or how to measure  
- Huge variability in process to process implementation ability  
- Implementation is difficult because it is tough heavy lifting  
- Implementation of large scale projects – shortage of skilled personnel  
- Team “aha” moment when it realized after multiple meetings with limited progress or direction - “We don’t know what we’re doing”  
- Within the organization there is a lack of project management skills and a non-biased office or system to prioritize opportunities  
- Recruited critical thinkers, interaction skills, presentation skills – “this deals with change management”  
- Stakeholder management skills - takes an investment of time but big payback |
# TABLE 3.5: ATTITUDE THEME

<table>
<thead>
<tr>
<th>Theme: Attitude</th>
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</tr>
</thead>
</table>
| **Change Required** | ▪ We have pain all around  
▪ Staff recognize that hospital is falling behind in approach and thus potentially more receptive to change and willing to embrace change  
▪ If staff can say “I saw it with my own two eyes” when translated back to unit and to peers we have a better chance of success  
▪ Need a burning platform, but focus should be on trying to explain why we need change  
▪ Current pain is less than the short term increased pain required to implement and get to a pain free state  
▪ Managers are open to integration of new process improvement ideas, but if what they’re doing is working fine, they’re fine with working with what they’re doing  
▪ Like a pebble in your shoe, if you ignore it long enough you get a callous and it doesn’t bother you, but you still have a pebble in your shoe  
▪ People are still starting to appreciate process improvement but there are still barriers to change or any rigid process; I am unclear whether the resistance is change in general or this process being proposed  
▪ A belief that this hospital, my department and I am special – typical methods and reasons for change don’t apply  
▪ Culture here is not conducive - change is not viewed as a good thing or viewed as positive  
▪ My 2nd project was not the unit’s idea and didn’t work well; “I’ve been here 20 years and I don’t care what you want to do, I don’t; I can wait you out”  
▪ We are solving today’s problems and not yet tomorrow’s problems; when I got here we were solving yesterday’s problems  
▪ Physicians designed and built the process so they had a vested interest in current system and were against most changes  
▪ Prism/perspective begets protection of paradigm – sometimes legacy of work to protect  
▪ 2-5% of time is value added typically, but employees when asked will say 50% of their time is value added  
▪ Culture of hospital likes to say that all welcome change, but not always true (longevity employees don’t like change) |
| **Sense of Urgency** | ▪ Get them to understand that the current state is really broken – show with data or a motivating factor  
▪ Hospital is now ripe for change, everything is broken, the train has derailed; we need to fix things rather than stay the course  
▪ Cross-pollination (team leader) helped as did the existence of a burning platform caused by increasing demand and bed blockage  
▪ Culture was motivated because volume in the lab was skyrocketing; staff asked process engineers to “see if you can find a way to help”  
▪ No burning platform like in the manufacturing industry; some staff still think we’ll just expand space when we are short - just build another building while physicians think “we are in a one player market” and dismiss other local hospital competition |
| **Job Security** | ▪ Efficiency thinks labor cuts by employees – reduction in force  
▪ Pockets of guardedness and fear; disconnects between staff  
▪ Nurses against Lean - union spread propaganda; nurse union hears of structure and the reaction is “NFW”  
▪ Too much “permission asking: mother may I”  
▪ During contract negotiations with Nurses Association, the union used negative propaganda with nurses that GE and TQM methods were not good for hospitals and that it would result in job cuts  
▪ Front line staff unsure of motivations of Lean  
▪ Hire staff with a balance of EQ, IQ and XQ (execution) – very picky we never fire anyone so I am stuck with who I hire for 20+ years  
▪ Staff fears – 1) you’re going to make us a factory and then 2) I am going to lose my job |
### Not Change Fatigued
- Lean - some of us are skeptics - just the process improvement label of the month
- A lot of people don’t understand Lean: just more management mumbo jumbo
- Lean is the new flavor of the day: just another process improvement initiative - “I seen about ten of these in my time here”
- Many employees have been here for more than 15 years - “I can wait you out, I’ve been here through 3 or 4 of you”; they’re connected to higher level provider who says “so and so doesn’t have to change or do that”; the employee just smiles and told you so
- Long term staff have seen many initiatives of process improvement and are very suspicious
- Culture shift – before it was “why aren’t they doing….. while now it is we are capable and who is going to champion this”
- Issue with too many projects and thus an inability to achieve optimal success
- Organization is always looking at ways to improve the process and standardize

### Belief in Lean as Solution
- Higher management roll out ideas do not work – if they would take the additional time to involve front line in decision making then they would work better
- Nurses Association – “You can take Lean and ….” - look at what it’s done for Toyota lately; misrepresented as a FTE cutting movement and challenges any and all changes
- Experienced nurses are throughout the hospital and are both vocal and skeptical
- Initial struggle with managing variation (patient care) and its apparent conflict with Lean methodology - realized some variation was acceptable
- What really worked was the Gemba - key learning was a level of grassroots thinking!
- Physicians are starting to buy-in to Lean - initially it was not considered “real science”
- I am all in but it wouldn’t surprise me if we failed
- Organization is committed to Lean as a tool to enable the long term health of the organization, but not Lean for transformational change
### TABLE 3.6: COACHING THEME

<table>
<thead>
<tr>
<th>Theme: Coaching</th>
<th>Instruction</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Simply getting them to think more systematically than in siloes led to efficiency; if we can get them to connect the dots they enjoy their job more</td>
</tr>
<tr>
<td></td>
<td>Aha moments lead to more holistic perspectives</td>
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<td></td>
<td>Ability to listen and translate into actionable/operational tasks</td>
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<tr>
<td></td>
<td>Provides a structure for mentorship, coaching and capability building within the hospital</td>
</tr>
<tr>
<td></td>
<td>Organization not used to being coached</td>
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<tr>
<td></td>
<td>Lean is not pushed on parts of the organization, we are brought in to help and organize efficiencies efforts</td>
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<tr>
<td></td>
<td><strong>Motivate</strong></td>
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<tr>
<td></td>
<td>Some staff are better and more skilled in process improvement – more experience, aptitude, motivated by a desire to fix or sense of personal satisfaction when improving something; others need more motivation</td>
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<tr>
<td></td>
<td>I act as an enzyme for change</td>
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<tr>
<td></td>
<td>Important to lead the horse to the water – shepherd the group</td>
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<tr>
<td></td>
<td>We create tools and enthusiasm</td>
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<tr>
<td></td>
<td>I’m an evangelist for Lean with a passion that likely cascades into my direct reports</td>
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<tr>
<td></td>
<td>We “targeted” specific physicians for involvement in meetings - best way to get them to participate is by a targeted request</td>
</tr>
<tr>
<td></td>
<td><strong>Teaching</strong></td>
</tr>
<tr>
<td></td>
<td>Telling people what to do is quicker, but burns bridges</td>
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<tr>
<td></td>
<td>Development of personnel is a foreign concept around here for some managers</td>
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<tr>
<td></td>
<td>We need resources with expertise to drive process and educate/coach</td>
</tr>
<tr>
<td></td>
<td>Coach from KPMG was available for three days a week on the project</td>
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<tr>
<td></td>
<td>“We are just learning to count” is said out loud to let people know where we are in the development process</td>
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<tr>
<td></td>
<td>Diffusion of Lean skills is a challenge requiring hands-on training and mentorship and the resources to provision such are not available</td>
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<tr>
<td></td>
<td>Both team leads had educator experience and gravitated to sharing the teaching materials</td>
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<tr>
<td></td>
<td><strong>Supervision</strong></td>
</tr>
<tr>
<td></td>
<td>Engage staff, don’t tell them what to do but shepherd, give them limitations (E.G. funds available for equipment)</td>
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<tr>
<td></td>
<td>I am responsible to put the right people in the first place and put them on the right seats on the bus</td>
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<tr>
<td></td>
<td>If you have no skin in the game, bosses wonder why you would want to spend time managing and certainly give you no time off to do so; others wonder why you would be in the project manager role if you’re not involved - what strange behavior?</td>
</tr>
<tr>
<td></td>
<td>Event forms are filled out when colleagues don’t adhere to protocol and their supervisors are supposed to follow up with complaint and rectify issue</td>
</tr>
<tr>
<td></td>
<td><strong>Day-to-Day Guidance</strong></td>
</tr>
<tr>
<td></td>
<td>Need a “dogger” of the process to get on the team and hold them accountable</td>
</tr>
<tr>
<td></td>
<td>Need right champions and the right project facilitators managing the daily actions</td>
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<tr>
<td></td>
<td>Issue is understanding data - which to pull and who to contact to get it pulled</td>
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<tr>
<td></td>
<td>Periodic meetings to discuss issues at times may seem redundant, but all communication adds to the richness of the issue being encountered</td>
</tr>
<tr>
<td></td>
<td>Daily statistics to leadership group and variance from performance goals are probed for rationale</td>
</tr>
<tr>
<td></td>
<td>Lots of visuals to demonstrate gains, have multiple touch-point meetings to review results and dialogues and emails to management if issues cropped up - all designed to avoid slippage</td>
</tr>
</tbody>
</table>
## TABLE 3.7: CULTURE THEME

<table>
<thead>
<tr>
<th>Theme: Culture</th>
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</thead>
<tbody>
<tr>
<td><strong>Well-Functioning Teams</strong></td>
</tr>
<tr>
<td>- Best work is in the emergency department as cross pollination of physicians and directors has allowed a more systematic approach</td>
</tr>
<tr>
<td>- Basic skills – working in teams, communication skills, knowledge on how to work towards common goals – lacking</td>
</tr>
<tr>
<td>- Invested significant time over the past year on trust and relationship development – now have many civil and some close relationships</td>
</tr>
<tr>
<td>- Buy-in requires a high trust factor on the team and amongst all parties</td>
</tr>
<tr>
<td>- Culture of hoarding good reports for themselves and not thinking what’s best for the organization as a whole and for the individual</td>
</tr>
<tr>
<td>- You would think we could solve problems using cross-functionally but we don’t have cross functional teams – we need to get out of our silos</td>
</tr>
<tr>
<td>- Physicians are not paid for meeting attendance, but if we go to the ER to conduct the order set meeting, they will participate if they are working</td>
</tr>
<tr>
<td>- For years there was an us vs. them conflict between ED and Inpatient Dept. – it was always their problem, but now we both own the problem – a real cultural shift; we now protect inpatient beds and they quickly pull patients from ED when we request it</td>
</tr>
<tr>
<td>- Recent surgical Lean initiative will be difficult because surgery still adversarial with emergency department</td>
</tr>
<tr>
<td>- Bed managers’ meetings - the language was about whose problem it was and placing blame, not solving root cause of issue; now we are being more open about a crisis situation and looking into causality and reasons for the issue</td>
</tr>
<tr>
<td>- Having frontline presence on the team is huge - helps with buy-in because they are involved in developing the ideas and they also bring a lot of great ideas to the team</td>
</tr>
</tbody>
</table>

| **Fact Based Decisions** |
| - Bring data |
| - We don’t measure well - bad data or no data at all |
| - Illusions of grandeur - one improvement will fix everything (I.E. a computer at the bedside will solve all my issues) |
| - Physicians and nurses more comfortable when the body of literature used to influence them – makes change easier |
| - Historically, when we solve problems we do so intuitively; Lean process permits problem solving using more rigor and thoroughness |
| - Often prioritization of projects and resources appears to be evaluated by who’s yelling the loudest |
| - First place I have been at where so much is done off line - numbers merged manually form multiple systems; I go to meetings and I have to continually say “I have no information on that; I’ll have to get back to you” |
| - Good documentation of facts and use of statistics helpful for obtaining physician buy-in; don’t want to make changes based on how we felt - this is an academic institution and we want to make changes based on objective results |
| - Focus on SSC (Short Stay Cohort) throughput and efficiency 8/70 beds; focused factory within a factory with headcounts benchmarked to leading peer-based hospitals in USA |
| - New Director’s leadership has brought a more fact-based approach to change and decision making |
| - In the past small incremental changes were made based on anecdotal evidence; issue with methodology and little data to support initiative |
| - Metrics presented at each meeting places the numbers in the forefront of my mind – makes me focus on performance metrics |
| - Concentrated effort using data to segment patients into more manageable cohorts and thus care processes |
| - Use statistical significant data but physicians still complain that the sample is only from a population that doesn’t represent their patients and the team could use in other department but not mine |
**Limited Hierarchical Behaviour**
- In 8 years I have never been invited to a nurse supervisor meeting
- The hospital is a matrix on steroids
- We have been running so lean (no money) for so long, that the organization became one of “survival of the fittest”, not one of helping each other
- Physician chairs can often have competing agendas which hinders collaboration, prioritization and decisiveness
- Physicians are called “consultants” at the hospital - when first hired I couldn’t understand why there were so many reserved parking spaces for consultants
- Long serving researchers and physicians have privileges – those are changing due to economic and political environment

**Safe Conflict**
- Discuss systems issues - not people or the particular person identified as the issue
- Not a bitch session; solution only posted on the wall not the problem
- Bring neurosurgeons into meetings with staff to air issues and identify improvement ideas - locate in lounge with pizza to try and create a safe, neutral environment
- Need to create a safe environment where they can talk - created what happens in Vegas anchor to indicate confidentiality of meeting discussions - they stay in the room
- I like somebody on the team who always asks why
- Always want the “Naysayer” to be part of the team – they often become the leader – “we want your passion”
- There exists a desire for excellence - needs to be part of organization culture and philosophy; it is happening in pockets where it is perceived “safe” for conversation
- Culture has changed and staff feel the environment facilitates them to speak up more, but it is still not completely open
- Culture is a well vetted one of mutual respect

**Patient-Centered Care**
- When discussion involves patients the results are usually better; debriefs on negative experiences end in good behaviors and results, but it takes a little time for physicians to change into proper mode of conduct
- For nurses change should make them consider – how will this improve care for patient and how is this going to make my job more efficient
- New process increases patient satisfaction and thus physician satisfaction - less dealings with unhappy families from long waits
- Patient care is the priority and should always take precedence however patient flow is also becoming a top of mind issue
- 90% of the time staff on board with change, but 10 % still have an issue with the staff being inconvenienced by change - they forget it is for the patient’s benefit and not the employee
- Key communication tool was to unify focus on the patient experience - all messaging and marketing materials distributed internally was framed from the patient perspective
- The patient is the process
- Physicians don’t want a cook book approach - but if a cookbook approach was better for patients, then why not utilize one?
**TABLE 3.8: LEADERSHIP THEME**

<table>
<thead>
<tr>
<th>Theme: Leadership</th>
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</table>
| **Communication of Vision** | - Need to learn how to communicate to different stakeholders  
- I have to be 100% sold before I’ll stand up and support project….it’s an integrity thing  
- There are a lot of good people; if engaged in the right way will do whatever it takes  
- Interesting that you chose here to look into Lean Management - we’re just dabbling in it; COO is interested in Lean, but hasn’t truly set the stage for why we’re doing it  
- There is a quality group and then the Lean office was initiated - Director of Applied Solutions “just appeared one day”  
- Told for a long period of timing that the process change was coming - it was not a shock or a jarring experience; deployment was very smooth and seamless - perhaps the constant communication during the pre-implementation process made it seem to naturally happen  
- Presented internally the project to anyone who would listen; conscious of language used to ensure no one is offended by manufacturing like references  
- Clear expectations and communication of the objectives with a system of reinforcement  |
| **Marketing & selling Lean** | - Learn over the years that getting buy-in and addressing resistance early is a big enabler of success  
- I use subtle behind the scenes influence to help enhance buy-in  
- Physicians (buy-in/support) are incredibly important to get things done; make or break the success of any initiative; get them involved up front otherwise they can throw a wrench into things  
- Lean is important to the senior team, but the concept has not been culturally accepted by all  
- Involvement of both frontline and office staff very beneficial for solution design as well as getting buy-in for implementation; frontline believes it is being heard, and thus even if their input is not used in the solution, they are more willing to go along with solution being implemented  
- The motivation for the project I would like to believe is better patient care, but I believe the hospital administration must have an ulterior motive  
- Numbers are provided in meetings but it is challenging to find a practical application - how do these numbers relate to what I care about - we haven’t been working with the numbers and thus they are not as familiar or easy to comprehend; I.E. 6 out of 100 specimens mislabeled – “what are we going to do about that” – if the errors were discussed in a better fashion and personalized “ what if your mother was one of the six” then it would result in better impact  
- Something had to be done, but the rapid buy-in was also due to the effectiveness of the solution in pilot and the quality of the sales job; the endorsement of senior management was important to the project success  
- Stakeholders unidentified early and thus become a roadblock or delay project – tougher in large hospital because so many people are affected  |
| **Managerial Conviction** | - By doing things differently – did we lose staff, absolutely!  
- Greenbelt training process was too slow - how do I justify…time over 5 months  
- The program appears to be losing steam; tone from the top is lacking  
- No time was allocated for GB training – “I doubt you spoke to anyone who’s boss gave them dedicated time to do training”  
- COO brought in new Director and there was a lot of buzz - Lean was the next big thing; the buzz was lost as budget process takes priority, then nurses strike preparation, the budget again, then JCAHO prep, the resources cut so no time to focus on projects  
- Lean is apparently not on the senior team radar anymore - “Don’t hear much about it anymore”; no presentations of successful projects at Manager meetings, no discussion of Lean at all really  
- Not unusual (happening now with patient experience) for momentum to fade  
- Perception is that Lean is not important to the hospital at this second - other issues are presumably more important and get more emphasis |
| Always something big - shouldn’t be the reason for losing focus on Lean - the “next big thing/event” causes administration to lose focus; management should maintain focus to keep the team focused |
| Management’s allocation of protected time (FTE resources) for project sends a strong signal about its importance |
| Leadership team is united in message to team regarding change |
| Leadership is supportive (time) of professional development and involvement in process improvement work groups |
| We have the benefit of consistent leadership and consistent organizational priorities; we can always tie projects back to practice goals - clarity in purpose |
| Once your persistence flags, you’re done! |

**Visibly Involved**

| Leadership involvement and presence drives project pace |
| Going to the GEMBA is important for communications with frontline personnel |
| It is important for senior management to be involved visibly |
| Senior manager introduces success program and then leaves - demonstrates importance but allows team to generate solution |
| Staff believed that no one cared about the unit, no one cared about them as individuals, director was invisible, communication was bad (learned everything in the cafeteria), no transparency, no guidance and no visibility into finances |
| Senior director 100% on board - I have resources at my finger tips and senior director is involved in training |
| A lot of project initiatives originate from the VP level, but the VPs are less interested in being involved and engaged – can be a time management issue – too many balls in the air |
| Director of Medical Surgical Nursing didn’t come to any meetings; need leadership involvement to succeed - by title or more importantly by influence |
| Senior leadership team is not viewed as cohesive by staff; at monthly Managers meetings (auditorium with approx. 100 Managers) senior team sits in cliques - SVP, CEO of PO, COO of PO and one other sit together, COO of hospital is alone, etc. |
| Senior leadership thinks they portray a well-functioning team, yet Managers perceive them to be a dysfunctional group; CEO is externally focused, so somewhat insulated or apparently naïve to the issue |
| Senior manager commitment was “hugely important”; 30 minute meeting with COO every two weeks, COO providing coaching on navigating organizational culture and politics, COO assisted with removing roadblocks and opened doors to communicate within organization |
| If COO walked into emergency department, nine out of ten people wouldn’t know who she was; the Director earned respect through his presence - is viewed as a good leader |
| Past CEO and current CEO extremely hands on and visible on Lean projects – visit departments, express support and provide leadership – “CEO visit – that was great!” – “Top down thing never hurts” |
| Leadership (CEO) came into the room and clearly endorsed and stressed the importance of this change |

**Champion of Change**

| Leadership component - need transformational leader - not a dictator; remove barriers to success, provide strategic direction, but does not define the process |
| Strategically engaged senior influential with an assertive personality |
| Stakeholder management is exponentially important |
| Stakeholder management was key - “stuck moving around boulders”; important to have senior management involvement – beneficial for removing barriers |
| Issue was identified by the CFO and he championed it all the way; project went smooth because the CFO provided clear leadership |
| My world revolves around how to utilize influence to enable others in their work |
| Fundamental problem pre new COO was a lack of and no clear project leadership champions |
| Leadership is required to get people over each hump or transition points in the continuum |
| Barrier to success is selling ideas up to more senior management and getting them to commit the required resources |
### TABLE 3.9: PROCESS

<table>
<thead>
<tr>
<th>Theme: Process</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Accountability</strong></td>
<td></td>
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<tr>
<td>Accountability absolutely mandatory</td>
<td></td>
</tr>
<tr>
<td>We’ve got to get better at being firmer</td>
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</tr>
<tr>
<td>Nurses and techs would not accept accountability for the Improve element; could not accept that they could have been part of the problem</td>
<td></td>
</tr>
<tr>
<td>The Nurse manager had no training; she was a long time nurse, but like nurses and techs she could not accept accountability for any aspect of the problem</td>
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<tr>
<td>Project sponsor lacked a willingness to apply pressure on pathologists; so the project was stifled by their unwillingness to change workflow</td>
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</tr>
<tr>
<td>It used to be (cases where due to bed blockage) patients would be in ED for &gt; 48 hours and sometimes would be discharged before they ever got a bed (spent entire stay in ED); now if a patient is in ED for &gt;24 hours the CEO is aware</td>
<td></td>
</tr>
<tr>
<td>KPMG is applying the Theta-care model from Wisconsin to drive an accountability culture and structure for improvement</td>
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</tr>
<tr>
<td>We need to move to a model where it is expected that physicians have a process improvement support component expectation as part of their job just like teaching and research</td>
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</tr>
<tr>
<td>There is a new whiteboard in ED with metrics and a place for suggestions - staff are starting to realize that issues are theirs to take ownership of and solve</td>
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<tr>
<td>Important that there is an established and clear expectation of time limitations on patient transfers, staff are held accountable and are required to explain exceptions to time limits</td>
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<tr>
<td>A poorly executed project had a lack of implementation accountability</td>
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<tr>
<td>Superstars don’t want to be told what to do</td>
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<tr>
<td><strong>Project Plan &amp; Timeline</strong></td>
<td></td>
</tr>
<tr>
<td>Monthly stop light reports - used as a tool - why yellow or red and plans to address</td>
<td></td>
</tr>
<tr>
<td>Bigger initiatives have a documented project plan with monthly actions, backed up by data, control mechanism and measurement</td>
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<tr>
<td>Meetings are unproductive; no pre meeting agenda sent, culture of showing up, but not doing anything (I am here to express my opinion, but that’s it); no one has action items or expects to have work to do coming out of the meeting</td>
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</tr>
<tr>
<td>The KPMG framework was extremely helpful for guiding the process - it required the team to stick to the timeline and meet deadlines</td>
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<tr>
<td>It was satisfying to work on a project with deadlines and clear deliverables – prior experiences on projects in the hospital were “wishy-washy” - no deadlines, meetings cancelled, teams changed, no clear timeline or deliverable, etc.</td>
<td></td>
</tr>
<tr>
<td>When I started here, I was told we would be finished a renovation to the ED in two years; it is now five years and it still isn’t completed – Lean was done quick</td>
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<tr>
<td>Introduce a common plan – important to lay the groundwork and provide structure</td>
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<tr>
<td><strong>Structured Method</strong></td>
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<tr>
<td>Coordination is very challenging - we get in our own way when we don’t have a good process</td>
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<tr>
<td>Without tracking and reporting structure we would be less successful</td>
<td></td>
</tr>
<tr>
<td>Process helps us do a few things well versus a lot of things bad</td>
<td></td>
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<tr>
<td>Common frameworks enable staff to speak the same language as process improvement group</td>
<td></td>
</tr>
<tr>
<td>Prior to this we had great ideas but we couldn’t execute; initially our goal was “to save world hunger” but the charter provides structure and focus</td>
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<tr>
<td>Lean and PMBOK provide more rigor and discipline to project management process - people take notice when more structure is evident</td>
<td></td>
</tr>
<tr>
<td>Use charter template owned by physician and administrator jointly with periodic reviews at hospital delivery platforms (green, yellow, red reports); portfolio of projects updated monthly for higher level reviews</td>
<td></td>
</tr>
<tr>
<td>Start by meeting with leadership and gaining buy-in and agreement on objectives and deliverables – project charter used for larger projects while smaller project follow same charter guidelines but don’t fill out the paperwork in such detail</td>
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</tbody>
</table>
3.3.2 LM Case Studies Impact on Descriptive Model

Upon examination of the data, themes emerged that informed further development of my conceptual understanding of the phenomenon. The key foci were on enhancements to capabilities understanding, improved distinction between preparation and implementation capabilities, and distinguishing between Lean and LM. The organizational resources that now collectively reflected a Lean Preparation Capability had expanded to include additional (or more granular) dimensions of institutional and individual resources. The “Ability” themed cluster from my case study research was relabeled “LM Skills”. The “Attitude” cluster was relabeled “LM Climate”. The “Culture” cluster was relabeled “LM Culture”. The “Leadership” Cluster was relabeled “LM Executive Leadership”. The “Coaching” was relabeled “LM Supervision”. And finally, the “Process” Cluster was relabeled “LM Implementation Capability”.

Mahoney & Pandain (1992) argue that a firm can make money (achieve rents) not simply because it has superior resources, but because it has a distinctive competency that allows it to make better use of its resources. This separation of superior asset (resource) and superior deployment of the asset (competency) is an important distinction. In relation to LM, this
distinction between preparing (strategically readying the organization and its personnel) and implementing (executing lean-based initiatives) was made clearer through the interview process. Interviewees generally felt that although continuity of some personnel was beneficial to the project’s overall success.

“Some people like to hand off ideas to others to just implement; need ownership of both - team continuity with the ability to add and drop skills throughout the process”
~ Project Manager, Science of Health Care Delivery ~

“Important to have continuity - the same team; engaged all the way through by picking the right people up front”
~ Director, Emergency Department ~

Interviewees generally felt that the two phases of LM required different sets of skills or capabilities.

“Skills required for various phases on projects differ: 1) diagnostic is a brainstorm and requires creative and diverse thinkers, 2) solution requires higher level thinking, and 3) implementation requires determination, persistence, leadership, broader knowledge and more effort”
~ Emergency Department Physician ~

“Implementation requires a different skill set”
~ Emergency Department Physician ~

“Selected 10-12 members based representation from other areas of the hospital and perception of having skills of influence, leadership, and adaptability – greater weighting on implementation requirements than on analytical skills”.
~ Project Leader, Lean-Based Initiative ~

“Skills required for data gathering are quieter and removed. Implementation skills require more interaction – to get them to listen”.
~ Emergency Department Nurse ~

“Planning is more task focused while implementation is both task and people focused.”
~ Director, Emergency Department ~

“Implementation and sustainability is a different process than solution development and design – it is a separate track. The skills may not be the same and thus perhaps different people should be doing different tasks”.
~ Emergency Department Nurse ~
“Different skills required across the continuum of problem solving, data collection and analysis, marketing ideas and expanding upon solutions”.
~ Division Head of Emergency Medicine ~

In addition, some interviewees commented on the temporal aspect of developing organization capabilities and the importance of preparation before implementation.

“Had to invest one plus year in educating staff”.
~ Operations Manager, Office of Access Management ~

“Executive team thinks culture change can occur in three weeks - the team has been tasked with creating the three week project - this is ludicrous, but a sign of the executive team’s thinking on change management”.
~ Project Leader, Performance Improvement Group ~

From my case study research, the distinction between LM and Lean became much clearer. LM emphasizes the firm’s managerial and executional deployment efforts associated with its lean-based initiatives. Lean on the other hand refers to the tools, concepts, practices and eventual outcomes of its lean-based efforts. Active management of its lean-based initiatives program incorporates cultivation of resources into capabilities and activation/leveraging of capabilities into a competence. These perspectives, collectively informed revisions to my initial Conceptual Research Model as now depicted in Figure 3.4.

**FIGURE 3.4: REVISED CONCEPTUAL RESEARCH MODEL**
3.4 Rigor

Carefully planned and executed study design addressed rigor and ethical criteria, while transparency in sampling and data collection and the use of multiple subjects from multiple locations and levels/roles in LM deployment helped address credibility and sincerity criteria. The purpose of the case study research was to enhance understanding of the phenomenon and inform subsequent quantitative research and theoretical model development. Analytical rigor augmented with checks for quality (e.g. researcher effects, data representativeness) and searching for both negative and positive evidence led to findings that can make a meaningful conceptual and theoretical contribution and resonate with audiences interested in LM and hospital process improvement. Through diligent attention to design, execution and analysis, this case study research addresses Tracy’s (2010) eight “Big Tent” criteria for excellence (see Table 3.10).

3.5 Summary

Considering Tracy’s (2010) model for excellence in qualitative research, my case study research of LM deployment in hospitals is certainly timely, relevant and of significant worthiness. My case study research helped enhance my understanding of the LM deployment phenomenon in US hospitals. At this point, through my further immersion in the hospital contextual environment, collection and immersion in the data from my interviews, theoretical coding and analysis of the data, category saturation (Goulding, 2002) was more likely to have occurred and an increase in my theoretical sensitivity (Glaser, 2008) has enabled the further refinement of my Conceptual Research Model. The results of this case study research have shaped the reconceptualization of my research model, construct formulation and laid a foundation for hypotheses development (Eisenhardt & Graebner, 2007). My emerging theories on LM deployment capabilities and competence now require further specification of constitutive
definitions of the constructs in my Conceptual Research Model, the further discussion of theoretical argumentation for the relationships between those constructs and stipulation of hypotheses to be tested and verified through my quantitative empirical survey study. The findings from my qualitative case study research formed the foundation of those next steps as described in Chapter Four.

**TABLE 3.10: ADDRESSING TRACY’S BIG TENT CRITERIA**

<table>
<thead>
<tr>
<th>Criteria (Tracy, 2010)</th>
<th>How Addressed</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Worthy Topic</strong></td>
<td>• The organizational and operational capabilities that underpin the successful deployment of LM in hospitals is relevant, timely, significant and interesting topic to both scholars and practitioners</td>
</tr>
<tr>
<td><strong>Rich Rigor</strong></td>
<td>• Four distinctive case study sites purposefully chosen</td>
</tr>
<tr>
<td></td>
<td>• 70 interviews conducted</td>
</tr>
<tr>
<td></td>
<td>• Semi-structured interview guide</td>
</tr>
<tr>
<td></td>
<td>• Within and across case data analysis</td>
</tr>
<tr>
<td><strong>Sincerity</strong></td>
<td>• I attempted to diminish the effect of my personal biases and subjectivity</td>
</tr>
<tr>
<td></td>
<td>• I am clear and transparent in my methods, data collection and the challenges with harnessing my biases and subjectivity</td>
</tr>
<tr>
<td><strong>Credibility</strong></td>
<td>• I use quotes from multiple interviewees from different case studies</td>
</tr>
<tr>
<td></td>
<td>• I triangulate data from multiple interviewees and case study locations</td>
</tr>
<tr>
<td><strong>Resonance</strong></td>
<td>• My emphasis on both the necessary organizational preparations and subsequent execution as keys to competency is interesting</td>
</tr>
<tr>
<td></td>
<td>• Findings transcend the industry under study but contextual effects are still likely to exist</td>
</tr>
<tr>
<td><strong>Significant Contribution</strong></td>
<td>• Conceptual and theoretical contributions result from the study and can result in advances to both scholarship and practice</td>
</tr>
<tr>
<td><strong>Ethical</strong></td>
<td>• I followed all ethical procedures as outlined by my academic institution</td>
</tr>
<tr>
<td></td>
<td>• I use professionalism in all contact with interviewees and case study representatives</td>
</tr>
<tr>
<td></td>
<td>• I will follow up with a research report with each case study location upon completion of my work</td>
</tr>
<tr>
<td><strong>Meaningful Coherence</strong></td>
<td>• The case study research achieved its intended goal</td>
</tr>
<tr>
<td></td>
<td>• I followed methods and procedures consistent with the objective</td>
</tr>
<tr>
<td></td>
<td>• The findings will be integrated into a mixed methods study and inform meaningful insights and interpretations of the phenomenon</td>
</tr>
</tbody>
</table>
CHAPTER 4 – THEORETICAL FRAMEWORK

4.1 Introduction

At the end of Chapter Three, I outlined my Revised Conceptual Research Model (see Figure 4.1) for my thesis. Based on data from 70 interviewees, this model emerged as an improved version after two rounds of coding and the emergence of several clusters of dimensions associated with experiences described from interviewees in respect to their personal and organizational journey through recent LM initiatives. In this chapter, I discuss the theoretical underpinnings of the relationships proposed between constructs (based on resource based theories with supportive framing by the value generation literature) providing argumentation for their causal relationships and a foundation for subsequent hypotheses development. In addition, I provide conceptual definitions for the constructs that provide a linkage to their operationalization in Chapter Five.

FIGURE 4.1: REVISED CONCEPTUAL RESEARCH MODEL

- LM Skills
- LM Executive Leadership
- LM Supervision
- LM Climate
- LM Culture
- LM Implementation Capability
- LM Preparation Capability
- LM Competence
- Environmental Uncertainty
- Loan Based Benefits
4.2 Lean From A Value Generation Perspective

A value system is comprised of multiple consumers, value creators and value capturers. Consumers of products and service offerings seek to satisfy needs and extract value from the system through increased utility and lower prices; the consumer ideal is lower price and increased functionality (Cox, 2004). Value creators develop, design and subsequently deliver product or service offerings seeking to maximize consumer perception of value by identifying novel combinations of resources that meet consumer needs and creating offerings that have the greatest potential to maximize payments into the value system (Priem, 2007). By developing new markets, expanding on existing markets or increasing prices, firms seek to grow the potential for value capture (Lepak et al., 2007). Value capturers attempt to extract maximum value created by the system through unique offerings of their own or copying others. While creating potentially valuable offerings for consumers is a competence, to maximize realization of that potential value (the monetization of value created) requires the successful capturing of utmost value from the value system.

For purposes of this discussion on value, I use the definition from Pitelis (2009: 118): “Value is the perceived worthiness of a subject matter to a socio-economic agent that is exposed to and/or can make use of the subject matter in question”. The fact that value is perceived infers that the consumer has the primary role in establishing that value. Customers are both the beneficiaries of those offerings and the judges of their value (Priem, 2007); it is therefore highly subjective, context specific and heterogeneous (Lepak, Smith & Taylor, 2007). Thus, both product and service offerings have value potential, but that value created is latent until realized when customer validation occurs. If consumers don’t place any value on the offerings, then a
A firm cannot generate competitive advantage or other benefits from their value creation attempts; their actions directed at value creation would have been wasteful, non-value adding activities.

A critical point in the thinking about LM deployment is its focus on value (Hines, Holweg & Rich, 2004) or as Porter & Lee (2013) label it "a value agenda" (pg. 3). LM involves the systematic paring of waste from operational systems in order to both improve the productivity and quality of throughput flows, and increase the value-add ratio of all work activities on an ongoing basis in pursuit of increasing value generation for and from its customers. Continuous improvement efforts made by an organization are an attempt to increase both the effectiveness of process flows (QT) and the efficiency of work effort (PT); the result is greater customer utility at the same price or a reduction of costs for the same level of customer utility. An organization that demonstrates a proficiency in the functions related to value creation (high degree of QT and PT) is said to possess a LM Competence; the ability to create valued offerings that potentially result in enhanced organizational competitiveness and greater value capture. Deriving Lean-Based Benefits requires the realization of that potential by the capturing of value created.

I conceptualize LM deployment as a value generating activity. Value is designed in an initial phase of value creation as the organization cultivates its resource bundles with a view to generate value. A second phase of value creation requires the activation of those resources; the delivery of value completes the value creation stage. At this point, the firm has demonstrated an ability to create value through lean-based initiatives and thus is said to possess a LM Competence. Capturing of value and the resulting Lean-Based Benefits is the realization of value from lean-based initiatives. This three phase perspective on value generation aligns with my conceptual LM model (see Figure 4.2).
4.3 Divergent Theories Of Strategic Action

The question of what drives strategic action has occupied a central position in the strategic management literature. Although several explanations of strategic action have been developed, two views have been particularly dominant - industry structure and resource based (Hunt, 2000). The industry structure view assumes complete rationality on the part of strategic decision makers and contends that industry structure influences the timing and effectiveness of strategic actions (Bain, 1956; Mason, 1957; Porter, 1980, 1985) and thus performance. According to traditional Industrial Organization (IO) economics (Bain, 1956; Mason 1939), industrial structures determine firm conducts, which in turn determine the collective performance of firms in the marketplace. Conducts are simply the reflection of industrial structures and thus can be ignored; therefore, performance can be directly explained by industrial structures (Porter, 1981).

It is necessary to note that the IO economics view takes the strategic group (firms with similar strategies) or the industry as the unit of analysis (Porter, 1981; McWilliams & Smart,
1993). It assumes that firms within an industry are homogeneous and thus have the same response to the same environmental change, and result in the same performance; the pursuit of sustainable competitive advantage is thus primarily driven by factors external to the firm. However, firms in the same industry may also differ in resource endowments (Penrose, 1959; Wernerfelt, 1984; Barney, 1991). The same environment change may generate opportunities for some particular firms, but threats to other firms. Therefore, they may respond differently to the same environmental change.

In contrast to the IO perspective, the resource based literature suggests firms are comprised of heterogeneous collections of productive resources and capabilities. While some empirical studies show that industrial factors do affect firm performance (Schmalansee, 1985; Rumelt, 1991; McGahan & Porter, 1997), resource based scholars theorize that competitive advantage and above normal performance is enabled by the application of valuable, rare, inimitable and operational (VRIO) resources primarily derived from internal not external factors (Penrose, 1959; Barney, 1991; Barney & Arikan, 2001). So while IO based theories generally suggest that firm performance differences are unusual and temporary, resource based theories presume that different levels of firm performance may exist within an industry and that those performance levels may persist due to potentially sustainable resource advantages (Barney & Arikan, 2001).

Research into LM has predominantly taken a resource based view of strategy (e.g. Lewis, 2000; Parry, Mills & Turner, 2010; Wiengarten, Fynes & Onofrei, 2013) whether using a primary resource based view (Penrose, 1959; Wernerfelt, 1984; Barney, 1991), or other theories that are natural extensions of the resource based view like competency theory (Prahalad & Hamel, 1990) or dynamic capabilities theory (Teece, Pisano & Schuen, 1997). If the nature of
LM is about improving the organization’s processes through its people - its resources, an IO perspective is incongruent with the LM approach. Thus, I assume a perspective founded in a resource based view rather than an IO perspective for purposes of this thesis.

4.4 Resource Based Theories

Strategic LM is a capability and resource based competency (Bhasin, 2012) that manifests itself in enhanced value for customers through improved operational performance outcomes (Eroglu & Hofer, 2011). Management’s pattern of resource decisions (acquisition, cultivation, orchestration and leveraging) results in capabilities and competencies that contribute to the success of the organization. Thus, when I examine LM in the US hospital industry, an assumption that there exists heterogeneity of amongst hospitals is made and the impact of resources, capabilities and competencies on operational and organizational performance is my focus. My emphasis for study is on the possession of individual and institutional resources, capabilities and LM Competence, no matter how they were developed, acquired, or accessed and the impact of their possession on generating value for and from the hospital’s customers as manifested in Lean-Based Benefits.

4.4.1 Resource Based View (RBV)

The RBV of the firm provides a theoretical foundation explaining why firms can build and sustain competitive advantage. It originates from the idea of viewing the firm as a collection of productive resources (Penrose, 1959), which include “all assets, capabilities, competencies, organizational processes, firm attributes, information, knowledge, and so forth” (Barney, 2002: 155). It assumes that different firms possess different resources and some resources are immobile (Barney, 1991). The key contention of the RBV is that if a resource is valuable, rare, inimitable and can be organized (VRIO), it will help to build sustainable competitive advantages, resulting
in above normal performance (Barney, 1991). “The value of resources can also be determined by their ability to enable firms to conceive of and implement strategies that are appropriate to the market within which the firm operates” (Barney & Arikan, 2001: 138) and thus firm performance will be significantly more affected by firm effects derived from resources than by industry effects (Rumelt, 1991).

While the RBV is a well-established and utilized theory for explaining firm performance and competitive advantage due to heterogeneity in resources, it has certain limitations. The RBV assumes that all resources are similarly implemented; “the remarkably naive view that once a firm understands how to implement strategies that can be sources of sustained competitive advantage, that implementation follows, almost automatically” (Barney & Arikan, 2001: 175). Since a foundational aspect of this thesis is that value delivery as represented by implementation capabilities are heterogeneous amongst hospitals (the mere possession of a unique resource or bundle of complementary resources does not assume that it will be utilized to its fullest value generating potential), the RBV does not completely explain the phenomenon under study. Other resource based theories must be examined.

4.4.2 Competence Theory

Competitors have difficulty neutralizing advantages created by resources that are immobile, socially complex, interconnected, tacit, require critical mass before they can be deployed efficiently or necessitate long periods of time to acquire (Barney & Arikan, 2001). Capabilities and competencies often fit this description (Prahalad & Hamel, 1989). Capabilities are features, faculties or processes that can be developed or improved; activities that a firm can do better than its competitors (Hayes & Pisano, 1996). Operational capabilities are derived from the firm’s aptitude at utilizing operational practices and resources and cultivating them towards a
desired end (Flynn, Wu & Melnyk, 2010). Capabilities are not the same as resources, but represent a superior way of allocating, coordinating and deploying resources (Flynn et al., 2010) embedded in organizational processes that are focused on coordination, learning and transformation (Harreld, O’Reilly, & Tushman, 2007). Capabilities cannot be purchased; they are organizationally specific and must be developed internally (Flynn, Wu & Melnyk, 2010). They do not reside within individual routines, but emerge over time from the synergies between sets of interrelated routines suggesting that they are developed through managerial decisions of identification, development and coordination of those routines (Peng, Schroeder & Shah, 2008). Their value is derived from their inimitability and difficulty in transferring them. Thus, capabilities derive much of their value more from organizational infrastructure, people, management and information systems, learning, and organizational focus.

Competencies are typically viewed as socially complex, interconnected combinations of capabilities and resources (often with a tacit component), that fit together synergistically and work in combination (Coates & McDermott, 2002). They represent a functional adequacy or sufficient skill or knowledge; a bundle of capabilities that in practice a firm leverages better than its competitors. Competencies play a major role in enabling firms to process more efficiently and effectively products and services that meet customer needs. This value creating competence is distinct to the firm and thus has the potential to provide marketplace advantages (Coates & McDermott, 2002; Hunt & Morgan, 2005).

Competence theories are founded on the beliefs that the essence of strategy is in the development of competitive advantages for the future at a rate faster than competitors can copy existing advantages, and that maintaining or creating competitive advantage relies on an organization’s ability to develop and improve existing skills and learn new ones (Hamel &
Prahalad, 1989). In essence, a distinctive competence (one that provides a competitive advantage) is a collection of attributes that allows the firm to pursue a chosen strategy more efficiently and effectively than its competitors (Barney & Arikan, 2001). Competency theorists argue that for a competence to be core it should make a significant contribution to customers' perception of value, be difficult to imitate, and provide access to a broad variety of markets (Hunt, 2000).

Organizational routines are persistent, regular and predictable patterns of behaviour (Nelson & Winter, 1982) and form the foundation of capabilities and competencies. Nelson & Winter (1982) argued that competencies and capabilities can provide sustainable advantages because they are based on organizational routines that are causally ambiguous stemming from their complexity, tacit qualities and specificity. These routines form heterogeneous knowledge resources and capabilities among firms that are the main determinants of superior performance and sustained competitive advantage (Eisenhardt & Santos, 2002; Oliveira et al., 2002); "the most sustainable advantages are those based on an organization’s ability to improve” (Hayes, Pisano, Upton & Wheelwright, 2005: 68).

4.4.3 Resource Advantage Theory

Resource Advantage (R-A) theory is an evolutionary, general theory of competition that describes the process of competition (Hunt & Morgan, 2005). R-A theory “is a direct fusing of marketing’s heterogeneous demand theory with management’s resource based theory of the firm” (Hunt, 1997: 59). R-A theory draws on IO theory, resource based theory and competence theory. R-A theory shares with IO theory that the goal of the firm is superior financial performance and that superior financial performance results from market place positions of competitive advantage. However, R-A theory explains that the market place position of
advantage is derived from comparative advantages in resources and competences. Like IO theory, R-A theory agrees that competitors, suppliers and buyers influence rivalry and firm performance; however it does not stop there in its theorization. R-A theory argues that industry structure does not entirely explain or determine performance; heterogeneous firm resources explain most of the variance in firm performance (Rumelt 1991; Roquebert et al., 1996). The perpetual struggle between firms for comparative advantages in resources (both tangible and intangible) yields advantageous positions leading to the potential for superior financial performance (Hunt, 2000). The imperfectly mobile nature of some of these resources contributes to a firm’s ability to sustain their competitive edge through a comparative resource advantage.

Despite its similarity to the RBV, R-A theory does not share the view that competition is an equilibrium seeking process. R-A theory refutes that the pursuit of perfect competition or equilibrium seeking is the goal of competition. Rather, competition is disruptive to the equilibrium; the constant struggle for advantage and superior financial performance is dynamic in nature and thus continually shifts the equilibrium (Hunt & Morgan, 2005). Firms are not seen as passive responders reacting to a changing environment by best matching resources to market opportunities, but as proactive participants, anticipating opportunities, designing offerings and acquiring, developing or creating the required resources, capabilities and competencies to create value adding offerings to capitalize on the changing environment (Hunt & Morgan, 2005). The pursuit of advantageous resource positions promotes rivalries and engagement in activities that are disruptive to the status quo (Hunt, 2000). Thus improvements, learning and innovation are natural results of R-A theory and as a consequence, perfect competition as assumed by neoclassical economics based theories, is not always achieved. Since perfect competition may be a condition at times and perfect equilibrium achieved, R-A-theory does not contradict
neoclassical economics based theories, but rather absorbs them as a possible condition, but not a necessary condition, for the theory to hold (Hunt & Morgan, 2005).

The soft assets of the firm are becoming an increasingly important aspect of its value (Gummesson, 1995). Human capital, social capital, relational capital, structural capital and organizational capital can be resources at the firm’s disposal to assist its pursuit of superior financial performance (Hunt, 2000). Behavioural assets like routines and competencies can be a main source of the firm’s wealth creating capacity (Falkenberg & Herremans, 1995) and intangible, heterogeneous and immobile resources are important elements of a firm’s resource base. By expanding on the neo-classical definition of capital, R-A Theory permits the inclusion of the social element and its role in the development of “higher order” competencies (Hunt, 2000). This broader definition of capital and constant struggle for comparative resource advantages results in innovation and the development of “higher order” resources and capabilities with the potential to generate value, and effect operational and organizational performance.

R-A theory’s supports the view that organizational learning occurs through the process of competing; adaptation of tangible and intangible assets is a function of competition, and growth is a natural by-product of that competition. Acting like a feedback loop, organizations come to learn their relative resources and competitive position in the market through the act of competing. The process of value generation and thus competing is an important mechanism for the firm to facilitate learning. Organizations can utilize feedback and subsequent learning to make adjustments, improvements and innovations to become more competitive in the market segment. The next cycle of competition provide opportunities for more learning, thus inducing further improvements and provoking further disequilibrium conditions; firms learn by competing
whether they need to use existing resources more effectively and efficiently, or whether they need to seek other resources to compete. R-A theory thus views competition as a process of knowledge discovery and subsequent adaptation; a form of experimentation and continuous improvement (Hunt, 2000). As such it is the theory best suited to explain the relationships in my Explanatory/Descriptive Research Model.

4.4.4 Resource Orchestration

Certain competencies can be replicated by competitors; it is not always a “zero sum game”. This does not diminish the competency of the original firm; however, it does diminish its relative comparative advantage. The resources and capabilities that facilitate the development of a LM Competence are not scarce; yet cultivating resources into capabilities, and leveraging them into a LM Competence is not as simple to do well as it sounds to do well (Ransom, 2008; Liker & Franz, 2011). Although the resource may be easily replicable and thus homogenous within an industry, the heterogeneity (and comparative advantage) may exist in the ability to deploy that resource. Thus, the possession and structuring of resources are important to establishing and sustaining potential comparative advantage, however those resources must be effectively mobilized, bundled, coordinated, cultivated, deployed and leveraged to capitalize on opportunities and/or mitigate threats for the firm to realize a comparative market advantage (Sirmon, Gove & Hitt, 2008; Sirmon et al., 2010). In the end, “What a firm does with its resources is at least as important as which resources it possesses” (Hansen, Perry & Reese, 2004: 1280).

Resource orchestration is important to operational and organizational performance (Helfat & Winter, 2007; Sirmon et al., 2011). Sirmon, Hitt & Ireland (2007) describe the orchestration of resources as the process of structuring and building a firm’s resource portfolio,
cultivating and bundling those resources to build firm capabilities, and leveraging the capabilities to realize competitive advantage. Sirmon, Gove & Hitt (2008) found that the management of resources influences competitive outcomes, however variances in resource quality and in their deployment flexibility influences the resource management actions and effectiveness. But, there is no one best way of organizing resources; the appropriate arrangement and coordination depends on the task and environment with which management is faced; it is contingent (Chandler, 1962; Schoonhoven, 1981). Thus, management’s proficiency in orchestrating resources becomes a key aspect of developing a LM Competence (Sirmon, Gove & Hitt, 2008).

Therefore, comparative advantage is not only established by the perception and judgement of consumers in regard to an organization’s product and service offerings relative to others in the market, but is highly influenced by the organization's proficiency at orchestrating its available resources. This resource orchestration takes place in the cultivation of key LM resources that collectively reflect the organization’s LM Preparation Capability. In order for an organization to possess a LM Preparation Capability, it must successfully search for and select the appropriate resources and orchestrate the resources it then has at its disposal. Thus, resource orchestration is a central concern for LM operational and organizational performance; investments in, and coordination of resources should fit/match with the appropriate deployment objectives or inefficiencies of the organization’s resources and reductions in employee confidence in Lean as a strategy (Marvel & Standridge, 2009).

Convis (2001) proposed that LM is comprised of an interlocking set of three underlying elements: the philosophical underpinnings, the managerial culture and the technical tools (Bhasin & Burcher, 2006). Liker and Hoseus (2008) proposed that LM (TPS at Toyota) is built upon two foundational pillars of the organization: I) respect for people and, II) kaizen, defined as change
for the better (Liker & Franz, 2011). To fully reap the benefits of LM, an organization needs to treat LM not as an abstract philosophy, but as a management approach which includes a philosophy, as well as practices, tools and processes (Pullin, 2002). Collectively these perspectives portray LM as an operational approach (philosophy) combining social and process dimensions of an organization. In concert, they affect value generation within a LM system. It is this separation into organizational social and processes bundles of attributes that I adopt.

I now will move to a more detailed description and definition of the constructs within my revised Descriptive Research Model and the support for causality of the relationships between them. The combination of rich descriptions, constitutive definitions and the prior theoretical argumentation will enable subsequent hypotheses development.

To restate, I conceived of LM as a three stage, customer focused, value generating process. Value design involves cultivating and orchestrating of individual and institutional resources in pursuit of a proficient LM Preparation Capability. Value delivery involves the fulfillment of the potential of the firm’s LM Preparation Capability moderated by the activation of the organization’s LM Implementation Capability. Kaizen (change for the better) is achieved through the deployment of a structured problem solving, continuous improvement mechanism (represented by a LM Implementation Capability) activating the potential of the firm’s LM Preparation Capability. This phase results in operational functionality and the organization possessing a LM Competence as a result of doing Lean well – functional proficiency in improving the effectiveness of work flow (QT) and efficiency of work effort (PT). Value capture involves the realization of value created by a LM Competence moderated by Environmental Uncertainty. This phase results in organizational effectiveness (doing the right Lean) and the organization generating Lean-Based Benefits for and from the customer (see
Figure 4.3 for the full Descriptive Research Model depicting this strategic approach to readying the organization to generate value via the deployment of LM).

**FIGURE 4.3:**

**STRATEGICALLY READY LM APPROACH - DESCRIPTIVE RESEARCH MODEL**

4.5 **Value Design – Cultivation**

Organizations are open-systems (Katz & Kahn, 1978) in constant interaction with a changing environment. They need to be adaptable to respond to environmental change. Flexible policies and empowered people are the primary source of adaptation. If permitted to experiment and learn new methods, people working the process at the “gemba” (primarily nurses in a hospital context) are the best to identify improvement opportunities (Liker & Hoseus, 2011). But, improvements through LM do not happen by themselves. They require the cultivation of
organizational resources; individual and institutional characteristics that foster the development of a LM Competence. Without instilling the respect for people pillar of LM, continuous improvement efforts will be ineffective in the long run.

4.5.1 LM Preparation Capability

LM “is a long-term plan for actually implementing a lean enterprise” (Chase 1999: 3); a learning organization that thrives on people engaging in identifying and solving problems together and achieving results that benefit everyone (Liker & Hoseus, 2008). What is "often omitted from lean implementations are the organizational development aspects that act as a mechanism to hold things together" (Bhasin, 2011: 423). Strategic and structural characteristics of an organization are necessary antecedents of its capabilities to implement change or innovation (Damanpour, 1991). Merely using Lean tools and practices and expecting to achieve sustainable improvement is unlikely. While the technical systems expose problems, it is the social systems that solve problems (Liker & Hoseus, 2008). Thus, identifying the key adoption antecedent characteristics should be a hospital's top priority as it seeks to maximize the benefits and likelihood of LM adoption. However, these antecedent characteristics are multifaceted and interconnected in a complex social system that takes time to develop (Hines, Holweg & Rich, 2004). “Sparked by the superior performance achieved by lean producers over the performance of traditional mass production system designs, western manufacturers emulated the shop-floor techniques, the structural parts of lean, but often found it difficult to introduce the organisational culture and mindset” (Hines, Holweg & Rich, 2004: 995). It is this 'organisational culture and mindset' that is the focus of value design and the development of a LM Preparation Capability. While it can be learned by anyone, it takes ten years of practice under expert guidance (Womack & Jones, 2007). There is no quick fix or silver bullet solution to establishing a LM approach to a
hospital or any other business. Little can be done to hurdle the preparation stage and quickly arrive at the end state of Toyota’s learning organization.

Adopting a LM approach in firms brings about radical changes not always welcomed despite the apparent advantages for customers and the organization. Rogers (1999) emphasized that getting any new idea adopted, even when it has clearly apparent advantages, is often very difficult, may normally take quite a long period of time and could potentially fail in the process of adoption. Embedding of practices such that they are likely to endure requires commitment of considerable resources and the involvement of many social aspects of the organization (Zeitz, Mittal & McAulay, 1999). LM practitioners have identified distinct individual and institutional elements critical to the successful deployment of LM within an organization (Ohno, 1988; Suzuki, 1993; Black, 2008). As such, due to the necessary integration of social and technical aspects, an organization must possess and combine multiple, distinct resources to have the potential to deploy lean-based initiatives successfully; these collective resources can constrain or enable collective action. The coordination of multiple organizational resources is required to generate incremental value capturing opportunities. It requires an active management cultivating and orchestrating those resources to realize their maximum collective potential.

The value design phase, as represented by a multidimensional, second order latent construct LM Preparation Capability, is theoretically grounded in R-A-theory and resource orchestration theory. While the utility of multidimensional constructs has generated considerable debate, advocates argue that they provide a more holistic representation of a complex phenomenon (Edwards, 2001) and thus I choose to utilize one here. The constructs of LM Skills, LM Executive Leadership, LM Supervision, LM Climate and LM Culture are linked through LM Preparation Capability. These individual and institutional dimensions act synergistically and
complimentary (Venkatraman, 1989). LM Preparation Capability can be thought of as reflecting the fit between the five complementary dimensions; a parsimonious representation of their co-alignment. Proficiency in all dimensions is a necessary condition for overall LM Preparation Capability. It is the complementary and synergistic effects of the distinct, but highly inter-related elements that give LM its unique character (Shah & Ward, 2007). These five dimensions must all exist in order to maximize the potential of the organization’s LM system and thus are reflective of the organizations LM Preparation Capability. I outline below the five key resource constructs.

### 4.5.2 LM Skills

Frontline engagement is key to many improvement methodologies (Flynn et al., 1994). Trained frontline personnel can learn and make substantial contributions to organizational performance (Flynn et al., 1994). "Training needs to be viewed as an important preventative cost which both aids the overall lean implementation and proceeds to reduce the time to implement lean" (Bhasin, 2012: 422). In order to improve the system, scale up and spread good ideas, skills enabling the rapid recognition, translation and local implementation of change concepts and improvement ideas must be built (Institute for Healthcare Improvement, 2008). LM Skills are comprised of both project management skills and analytical problem solving skills. Bhasin (2012) identified insufficient supervisory skills, insufficient senior management skills and insufficient workforce skills as barriers to LM implementation. Skills such as communication,
problem solving and teamwork (Klein, 1994; Emiliiani, 2003) are vital for LM success. Investing in training and development of the workforce allows employees to add tangible value through their ability to identify and solve problems, exercise judgement and coordinate within and across departments (Flynn, Sakakibara & Schroeder, 1995).

Front-line workers should be empowered; moving away from repetitively fulfilling a given task to actively improving processes (Klein 1994; Bhasin & Burcher 2006; Liker & Meier 2006; Noer 2009). Therefore, responsibility must be promoted as far down the hierarchical ladder as possible (Womack et al., 2007). But empowerment alone will not be enough; the front-line employees must be trained with the skills to improve the process. Control charts, value stream mapping, visual management and 5S, process capability analysis, error proofing, setup time reduction methods (Mader, 2008); the specific skill itself is not as important as the range of skills. Providing employees with a full complement of project management and problem solving skills will prepare them for success. To facilitate skills training requires an organizational structure; typically provided through a Lean program office established and adequately funded and staffed within the organization (Hobbs & Aubry, 2007).

Toyota has taught us that investing in employees through human resource practices that improve problem solving skills and adaptability facilitates cognitive contributions (Adler et al., 2009) to LM. LM Skills is thus defined as the firm's proficiency in training all employees with the project management, problem solving, communication and teamwork abilities (Philips, 2002; Bhasin, 2011) to facilitate the creation of value.

4.5.3 LM Executive Leadership

The critical role of executive leadership to an organization’s improvement initiatives has been discussed extensively in the quality management literature (Peng et al., 2008) and often
seen as the driving force of process improvement efforts (Flynn & Saladin, 2006). In most circumstances, LM is advocated from the top of the organization. Top management obviously sees the rationale for Lean; they’re most connected with what’s going on in the external environment, the competitive situation, the markets, regulations, customers, etc. Their perspective invokes a need for Lean at a very visceral level. However, the executive level tends to be the most isolated (furthest from the “gemba”) from the impacts of the changes throughout the organization. Therefore, people on the front-line seem most resistant because they’re the ones whose behavior must be modified as a significant part of the LM process. They’re resistant because they just haven’t been brought along to get it. An organization’s members need a reason to buy-in and engage with LM or the initiative will feel like pushing on the proverbial string. Institutional leaders (Selznick, 1957) do more than act as custodians; simply managing and administrating. Institutional leaders are visionaries and institutional builders. They establish and charismatically vocalize a LM vision and purpose for the organization (Rafferty & Griffin, 2004) around which the firm’s employees can rally (Collins & Porras, 1996) and commit the firm to a learning orientation in support of that vision (Barney & Arikan, 2001). They visit the “gemba” to know what is done to add value and thus what is required of them to champion the approach. But, LM Executive Leadership involves much more than establishing the vision and designing the organizational structure; it involves a visible, persistent, daily attention to the vision; “walking the talk”, not just “talking the talk” by senior leaders (Liker & Hoseus, 2008). “The currency of leadership is attention” (Institute for Healthcare Improvement, 2008: 14); employees pay attention to what the leaders pay attention to and what they do with their time. Attention provides the social energy that drives an organization (Hitt, Hoskisson & Harrison, 1988) and signals to employees what leadership believes is important (Institute for Healthcare
Improvement, 2008). LM Executive Leadership must be invested in the process - not detached - and provide passionate, authentic, daily leadership to avoid organizational entropy while reinforcing the importance of LM to the success of the business (Liker & Franz, 2011). Once adopted, subsequent LM entrenchment efforts (Zeitz, Mittal & McAuley, 1999) are never ending (continuous improvement is perpetual); executive leaders must be engaged and committed for the long haul or organizational entropy and complacency will emerge, gradually sabotaging LM efforts (Ohno, 1988; Suzaki, 1993; Institute for Healthcare Improvement, 2005; Black, 2008). To realize and sustain organizational-level results, executive leaders must be able to grow the organization’s collective will (Institute for Healthcare Improvement, 2008) and exhibit personal courage to accomplish goals in the face of opposition, external or internal (Crossan et al., 2013). LM Executive Leadership must be vocal, visible champions, motivating and inspiring employees to embrace and actively contribute to LM (Hackman & Wageman, 1995) through the creation of an environment where it is permissible to fail, set stretch goals, and encourage ‘leaps of faith’.

At Toyota, “the only hope of seriously marching toward the ideal of continuous improvement is to have passionate executives leading the charge” (Liker & Franz, 2011; pg 3). LM Executive Leadership is passionate about LM and has an authentic, hands-on style, yet leaves tactical improvement to the front-lines (Keroack et al., 2007). In hospitals, the senior executive team, including senior physicians (Lam & Schaubroeck, 2000), is united in its vision and understanding of Lean (Institute for Healthcare Improvement, 2005) and passionate about continuous improvement (Keroack et al., 2007). LM Executive Leadership establishes the vision, charismatically and inspirationally communicates the vision, exhibits courage and will in the face of cynics and skeptics, and supports the development of organizational structures and infra-
structure required to support the entrenchment of a LM approach across the entire hospital. They are the chief marketing and promotion officers of LM in the firm.

4.5.4 LM Supervision

At the heart of LM is problem solving at the “gemba” (Ohno, 1988; Suzaki, 1993; Black, 2008). LM is not accomplished in the boardroom or the corner office, but in the trenches; the front-line. It requires engaged managers who coach, teach, mentor, provide ideas, and act as role models and cheerleaders face-to-face with front-line personnel. They lead through relationships (Uhl-Bien, 2006) rather than authority, dominance or superiority (Drath, 2001). They empower, interact and communicate with employees (Suzaki, 1993) instilling pride, teamwork, trust and accountability. This cannot be done sitting in an office sending emails; it must be done at the “gemba” by the direct supervisors of those who deliver value. While executive leadership helps negotiate trade offs and prioritization of resources to various opportunities (Tucker, 2007), lower levels of management leadership influence the day-to-day implementation of LM and provide clarity in objectives (Ohno, 1988). These change agents act as evangelists, spreading the gospel of LM; engaging employees to not just work on the system of care, but to work in the system of care.

LM Supervision is characterized as empowering leadership. It involves sharing power with subordinates, increasing their levels of responsibility and autonomy, and manifests itself through behaviours such as encouraging freedom to express opinions, supporting collaborative decision making, teamwork and information sharing (Lorinkova, Pearsall & Sims, 2013). Engagement is a distinct and important motivational concept that involved the harnessing of an employee’s full self in terms of physical, cognitive, and emotional energies towards their work (Rich, Lepine & Crawford, 2010) resulting in an enthusiastic, energetic immersion (Seijts &
Crim, 2006), positive, fulfilling work-related state of mind characterized by vigor, dedication and absorption to one’s work (Schaufeli et al., 2002) whereby the individual chooses to expend discretionary energy in fulfilling their job responsibilities (Kahn, 1990; May, Gilson, & Harter, 2004; Rich, Lepine & Crawford, 2010).

In contrast, a directive leadership style is associated with positional power and is characterized by structuring subordinates work through the communication of clear directions and expectations of compliance to instructions (Lorinkova, Perasall & Sims, 2013) resulting in clearer task and role responsibility, rapid decisions making, and external monitoring with feedback on performance (Kahai, Sosik & Avolio, 2004). Organizations with directive leadership initially outperform teams with empowering leadership, but over time, empowering-led organizations exhibit better performance due to higher levels of learning, coordination, enablement and mental model development (Lorinkova, Perasall & Sims, 2013). Given the longer term view to LM and the superior performance of teams led by management categorized by an approach closer to the empowering end of the continuum, it seems best suited to LM (Black, 2008) provided that it is complimented by effective oversight at the highest levels of governance and leadership (Institute for Healthcare Improvement, 2008).

When done well, LM Supervision demonstrates a high degree of behavioural integrity (Simons, 2002), are exceptional communicators and open minded listeners who excel in working with teams. They learn, sharing knowledge, and coach others on how to uncover problems, and are committed to the problem solving process - not providing the answers (Liker & Franz, 2011). Demanding, but fair in their pursuit of perfection; understanding that expecting quick and easy results is a recipe for disappointment. LM Supervision effectively strikes a balance (Recht & Wilderom, 1998) between the long term learning orientation that supports and nurtures the
cultivation of capabilities and the short term objectives of generating incremental value for and from customers through improvement of current work flows and work efforts in pursuit of greater quality throughput and productive throughput.

4.5.5 LM Climate

The generic climate construct originates from Lewin (1935) and "emphasizes how our perceptions of the whole are influenced by the elements we perceive" (Bowen & Schneider, 2013: 2). As research evolved on climate as a construct, the generic version was replaced with the thought that climate should refer to a specific focus (Schneider, 1975); "a climate for something" (Bowen & Schneider, 2013: 2). LM Climate is the organization's employees' shared sense of the policies, practices and procedures they experience and the emphasis on LM they observe in the behaviours that are rewarded, supported and expected (Bowen, Schneider & Kim, 2000).

The better the climate, the more feasible improvements appear which facilitates the implementation process (Vasilash, 1998) and complex change (Kotter, 1996; O'Connor and Fiol, 2006). LM involves adaptations in processes, work flows and work efforts. These adaptations can be disruptive to those involved creating barriers to adoption (Bhasin, 2012). To initiate and sustain improvements requires the organization to believe that the adaptation is worthwhile and needed (Armenakis et al., 1993), appropriate (Armenakis & Harris, 2002), and that it has the capability and shared commitment to succeed (Weiner, 2009). Recent literature on the organizational change readiness has begun to introduce the affective keys to the cognitive views established in the past (Rafferty et al., 2013). My focus on LM Climate is on the perceptions of employees as it pertains to the organizational sense of work practices, structures and available resources rather than on their objective occurrence. This emphasizes the idea that LM Climate is
in essence a perceptual organizational phenomenon observed or registered by individual employees. In a word it’s the atmosphere (McNabb & Sepic, 1995). Documented organizational policies and procedures do not adequately represent climate; it is best measured through the interpretation of the organization’s members.

The affective aspects of organizational readiness for change may be influenced by the organizational policies and practices that specifically provide opportunities for employees to deal with the emotions generated by change (Rafferty et al., 2013). It’s getting to the hearts and minds of the people; to the extreme of saying that unless you worry about changing the hearts, souls and minds, it’s going to be very difficult to achieve sustainable change. The organization must create a system of trust that works together for mutual benefit, not mutual suspicion. Cross-functional information flow and transparency are vital to coordination across a firm’s internal boundaries, but also demonstrate openness to employees. Visible measurement and open dialogues about key objectives not only focuses the group, but encourages transparency and accountability. Employment relationships are “not built primarily on trust, but on the mutual interdependence enshrined in the agreed upon rules of the game” (Womack & Jones, 2007: 2314).

Mutual interdependence requires job security for all levels of employees. LM should not become a licence to reduce jobs (Haskin, 2010); every effort should be made to re-deploy anyone displaced by the improvements (Bhasin, 2011). If an employee believes that a change resulting from a lean initiative would result in job elimination (the employee is deemed the waste) then organizational efforts towards improvement are likely to be suboptimal or sabotaged altogether (Adler, 1993; Recht & Wilderon, 1998). By assuring job security, the organization can “replace a vicious circle of mistrust with a virtuous circle of cooperation” (Womack & Jones, 2007: 2222).
The dimensions of the climate under study must be specifically chosen because they are conceptually related to the outcome of interest and should be focused on the outcome of interest (Schneider, Erhart & Macey, 2011). I define LM Climate as the collective mindset and beliefs of the organization’s employee’s towards the adoption and deployment of a lean approach; the perception of employees that the business is challenged, LM is needed, appropriate and valued, that the firm has the capacity to succeed in its execution and that there is a shared resolve and reciprocal obligation (trust) if they get behind the adaptation.

### 4.5.6 LM Culture

Organization culture has a significant impact on the implementation of lean (Henderson et al., 1999; Atkinson, 2010) and firm performance (Barney, 1986; Hansen & Wernerfelt, 1989). Schneider, Erhart and Macey (2011) define culture based on the work of Trice & Beyer (1993) as the beliefs, ideologies, and values, and the ways these are transmitted through symbols, language, narratives (myths, stories), and practices (rituals, taboos) especially during socialization to the workplace. Culture is relatively permanent; however relative permanence should not be construed as rigid. A LM Culture is a learning culture (Senge, 1990). By emphasizing an orientation of learning, innovation and improvement, culture will not become a source of rigidity, but will permit the firm to adapt to an ever-changing environment (Schneider, Erhart & Macey, 2011). Embracing fallibility and failures as learning opportunities and not reasons to justify existing practices and decisions and point fingers at others (Weick & Sutcliffe, 2001) permits the framing problems as opportunities for learning and benefits problem-solving from the combination of positive attributions that boost motivation and the suppression of threat effects (MacDuffie, 1997); evaluating problems as opportunities to enhance long term value (not liabilities to be avoided) creates an organizational mindset that favors investments in process.
improvements, incurring short term costs of prevention to avoid longer term costs of failure from disregarding the problem (MacDuffie, 1997).

Lean is not an instantaneous solution to all an organization’s problems, but an approach that requires time, mistakes, reflections and experience to master (Liker & Hoseus, 2008). “We believe that our production system, with its many nuances, can be learned by anyone…but it takes ten years of practice under expert guidance” (Womack & Jones, 2007; pg 3661). Bhasin & Burcher (2006) posit that it is more critical that the firm sees the LM process as a long-term journey that can only succeed with a clear direction, a well-planned transformation and an adequately sequenced project, more so than the possession of problem solving skills. Seen as a journey and not simply viewed as a tactic or process to be applied to achieve a single result (Anvari, Norzima, Hojjati & Ismail, 2010) means that sustaining improvements requires culture adaptation, not merely the adoption of tools (Liker & Franz, 2011).

Large organizations (like hospitals) are not culturally homogeneous; there are usually various sub-cultures (Martin, 1992; 2002) which manifest as a source of conflict (Morgan, 1997; Ransom, 2008; Liker, 2004; Koltzenburg, 2004; Hunter, 2004) and have been identified as a major concern for adoption of LM (Hunter, 2004; Jones, 2009) and the organization’s ability to sustain initiatives (Vinodh & Balaji, 2011). A hospital is a complex constellation of disjointed and often poorly connected activities and functional groups; coordination and collaboration across sub-system boundaries (Nembhard, 2013; Kislov, 2013) are challenging. These potentially harmful patterns of systematic behaviour founded on organization’s values, beliefs and habits, can jeopardize lean initiatives unless they are explicitly addressed (Recht & Wilderon, 1998; Philips, 2002; Institute for Healthcare Improvement, 2008).
Empowerment plays a vital role in any lean deployment (Recht & Wilderon, 1998), yet managers often struggled to delegate responsibilities appropriately; effectively moving away from controlling, evaluating, directing and planning to helping, empowering, coaching and listening to employees (Noer, 2009). In addition, interpersonal trust plays a major role in ensuring that actions of the collective group are distributed in an efficient and fair manner (Arrow, 1974). Hartwell and Roth (2010) add that the long-term journey can be successfully completed only if an environment of trust is established. Trust is the lubricant that enables team members to sacrifice personal agendas for the benefit of the collective group and ultimately themselves as a whole (McGrath et al., 1995). Interpersonal trust promotes efficiency by allowing teammates to exercise social control upon each other (Larson, 1992). Trust improves profitability by streamlining transactions and reducing costs (Williamson, 1991; Zaheer, McEvily & Perrone, 1998). From trust emerges psychological safety: the belief that one will not suffer negative outcomes for speaking up with ideas, questions, concerns, or mistakes (Nembhard, 2013). In a culture where mistakes are severely punished and successes are highly praised, employees avoid admitting mistakes (McGrath, 1999). Conversely in safe and empowered cultures with high degrees of interpersonal trust, mistakes become fertile ground for continuous improvement. At Toyota where inventories levels are purposely lowered to uncover problems (Adler et al., 2009), “Confronting your boss is accepted and bringing bad news to the boss is encouraged” (Adler et al., 2009: 106). At Toyota, they “deliberately force contradictory viewpoints within the organization and challenge employees to find solutions by transcending differences rather than by resorting to compromises” (Adler et al., 2009: 105). This planned friction, in combination with free flowing information up and across the organization, and respect for all employees, is an incubator for new ideas. By not emphasizing who caused the
problem, but rather what in the process permitted the problem, a culture of problem solvers and a collective understanding that all members of the organization can and should be accountable, “cognitive contributors” (Adler et al., 2009) to the system is developed (Suzaki, 1993).

LM Culture is thus defined as the organization's collective set of shared values and beliefs that enable the day-to-day establishment of an organization, focused on the pursuit of greater value generation for customers and the organization through continuous improvement of work flows and work efforts. It includes elements of empowerment, trust, respect, accountability and safety embedded within a collaborative, long-term, value driven, learning orientation.

4.5.7 **LM Preparation Capability Summary**

Powell’s study of TQM found that “potential TQM adopters may not appreciate that TQM success depends not only on adopting the TQM attributes, but also on the pre-existence of complementary factors apparently unrelated to TQM, yet more difficult to imitate than TQM itself” (Powell, 1995: 21). Lean is not TQM; however firms who choose to ignore the development of a LM Preparation Capability face similar challenges. I define LM Preparation Capability as a second order latent construct that reflects the interaction of a hospital's LM Skills, LM Executive Leadership, LM Supervision, LM Climate and LM Culture. In essence they work synergistically in an ongoing process of readying the organization for the deployment of LM and to enhance the potential for the firm to develop a LM Competence and implement a LM continuous improvement process. I do not suggest that used in isolation, any of these resources will lead to a LM Preparation Capability, but rather I suggest that each resource in combination with the other resources provide an organizational potential for value creation.

**P1: LM Preparation Capability is a multidimensional higher order construct reflecting the synergistic degree of organizational readiness for LM deployment through the co-**
alignment of LM Skills, LM Executive Leadership, LM Supervision, LM Climate and LM Culture.

**H1a**: LM Skills positively reflects the organizations LM Preparation Capability.

**H1b**: LM Executive Leadership positively reflects the organizations LM Preparation Capability.

**H1c**: LM Supervision positively reflects the organizations LM Preparation Capability.

**H1d**: LM Climate positively reflects the organizations LM Preparation Capability.

**H1e**: LM Culture positively reflects the organizations LM Preparation Capability.

### 4.6 Value Delivery – Activation

By its very nature, implementation is a social process (Damschroder et al., 2009); people are not passive recipients of solutions to problems; they experiment, improve and redesign them through dialogues with others and they develop feelings about them. Kaizen activates the potential of an organization’s people through the utilization of a standardized mechanism/process for problem solving/value creation; Kaizen teaches “people a standardized, conscious means of grasping the essence of situations and responding scientifically” (Liker & Franz, 2011: 68).

Faced with competitors of similar resource configuration, superior execution attained through developing distinct organizational capabilities can generate a comparative advantage - being better at the same game (Hayes & Upton, 1998). While competing through superior strategy planning and the possession of superior resources can work effectively in the early stages of an industry’s life cycle, as the industry matures, an organization must shift more focus to superior implementation in order to gain comparative advantages.
From an operational perspective, value design and value delivery require different types of knowledge and capabilities (Mahoney & Pandain, 1992). Managers must decide how much capital to invest or allocate to value design or value delivery resources. While LM Preparation Capability is a determinant of value creation it can also engender firm differentiation, add perceived value to the customer and assist in the capture of value (Pitelis, 2009). But possession of the right resources does not guarantee the development of competitive advantage; creating a resource comparative advantage and subsequent marketplace competitive advantages only occurs if the resources possessed are managed effectively (Sirmon et al., 2011) and efficiently deployed (Adler et al., 2009). “Organizations can increase efficiency by adhering strictly to proven process templates, thereby rendering operations more stable and predictable” (Adler et al., 2009: 99). Deployment of resources in a structured mechanism facilitates effective lean problem solving and the development of efficient counter measure, value capture and competitive advantage. “The establishment of standardized processes and procedures is the greatest key to creating consistent performance” (Liker & Meier, 2006: 111).

4.6.1 LM Implementation Capability

Capabilities are not the same as resources; they represent a superior way of allocating, coordinating and deploying resources and are often context specific (Ethiraj et al., 2005). Operational capabilities include explicit elements like resources (factors) and operational practices (standardized routines, procedures and policies developed to achieve specific objectives) as well as less visible tacit elements like know how, skill sets and leadership. Operational practices provide the general instructions on how to use organizational resources (which are passive and reactive); once documented they become the standard operating procedures or best practices of the organization. High competence levels are often achievable
where skills and routines can be learned and perfected through repetition and practice (Nelson & Winter, 2002).

Not all capabilities provide the same marginal contribution to performance – different capabilities have different cost and benefits associated with their development or acquisition. Wu et al., (2010) defined a capability as the ability to deploy/leverage resources to some beneficial end. Capabilities that involve the deployment of resources, tend to evolve over time reflecting both passive learning-by-doing and active firm-level-investments in improvements and learning, and are hard to imitate or easily acquire (Ethiraj et al., 2005). Operational capabilities are tightly embedded within the operational management system because of three factors: 1) the interconnectedness of capabilities with practices and resources, 2) linkages to the social network of the organization, and 3) the fit with the problems the firm is attempting to address (Grewal & Slotegraaf, 2007). These traits create a barrier to imitation and are crucial to explaining differences in operational competencies and comparative advantages between organizations (Hunt, 2000; Grewal & Slotegraaf, 2007).

Researchers have argued that the primary basis for organizations to compete is through the development of unique capabilities (Swink & Hegarty, 1998). The capability to effectively implement strategy (E.G. Lean) will emerge as a critical source of competitive advantage in the twenty-first century (Bigler 2001). The literature suggests that an effective implementation capability is important to the achievement of superior performance (Pryor et al., 2007; Crittenden & Crittenden, 2008; Singer, 2008). “More firms need to shift from relying on superior strategy to developing superior strategy implementation capabilities” (Egelhoff, 1993: 49). The LM approach uses a standardized problem solving mechanism (e.g., Plan-Do-Check-Act (PDCA) [Shewhart, 1939; Deming, 1986]) to activate organizational resources to reduce waste and
enhance value-adding portion of activities. PDCA is an acronym for the four stages of problem solving utilized within the mechanism: Planning, Doing, Checking, and Acting. Each stage requires a unique, yet complimentary set of skills and routines. Planning requires an analytically focussed set of routines that facilitate the recognition of a problem (or opportunity), the clear definition of the problem, root cause analysis, idea generation, objective, fact-based selection of the appropriate counter measure, clear goal setting and the detailed drafting of an implementation plan (Suzaki, 1993). Planning requires a blend of process focus, imagination and creativity, pragmatism and a robust analytical toolkit. Doing is a more exacting focussed set of routines that emphasizes execution precision. Doing is essentially performing the implementation plan as detailed by the Planning stage to solve the problem identified. Execution tends to be the weak link (Institute for Healthcare Improvement, 2008). Attention to detail and discipline is important as the counter measure is put in place as designed. Checking (sometimes labelled ‘studying’ in the PDSA) requires the implementation team to verify that the prescribed counter measure is acting as designed in the Planning stage. If the counter measure was executed as designed, theoretically it should achieve its designed objective. This Checking stage requires attention to detail, accurate measures and objectivity. Acting (or Adjusting) is a two pronged stage: I) If the counter measure is performing as designed (verified in the Checking stage), the counter measure must be clearly documented in a manner that will facilitate repetition and diffusion within the organization or II) if the counter measure is performing less than at its established objective, it must be adjusted and rechecked. Acting requires exceptional communication skills (both written for documentation and oral for diffusion) and the ability to influence as the counter measure is shared with the organization for broader distribution and subsequent standardization while Adjusting requires experimentation and adaptation skills to rethink the counter measure and
modify its application to the problem at hand. A firm can use PDCA, or another standardized, structured approach in its LM efforts to deliver value. Through consistent application of the same problem solving process, routines can capture the lessons from previous experiences, enable process replication without reinventing the wheel for every problem (Levitt & March, 1986) and improve operational efficiency. The execution of this type of structured process improvement mechanism represents a LM Implementation Capability.

If LM is viewed from the perspective of an operational strategy, improving the capability to effectively implement a structured problem solving mechanism will be an important organizational capability to improve firm performance. Yet research into LM implementation capabilities has been lacking. Pryor et al., (2007: 3) has called for research with a focus on “a more inclusive framework so that strategic implementation (…) might emerge as a core competency.” Although not a core competency in my conceptual research model, LM Implementation Capability is a moderating factor on LM Preparation Capability’s effect on LM Competence and thus firm performance. I thus define LM Implementation Capability as the proficiency in executing a standard, structured problem solving framework to effectively surface problems and plan, implement, standardize and diffuse the best available counter measure to the exposed problem in an effective and efficient manner.

4.6.2 LM Competence

Coates and McDermott (2002:436) define a competence as “a bundle of aptitudes, skills and technologies that a firm performs better than its competitors, that is difficult to imitate, and provides an advantage in the marketplace”. Competence reflects an expertise that enables an organization to deploy capabilities, resources and routines, usually in combination, to achieve a desired end (Menor & Roth, 2007). Competencies that involve some form of learning or
knowledge are more difficult to transfer or duplicate, and context specific (Prahalad & Hamel, 1990; Coates & McDermott, 2002). This is consistent with the business strategy literature argumentation that the distinctive competence of an organization is more than what it can do, but it is what it can do particularly well (Andrews, 1971) and includes the portfolio of skills and resources it possesses in combination with the way they’re used to produce desired outcomes (Fiol, 1991; Sanchez, Heene & Thomas, 1996). “The most sustainable advantages are those based on an organization’s ability to improve” (Hayes et al., 2005: 68). A firm's LM Competence is developed through the interaction of its LM Preparation Capability (respect for people) and LM Implementation Capability (kaizen). LM Implementation Capability cannot create value by itself. Without LM Preparation Capability, it makes no contribution to the firm’s pursuit of value generation. However, once a firm is strategically readied and a LM Preparation Capability is possessed, it requires activation. Therefore, I hypothesize that the firm’s degree of LM Preparation Capability is positively associated to the firm’s LM Competence and moderated by its LM Implementation Capability. Moderation implies that the impact of the predictor variable (LM Preparation Capability) on the dependent variable (LM Competence) is influenced by an interaction between the predictor and another variable (LM Implementation Capability). This other variable is designated as the moderator (Kroes & Ghosh, 2010). LM Implementation Capability does not directly affect LM Competence; without LM Preparation Capability there is no value designed to be delivered, and thus no LM Competence for the organization to possess. It is the interaction between LM Preparation Capability and LM Implementation Capability that best explains the degree of LM Competence and the operational functionality of the organization. LM Implementation Capability positively moderates the effect of LM Preparation Capability on LM Competence. The greater the organization's capability to implement - its deftness in
execution - (March, 1995) the more designed value that is delivered and thus enhances the firm’s overall value creation.

The degree of competence in an initiative can be assessed by the extent to which its objectives are being realized and the level of competence can thus be defined as its ability to reliably and consistently meet or exceed its objectives (McGrath et al., 1995). LM is focused on the ongoing paring of waste from the operational systems in order to improve the quality of throughput flows (PT) and the efficiency of work efforts (QT). I thus define LM Competence as the proficiency of the organization at improving throughput-focused work flows and (2) increasing the productivity and value-add ratio of all work efforts on an ongoing basis.

**H2: LM Preparation Capability has a positive effect on LM Competence; a greater level of LM preparation capability likely results in a greater level of LM Competence.**

**H3: LM Implementation Capability positively moderates the effect of LM Preparation Capability on LM Competence; the degree of this positive moderation increases with the level of LM Implementation Capability.**

### 4.7 Value Capture – Realization

Value capture (the search for profits) is the basic rationale for all firms when they entertain entering a market (Cox, 2004). In LM, if cultivation/design prepares the firm for value creation and delivery activates the design phase’s value potential, then value capture occurs when the market determines the degree of realization of the value created. While, value creation is an operational success (the firm was able to efficiently design, and deliver value creating offers), value capture is only an organizational success if the firm is able to effectively meet perceived/anticipated consumer requirements (thus maximizing the opportunity for value
Value can only be assessed by the customer (Womack & Jones, 2003); when attempting to generate and capture value, it is imperative that the organization is cognizant about what its customers’ needs and wants are in respect to its products and services, otherwise the potential for wasted effort, misaligned with consumer needs, is more probable. The challenge is identifying who the customer is and what their needs are and will be before investing in value creation.

The context of this research is the hospital industry. From this industry perspective, if we take the view that the patient is the customer, those needs and wants are fairly straightforward. A significant amount of research has already been conducted to define the physician-related determinants of patient satisfaction in hospitals (Bursch, Beezy & Shaw, 1993; Hall & Press, 1996; Yarnold et al., 1998; Trout, Magnusson & Hedges, 2000) and the Center for Medicaid and Medicare Services (CMS) has used a standardized patient survey (Hospital Consumer Assessment of Healthcare Providers and Systems - HCAHPS) for measuring patients' perspectives on hospital care since 2005. An oversimplified summary and generalization of these efforts is that patients want fast, safe, efficient care from a care giver who communicates well and is empathetic. The key operational outcomes of a LM approach are: lower costs, higher quality, increased throughput, increased safety and better employee morale (Ohno, 1988; Suzaki, 1987, 1993). From a hospital context these operational measures are consistent with the objectives of the organization and in alignment with customer value. Hospitals seek to lower costs per procedure, reduce readmissions due to poor quality, reduce length of stay to enable increased utilization, throughput and contribution margin, increase safety by reducing preventable errors, and increase employee morale to minimize turnover. Patients want lower prices, higher quality procedural outcomes, less time spent in the hospital, lower levels of
accidents, and more pleasant interactions with hospital personnel. Not all market segments of patients will value these objectives equally. Thus, hospitals using LM must consider their own patient mix preferences and customer views on each dimension of value when designing and delivering value creation in order to maximize value capture outcomes. In the end, doing the right Lean things in an efficient manner results in operational effectiveness and maximum realization of Lean-Based Benefits for patients and the hospital from value created.

4.7.1 Environmental Uncertainty

Uncertainty refers to “the difference between the amount of information required to perform the task and the amount of information already possessed by the organization” (Galbraith, 1973: 5). Low levels of value capture can result from mitigating environmental factors (Shimizu & Hitt, 2004); high Environmental Uncertainty can be detrimental to the organization’s value capturing efforts. In environments with high degrees of uncertainty, organizations are less able to forecast environmental conditions and thus face greater risks of counter measures missing the consumer value “sweet spot”. While risk can be calculated and managed when formulating plans, uncertainty is far more difficult to factor into planning (Milliken, 1987; Gaur et al., 2011). Research has shown that Environmental Uncertainty can wield significant effect on organizational processes (Sutcliffe & Zaheer, 1998; Walker & Weber, 1987).

Dess & Beard (1984) categorized Environmental Uncertainty into three categories: dynamism, complexity and munificence. Dynamism is “change that is hard to predict and that heightens uncertainty for key organizational members” (Dess and Beard, 1984: 56) and refers to the rate of change in the environment and the unpredictability of environmental changes. In the presence of environmental dynamism, decision makers are faced with more difficult resource
allocation choices; performance measures are therefore more negatively affected by higher levels of uncertainty. Dynamism can be considered on two dimensions: unpredictability and instability (Henderson et al., 2006). Instability is the degree of change – how much dynamism; unpredictability is the degree of volatility in the change – how much does dynamism vary. Whether classified as instability or unpredictability, scholars have shown that dynamic uncertainty for a firm (caused by external factors) rises with an increase in consumer preference variance, technology change (David & Han, 2004), fluctuations in market demand (Voss & Voss, 2000) and alterations to the competitive landscape (Poppo & Zenger, 2002) and negatively impacts operational effectiveness.

“Environmental complexity refers to different external forces with which an organization interacts” (Gaur et al., 2011). Complexity, unlike dynamism, refers to a single point in time. Decision makers can adapt more easily to complexity as they gather more information, whilst dynamism by definition is always changing and thus more difficult to predict and manage (Gaur et al., 2011).

Munificence is the extent to which the environment can support sustained growth (Starbuck, 1976). Organizations seek environments that permit both growth and stability. These environmental characteristics allow an organization to generate slack resources (Cyert & March, 1963), which provides a buffer for the organization during periods of relative scarcity (Dess and Beard, 1984). When faced with low munificence, resource availability is less and growth can be stifled unless slack has been built into the system. In periods of high munificence, slack is less necessary because resources are plentiful and thus growth enabling resources can be acquired just-in-time. Firms must anticipate such scenarios and invest in the internal development of key
resources to avoid issues of low munificence, potentially stockpile key resources or identify sources they can access rapidly when the need is identified (Sirmon, Hitt & Ireland, 2007).

Environmental Uncertainty therefore refers to the degree to which a firm’s external environment is characterized by an absence of a perceived pattern, predictability, and expected change (Fynes et al., 2004; Srinivasan, 2011). Changes in uncertain environments are often frequent and rapid, requiring recalibration of plans and subsequent implementation of those plans. Uncertainty can negatively impact the operational effectiveness of a firm’s plan; although plans are implemented successfully and efficiently, changes in the environment will likely be unaccounted for in the plan and have a negative effect on operational effectiveness. In environments of high uncertainty, LM initiatives designed to create comparative marketplace advantage, will have a lower likelihood of success and providing Lean-Based Benefits to both the hospital and its customers.

Milliken (1987) separated managerial cognition of environmental uncertainty into three categories: state, effect and response. State uncertainty refers to an inability to predict the external environment and how it may be changing. Effect uncertainty relates to an inability to understand how a specific change in the environment will impact the firm. Response uncertainty relates to an inability to determine the options available for a firm to enact and the potential value that the responses will return. In this study, I am interested in measuring the impact of state uncertainty. I presume that effect and response uncertainty is accounted for by the planning capabilities of the organization utilizing Lean.

In summary, Environment Uncertainty includes factors that are external to the firm and entail factors that are strategic in nature: changes in product or process technology, competitor behavior, changes in consumer tastes and preferences, and resource availability. In seeking to
explain why some firms are more effective than others at capturing value. I am considering the resources available within organizational environments and the environmental uncertainties facing managers trying to determine how those resources should be orchestrated (Sirmon et al., 2011) and utilized (Aldrich & Mindlin, 1978; Lawrence & Dyer, 1983). When assessing organizational effectiveness in LM, munificence, dynamism, and complexity are the relevant dimensions of Environmental Uncertainty to take into consideration (Duncan, 1972; Castrogiovanni, 1996; Gaur et al., 2011). I define Environmental Uncertainty as the level of dynamism, complexity, and resource munificence over the period of time that lean countermeasures are planned, implemented, and available to the marketplace.

4.7.2 Lean-Based Benefits

Customers do not desire or purchase a firm’s capabilities or competencies (Penrose, 1959; McGrath et al., 1996). Customers desire to purchase product and service attributes created by the firm effectively applying its capabilities. While LM Competence reflects the efficiency that the organization implements the plan to achieve operational objectives (functionality) in pursuit of value creation for and from customers, Lean-Based Benefits reflect how effectively the organization’s LM Competence captures value given the degree of Environmental Uncertainty that prevails. Value captured for and from customers can manifest itself as immediate or future operational, marketplace, strategic, or financial rewards. Benefits such as employee morale, customer satisfaction, loyalty, and brand reputation should result in future financial gains and are thus strategic objectives of the hospital despite the fact that they cannot be accounted for on current financial statements; but it is assumed that they have value generating capabilities for future periods in time. By adapting Colgate and Smith’s (2007) typology framework, value
derived from lean-based initiatives can be further segmented into three categories for customers and the organization: economic value, functional value and experiential value.

(I) Economic Value - the extent to which lean-based initiatives generate reduced financial cost, psychological cost, personal investment and risk for customers

(II) Functional Value - the extent to which lean-based initiatives provide greater customer utility through improved outcomes

(III) Experiential Value - the extent to which lean-based initiatives create customer outcomes that are memorable, individualized, and enriching

All else being equal, firms with a distinctive competency in LM have a higher likelihood of developing and maintaining a comparative advantage in the marketplace through the greater generation of economic, functional and experiential value. Firms with the sufficient capabilities to prepare and implement lean-based initiatives to their operations, would achieve significant efficiencies in safety, quality, cost, productivity and employee morale (Suzaki, 1993) thus enabling the potential for more effective operational performance. Given the impact of LM on operational functionality and organizational effectiveness, it naturally follows that firms with a greater degree of LM Competence will have higher associated levels of Lean-Based Benefits.

**H4: LM Competence has a positive effect on Lean-Based Benefits; a greater level of LM Competence likely results in a greater level of Lean-Based Benefits.**

Firms competing in environments of high complexity, dynamism and low munificence will experience greater levels of Environmental Uncertainty. Higher degrees of Environmental Uncertainty will moderate the impact of the firm to capture value and Lean-Based Benefits.
generated through its LM Competence. The firm may be efficient in its LM operations, but the effectiveness of its efforts will be compromised if Environmental Uncertainty is high.

**H5: Environmental Uncertainty negatively moderates the effect of LM Competence on Lean-Based Benefits; the degree of this negative moderation increases with the level of Environmental Uncertainty.**

### 4.8 Conclusion

A theory can be defined as an ordered set of assertions about a generic behaviour or structure that is assumed to hold through a wide range of different instances (Weick, 1989); a system of constructs and variables related to each other by propositions and hypotheses (Bacharach, 1989). Wacker (1998) defines theory as being made up of four components: I) definitions of terms or variables, II) specification of the domain where the theory is applicable, III) a set of relationships between the variables and, IV) specific predictions supported by empirical verification. Given the explanatory underpinnings of the hypothesized relationships (and hypotheses development I have provided in this chapter), Theoretical Research Model (see in Figure 4.4), construct definitions, and theoretical perspectives and grounding, I believe that I have met all but the empirical verification component of Wacker`s (1998) criteria for theory development. I will now develop measurement scales designed to test my hypotheses following the two-stage approach suggested by Menor and Roth (2007) in an attempt to satisfy Wacker`s last requirement of empirical verification. In Chapter Five, I will operationally define the constructs in more detail and describe the methods used to develop the measurement scales to be used in my quantitative survey research.
FIGURE 4.4: THEORETICAL RESEARCH MODEL WITH HYPOTHESES
CHAPTER 5 – OPERATIONALIZATION OF SURVEY

5.1 Introduction

Having established the Descriptive Research Model (see Figure 5.1), constitutive construct definitions, theoretical perspectives and grounding, and subsequent hypotheses development in Chapter Four, I will outline in this chapter two further aspects of my research study: (I) the operational definitions of the constructs presented in the Descriptive Research Model (previously defined constitutively) and the associated measurement items to be subjected to pre-testing, and (II) the detailed methodological descriptions of the pre-testing and subsequent formation of my survey instrument for the second phase of my research study.

FIGURE 5.1: DESCRIPTIVE RESEARCH MODEL WITH HYPOTHESES

Two challenges in the development of new multi-item measurement scales are (I) the selection of the appropriate items and (II) coverage of the construct domain with a required level
of validity and reliability (Menor & Roth, 2007). A reliable measurement item is one that measures a construct consistently across time, individuals, and situations, while a valid measure is one that measures what it is intended to measure. To address these challenges I applied Menor & Roth’s (2007) two stage approach: first employing two rounds of an item-to-construct sorting analysis using independent panels of informed judges to establish tentative item reliability and validity, and then secondly, a confirmatory analysis of survey data collected from key respondents to assess the reliability and validity of the newly constructed scales. Stage one will be outlined in this chapter, while stage two will be discussed in detail in Chapter Six.

5.2 Operational Construct Definitions

Without empirical referents to the theoretical constructs, the empirical justification of the theory will remain unknown (Carmines & Zeller, 1979). When moving from the theoretical to the empirical world, the constitutive construct definitions outlined in Chapter Four must be operationalized. These operational definitions lead to enhanced consensus on what is being studied and the establishment of reliable and valid measures essential to the development of correct inferences and conclusions from the data.

I will now outline my operational definitions and include measurement items to be subsequently pre-tested. The measurement items are indicated as either sourced directly from the literature, adapted from the literature for this study, or created for this study. The new scales I develop for the constructs in this LM study were derived or adapted from measurement items in previously cited scales or created based on in-depth discussions with interviewees familiar with LM in my case study research. Hence the constructs are likely to be content valid at the outset of my first stage of scale development.
5.2.1 LM Preparation Capability

LM Preparation Capability is a parsimonious representation of the co-alignment of the constructs LM Skills, LM Executive Leadership, LM Supervision, LM Climate and LM Culture. LM Preparation Capability is reflected in the five dimensions and represents the organization’s degree of strategic readiness for the deployment of LM; its proficiency at the ongoing process of developing the institution for the successful deployment of a LM program and its individuals on a per initiative basis. These individual (skills, leadership, and supervision) and institutional (climate and culture) considerations are embedded in LM Preparation Capability and act synergistically and complimentary (Venkatraman, 1989). They are co-aligned and thus competency in all dimensions is a necessary condition for overall LM Preparation Capability. This concept of complementarity is consistent with a systematic approach to LM deployment and exists when the marginal return to a resource is increased by the presence of another resource (Powell & Dent-Micallef, 1997).

The notion of co-alignment operationalizes the synergies of the five LM Preparation Capability dimensions. “Co-alignment is viewed as a pattern of co-variation or internal consistency among a set of theoretically related constructs (Venkatraman, 1989)” (Menor, 2000: 53). The basis for operationalization of fit as co-variation is based in the principles of factor analysis; I am attempting to explain the co-variation amongst five sets of items/measures with five lower order constructs, and the co-variation of those constructs with a higher order construct LM Preparation Capability. By utilizing LM Preparation Capability as a higher order latent construct, the parsimony of the model is dramatically increased (Menor, Krystal, & Rosenzweig, 2007). Co-variations between the five lower order constructs and the moderating effect of LM Implementation Capability on the each relationship between the five constructs and LM
Competence are not represented. The pattern of co-variation among the lower order constructs can be captured by the unobservable higher order construct LM Preparation Capability while allowing for a less complex and more parsimonious representation of the model (Wetzels, Odekerken-Schroder & van Oppen, 2009). Other operations management scholars have utilized this method of representing co-alignment (e.g. Ettlie & Pavlou, 2006; Menor & Roth, 2008). Figure 5.2 illustrates an alternative Descriptive Research Model without the higher order latent construct, but with direct effects included. The itemized loadings, error and disturbance terms are omitted, but the multiple co-variations and moderations effects are included.

**FIGURE 5.2: DIRECT EFFECTS (ALTERNATIVE) DESCRIPTIVE RESEARCH MODEL**

Like most multi-dimensional constructs, LM Preparation Capability is not directly observable; its study requires scrutiny of the five dimensions that reflect such a capability. These five co-varying dimensions must be perpetually developed and cultivated in order to support an organization’s pursuit of a LM Competence. Entrenchment (Zeitz, Mittal & McAuley, 1999) or embedding of an enduring LM approach to process improvement requires a LM Preparation Capability to resist organizational pressure for entropy (Liker & Franz, 2011). Without sufficient
cultivation of preparation dimensions, there may be process improvement, but it is highly unlikely that the organization will possess a LM Competence.

5.2.1.1 LM Skills

Individuals within a LM program require specific skills to efficiently and effectively deploy LM. Managerial and supervisory skills (Bhasin, 2012), communication, problem solving and teamwork skills (Philips, 2002), are all vital for LM success. Management must train and coach employees to assess, analyze and improve work processes (Hackman & Wageman, 1995). LM Skills captures the organization’s investment and expertise in training and developing the abilities of its workforce that enables all employees to add tangible value through their ability to identify problems and analytically form appropriate solutions, and manage implementation coordination within and across departments (Flynn, Sakakibara & Schroeder, 1995). LM Skills is thus operationally defined (see Table 5.1) as the project management, problem solving, communication and teamwork abilities that employees could utilize during lean-based initiatives. The cultivation of more proficient LM Skills across the organization reflects a greater LM Preparation Capability.

5.2.1.2 LM Executive Leadership

Inadequate executive leadership represents the single biggest reason for the failure in change initiatives (Black, 2008; Powell et al., 2010). In a Lean organization, engaged senior leadership (Kahn, 1990) is a requirement for success (Ohno, 1988; Suzaki, 1993; Black, 2008). Leadership involvement is critical to an organization’s improvement initiatives (Flynn & Saladin, 2006; Peng et al., 2008) and provides the social energy that drives an organization (Hitt, Hoskisson & Harrison, 1991). In hospitals, the actions of executive leaders have a measurable effect on generating value for the patient (Keroak et al., 2011). Executive leaders communicate
TABLE 5.1: LM SKILLS MEASUREMENT ITEMS

Operational definition of **LM Skills**: the project management, problem solving, communication and teamwork abilities that employees could utilize during lean-based initiatives.

**Survey Question Framing**: With respect to the lean-based initiatives in your department, how strongly do you agree or disagree with the following statements … Questions anchored on a five point scale of “Strongly Disagree” to “Strongly Agree”

<table>
<thead>
<tr>
<th>Item #</th>
<th>Original Measurement Item For Evaluation</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>We effectively utilize cross-functional teams as a method to approach lean-based initiatives.</td>
<td>Adapted from Hult, Hurley, Giunipero &amp; Nichols (2000)</td>
</tr>
<tr>
<td>2</td>
<td>We provide ongoing training for our departmental employees on problem solving techniques.</td>
<td>Created</td>
</tr>
<tr>
<td>3</td>
<td>We provide lean-based improvement training to hourly employees throughout the organization on an ongoing basis.</td>
<td>Adapted from Douglas &amp; Fredenhall (2004)</td>
</tr>
<tr>
<td>4</td>
<td>We provide lean-based improvement training to managers and supervisors throughout the organization on an ongoing basis.</td>
<td>Adapted from Douglas &amp; Fredenhall (2004)</td>
</tr>
<tr>
<td>5</td>
<td>We provide training in the basic statistical techniques (such as histograms and control charts) on an ongoing basis.</td>
<td>Adapted from Douglas &amp; Fredenhall (2004)</td>
</tr>
<tr>
<td>6</td>
<td>A high level of importance is placed on developing a proficiency in communication.</td>
<td>Adapted from Chesten, Helgheim, Randall &amp; Warden (2005)</td>
</tr>
<tr>
<td>7</td>
<td>Our department’s care givers function as a team.</td>
<td>Adapted from Chesten, Helgheim, Randall &amp; Warden (2005)</td>
</tr>
<tr>
<td>8</td>
<td>We provide ongoing training on project management tools and techniques to our departmental employees.</td>
<td>Created</td>
</tr>
<tr>
<td>9</td>
<td>We have enough lean-based training to do our jobs well on lean-based initiatives within the department.</td>
<td>Adapted from Chesten, Helgheim, Randall &amp; Warden (2005)</td>
</tr>
<tr>
<td>10</td>
<td>Employees that are involved in the implementing of lean-based initiatives were also involved in the development of the solution.</td>
<td>Adapted from Gilgeois (1995)</td>
</tr>
<tr>
<td>11</td>
<td>Ongoing training in conflict resolution is given to managers and supervisors throughout the organization.</td>
<td>Created</td>
</tr>
<tr>
<td>12</td>
<td>Employees are cross-trained in this department so that they can fill in for others if necessary.</td>
<td>Adapted from Schroeder, Bates &amp; Juntilla (2002)</td>
</tr>
</tbody>
</table>

*Note: Final measurement items included in the survey are (in original format) in italics*
a clear vision of the future state and create similar interpretations or beliefs about the potential of LM in their followers (Herold et al., 2008; Oreg & Berson, 2011); they are charismatic individuals with significant personal authority who identify with LM and dedicate themselves to supporting, marketing and driving the adoption, entrenchment and implementation (Helfrich et al., 2007; Damschroder et al., 2009). They set the ‘True North’ for the organization. They inspire hope and optimism about the future and sustain those feelings through consistent messaging and periodic face-to-face engagement at the “gemba”. LM Executive Leadership is operationally defined (see Table 5.2) as the efforts of the organization’s senior leadership to explicitly communicate the purpose and objectives of lean-based initiatives, engender commitment from direct reporting personnel, provide oversight, and engage personnel involved in those initiatives in a visible, persistent and authentic manner. The possession of more competent and capable LM Executive Leadership reflects greater LM Preparation Capabilities.

5.2.1.3 LM Supervision

A hospital’s commitment to the cultivation of its middle management ability is critical to the long term success of a LM program (Hardy, 2013). Middle management are those “employees supervised by an organization’s executives and who supervise front-line employees” (Birken et al., 2013: 30). Management supervision provides the critical linkage between the organizational vision and objectives established by the senior executive and the front-line deployment of those objectives. In LM, effective, engaged management leaders strike a balance between process and results (Recht, 1998) and focus more on improvement than supervision (Black, 2008). They empower employees through teaching and coaching (Recht, 1998; Black, 2008). They demonstrate persistence, consistency, accountability, authenticity and high degrees of interpersonal trust (Hall, 1996; Black, 2008). LM Supervision is operationally defined (see
**TABLE 5.2: LM EXECUTIVE LEADERSHIP MEASUREMENT ITEMS**

Operational definition of Executive Leadership: the efforts of the organization’s senior leadership to explicitly communicate the purpose and objectives of lean-based initiatives, engender commitment from direct reporting personnel, provide oversight, and engage personnel involved in those initiatives in a visible, persistent and authentic manner.

**Survey Question Framing:** With respect to the lean-based initiatives in your department, how strongly do you agree or disagree with the following statements … Questions anchored on a five point scale of “Strongly Disagree” to “Strongly Agree”

<table>
<thead>
<tr>
<th>Item #</th>
<th>Original Measurement Item For Evaluation</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>The organization’s senior leaders are committed to employee lean-based improvement training.</td>
<td>Adapted from Douglas &amp; Fredenhall (2004)</td>
</tr>
<tr>
<td>2</td>
<td>The organization’s senior leaders have demonstrated the ability to set and communicate organizational goals for lean-based programs.</td>
<td>Adapted from Institute for Healthcare Improvement (2011)</td>
</tr>
<tr>
<td>3</td>
<td>Our senior leaders encourage employee involvement in the lean-based improvement program.</td>
<td>Adapted from Rungtusanatham, Forze, Koka, Salvador &amp; Nie (2005)</td>
</tr>
<tr>
<td>4</td>
<td>Front-line employees believe that the organization’s senior leaders accept accountability for our lean-based improvement program’s success.</td>
<td>Adapted from Rungtusanatham, Forze, Koka, Salvador &amp; Nie (2005)</td>
</tr>
<tr>
<td>5</td>
<td>The organization’s senior leaders visibly demonstrate personal commitment to lean-based improvement on a consistent basis.</td>
<td>Adapted from Institute for Healthcare Improvement (2010)</td>
</tr>
<tr>
<td>6</td>
<td>Our organization’s senior leaders inspire employees to contribute to lean-based initiatives.</td>
<td>Created</td>
</tr>
<tr>
<td>7</td>
<td>The organization’s senior leaders assume responsibility for lean-based performance improvements.</td>
<td>Adapted from Zu, Fredendall &amp; Douglas (2008)</td>
</tr>
<tr>
<td>8</td>
<td>Our organization’s senior leaders create and communicate a vision focused on lean-based improvement.</td>
<td>Adapted from Flynn &amp; Flynn (2004)</td>
</tr>
<tr>
<td>9</td>
<td>The organization’s goals, objectives and strategies are communicated to me by senior leaders.</td>
<td>Adapted from Bates, Amundson, Schroeder &amp; Morris (1995)</td>
</tr>
<tr>
<td>10</td>
<td>The long-run competitive strategy of my organization has been communicated to me by senior leaders.</td>
<td>Adapted from Bates, Amundson, Schroeder &amp; Morris (1995)</td>
</tr>
<tr>
<td>11</td>
<td>We see our organization’s senior leaders at the front-line of service delivery on a regular basis.</td>
<td>Created</td>
</tr>
<tr>
<td>12</td>
<td>Our organization’s senior leaders understand the needs of front-line employees and customers.</td>
<td>Created</td>
</tr>
</tbody>
</table>

*Note: Final measurement items included in the survey are (in original format) in italics*
Table 5.3) as the efforts of front-line managers to consistently coach, support, motivate, and empower their personnel to work collaboratively and productively on lean-based initiatives. The possession of a proficiency in LM Supervision throughout the hospital is a greater reflection of a LM Preparation Capability.

5.2.1.4 LM Climate

Climate concerns the organization's employees' shared sense of the policies, practices and procedures they experience and the emphasis on LM they observe in the behaviours that are rewarded, supported and expected (Bowen, Schneider & Kim, 2000). LM Climate is a critical antecedent to successful implementation of complex changes (Kotter, 1996; O'Connor & Fiol, 2006). A LM Climate is a “blame-free”, transparent environment where employees are encouraged to identify problems without fear or any reprisal yet are accountable for results. Financial and time resources are allocated for LM and rewards and incentives are aligned with the objectives of LM. Process improvements do not result in reductions in staffing (except through attrition). A supportive and positive LM Climate manifests itself in the organizational readiness for and acceptance of LM; a sense of urgency or challenge, a shared resolve of an organization’s members to implement a change (change commitment), their mutual confidence in the collective capability to make the change (change efficacy) (Weiner, 2009) and the belief that the change is needed (Armenakis et al., 1993) and appropriate (Armenakis & Harris, 2002). “Climate can be viewed as the more immediate tangible layer on top of the organization’s underlying culture” (Bowen, Schneider & Kim, 2000: 441). LM Climate is a summary sense employees have about what is important in the organization. In essence, it is the attitude of the employees towards the organization’s LM efforts (Schneider, 1975). It is the summary sense
employees have about how important LM is to the organization; their perceptions of how the organization goes about the business of LM on a daily basis that emerges from the messages sent

**TABLE 5.3: LM SUPERVISION MEASUREMENT ITEMS**

<table>
<thead>
<tr>
<th>Item #</th>
<th>Original Measurement Item For Evaluation</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Our direct supervisor(s) empower as opposed to direct us on lean-based activities.</td>
<td>Adapted from Institute for Healthcare Improvement (2005)</td>
</tr>
<tr>
<td>2</td>
<td>Our direct supervisor(s) listens to our problems and concerns.</td>
<td>Adapted from Chesten, Helgheim, Randall &amp; Warden (2005)</td>
</tr>
<tr>
<td>3</td>
<td>Our direct supervisor(s) gives fair evaluations of our work.</td>
<td>Adapted from Chesten, Helgheim, Randall &amp; Warden (2005)</td>
</tr>
<tr>
<td>4</td>
<td>The organization’s supervisors encourage people who work for them to exchange opinions and ideas.</td>
<td>Adapted from Flynn, Schroeder &amp; Flynn (1999)</td>
</tr>
<tr>
<td>5</td>
<td>The organization’s supervisors encourage the employees who work for them to function as a team.</td>
<td>Adapted from Flynn, Schroeder &amp; Flynn (1999)</td>
</tr>
<tr>
<td>6</td>
<td>The organization’s front-line supervisors regularly provide lean-based coaching.</td>
<td>Created</td>
</tr>
<tr>
<td>7</td>
<td>The organization’s supervisors frequently hold group meetings where the people who work for them can really discuss things together.</td>
<td>Adapted from Flynn, Schroeder &amp; Flynn (1999)</td>
</tr>
<tr>
<td>8</td>
<td>Our front-line supervisors are more likely to tell us something face-to-face than to send a memo.</td>
<td>Adapted from Flynn, Schroeder &amp; Flynn (1999)</td>
</tr>
<tr>
<td>9</td>
<td>Frontline employees trust their supervisors and feel safe discussing any work related issues.</td>
<td>Created</td>
</tr>
<tr>
<td>10</td>
<td>Frontline employees respect their direct supervisor(s) in this organization.</td>
<td>Created</td>
</tr>
</tbody>
</table>

*Note: Final measurement items included in the survey are (in original format) in italics
### TABLE 5.4: LM CLIMATE MEASUREMENT ITEMS

**Operational definition of LM Climate:** the operational environment that exists in which policies, practices and procedures exist to facilitate the undertaking of collaborative and productive lean-based initiatives.

**Survey Question Framing:** With respect to the lean-based initiatives in your department, how strongly do you agree or disagree with the following statements … Questions anchored on a five point scale of “Strongly Disagree” to “Strongly Agree”

<table>
<thead>
<tr>
<th>Item #</th>
<th>Original Measurement Item For Evaluation</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Employees are not laid-off, right-sized or fired as a result of lean-based initiatives in our organization.</td>
<td>Adapted from Gilgeous (1995)</td>
</tr>
<tr>
<td>2</td>
<td>In our organization, frontline workers freely challenge the ideas of more senior employees.</td>
<td>Created</td>
</tr>
<tr>
<td>3</td>
<td>Quality of participation in lean-based initiatives is a significant part of managerial performance evaluation.</td>
<td>Adapted from Bates, Amundson, Schroeder &amp; Morris (1995)</td>
</tr>
<tr>
<td>4</td>
<td>Leadership has put into place a process for obtaining frontline input to develop a portfolio of waste reduction projects.</td>
<td>Adapted from Institute for Healthcare Improvement (2011)</td>
</tr>
<tr>
<td>5</td>
<td>In our organization we seek perfection through the removal of all waste instead of simply being 'just as good' as established by benchmarking.</td>
<td>Adapted from Institute for Healthcare Improvement (2005)</td>
</tr>
<tr>
<td>6</td>
<td>When problems surface, our organization uses root cause analysis to seek process improvement instead of blaming people.</td>
<td>Adapted from Institute for Healthcare Improvement (2005)</td>
</tr>
<tr>
<td>7</td>
<td>Our organization rewards group sharing and team performance as opposed to individual performance.</td>
<td>Adapted from Institute for Healthcare Improvement (2005)</td>
</tr>
<tr>
<td>8</td>
<td>Continuous improvement is stressed in all work processes throughout the organization.</td>
<td>Adapted from Flynn, Schroeder &amp; Flynn (1999)</td>
</tr>
<tr>
<td>9</td>
<td>Our organization’s existing incentive and reward systems are appropriate for employee involvement and development in lean-based initiatives.</td>
<td>Adapted from Gilgeous (1995)</td>
</tr>
<tr>
<td>10</td>
<td>Our organization’s supervisors are incented and rewarded for lean-based improvement.</td>
<td>Adapted from McKone, Schroeder &amp; Cua (1999)</td>
</tr>
<tr>
<td>11</td>
<td>When we are on a difficult lean-based assignment, we can usually count on getting assistance from our boss and coworkers.</td>
<td>Adapted from Janz &amp; Prasarnphanich (2003)</td>
</tr>
<tr>
<td>12</td>
<td>Our organization’s members are continually willing to challenge each other’s thinking about their processes.</td>
<td>Adapted from Hult, Hurley, Giunipero &amp; Nichols (2000)</td>
</tr>
</tbody>
</table>

* Note: Final measurement items included in the survey are (in original format) in italics
by management in its reward, support and expectations of behavior and its policies, practices and procedures that they experience. LM Climate is operationally defined (see Table 5.4) as the operational environment that exists in which policies, practices and procedures exist to facilitate the undertaking of collaborative and productive lean-based initiatives. A more positive LM Climate in the organization is a greater reflection of a LM Preparation Capability.

5.2.1.5 LM Culture

“Organizational culture concerns the basic assumptions and values that guide organizational action as transmitted implicitly and explicitly to newcomers through myths, stories and socialization tactics” (Bowen & Schneider, 2000: 3). It emerges over time to contain a set of assumptions and beliefs that helps guide individuals in their day-to-day working behavior (Wilms, Hardcastle & Zell, 1994). It resides deeper in the psychosocial life of the organization’s members than their perceptions of the tangibles (Bowen et al., 2000). “Culture ultimately reflects the group’s efforts to cope and learn and is the residue of the learning process. Culture thus fulfills not only the function of providing stability, meaning and predictability in the present, but is the result of functionally effective decisions in the past” (Schein, 1992: 92). Culture’s beliefs and values are deeply rooted and difficult to access or change and is “the backdrop against which lean tools and techniques are implemented” (IHI, 2005: 4).

A LM Culture is a learning culture that supports continuous improvement. A LM Culture emphasizes and embraces change, learning, innovation and improvement. I operationally define (see Table 5.5) LM Culture as the collective views and beliefs held within the organization that reflect the norms, values and assumptions that exist with regards to the importance and functioning of lean-based initiatives. A more positive LM Culture is a greater reflection of a LM Preparation Capability.
TABLE 5.5: LM CULTURE MEASUREMENT ITEMS

Operational definition of **LM Culture**: the collective views and beliefs held within the organization that reflect the norms, values and assumptions that exist with regards to the importance and functioning of lean-based initiatives.

**Survey Question Framing:** With respect to the lean-based initiatives in your department, how strongly do you agree or disagree with the following statements … Questions anchored on a five point scale of “Strongly Disagree” to “Strongly Agree”

<table>
<thead>
<tr>
<th>Item #</th>
<th>Original Measurement Item For Evaluation</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>During problem solving sessions, the organization makes an effort to get all team members opinions and ideas before making a decision.</td>
<td>Adapted from Sakakibara, Flynn &amp; Schroeder (1993)</td>
</tr>
<tr>
<td>2</td>
<td><em>Our organization is process driven and not expert driven.</em></td>
<td>Adapted from Institute for Healthcare Improvement (2005)</td>
</tr>
<tr>
<td>3</td>
<td><em>Our organization continues to search for additional learning and further improvement after installation of new processes.</em></td>
<td>Adapted from Rungtusanatham, Forze, Koka, Salvador &amp; Nie (2005)</td>
</tr>
<tr>
<td>4</td>
<td>Employees are encouraged to quickly try new ideas or models of new ideas and learn through experimentation.</td>
<td>Adapted from Institute for Healthcare Improvement (2005)</td>
</tr>
<tr>
<td>5</td>
<td><em>We can do almost anything we want without consulting our direct supervisor(s).</em></td>
<td>Adapted from McKone, Schroeder &amp; Cua (1999)</td>
</tr>
<tr>
<td>6</td>
<td><em>Employee teams are encouraged to try and solve their own problems through their own innovations/improvements as much as possible.</em></td>
<td>Adapted from McKone, Schroeder &amp; Cua (1999)</td>
</tr>
<tr>
<td>7</td>
<td><em>Our organization places its customers’ needs above all others.</em></td>
<td>Created</td>
</tr>
<tr>
<td>8</td>
<td><em>Front-line employees believe there is a strong commitment to continuous improvement at all levels of this organization.</em></td>
<td>Adapted from Douglas &amp; Fredenhall (2004)</td>
</tr>
<tr>
<td>9</td>
<td>Employees in the organization continually analyze their work processes to look for ways of doing a better job.</td>
<td>Adapted from Douglas &amp; Fredenhall (2004)</td>
</tr>
<tr>
<td>10</td>
<td><em>Sayings that embody organizational wisdom about process improvement are often told within the department.</em></td>
<td>Adapted from Bates, Amundson, Schroeder &amp; Morris (1995)</td>
</tr>
<tr>
<td>11</td>
<td><em>Stories are told within the organization about lean-based improvement accomplishments of past employees.</em></td>
<td>Adapted from Bates, Amundson, Schroeder &amp; Morris (1995)</td>
</tr>
<tr>
<td>12</td>
<td><em>Our organization believes that employee learning is an investment, not an expense.</em></td>
<td>Adapted from Hult, Hurley, Giunipero &amp; Nichols (2000)</td>
</tr>
</tbody>
</table>

*Note: Final measurement items included in the survey are (in original format) in italics*
5.2.2 LM Implementation Capability

Value design and value delivery require different types of operational capabilities. Potential value designed, lays dormant until the value delivery stage where its potential is activated. This potential, as reflected in its LM Preparation Capability is fulfilled by its interaction with the organization’s LM Implementation Capability. Yet, LM Implementation Capability alone cannot create value; without the value potential as represented in its LM Preparation Capability there is nothing to be implemented. Thus LM Implementation Capability moderates the leveraging of the LM Preparation Capability into a LM Competence. LM Implementation Capability represents the organization’s efforts to apply a standardized problem solving process mechanism (e.g. Plan-Do-Check-Act [PDCA] [Shewhart, 1939; Deming, 1986]) to activate its LM Preparation Capability in pursuit of value creation and a LM Competence. I operationally define (see Table 5.6) LM Implementation Capability as the organization’s proficiency in consistently deploying a standard approach when undertaking lean-based work efforts and work flows improvements. Higher levels of LM Implementation Capability, lead to a greater effect of LM Preparation Capability on LM Competence.

5.2.3 LM Competence

The cultivation of LM Preparation Capability and LM Implementation Capability facilitates the leveraging of those capabilities into a LM Competence. LM Competence is evidence of an organization’s proficiency in improving the quality of process based flows (QT), the work effort required (PT) and the value-add ratio of all work activities and as such should be assessed based on process criteria (Hackman & Wageman, 1995); the reduction in processing flow variability (and associated work effort waste and burden) and the increase in value available for capture. Although LM projects may have specific performance objectives, the project
TABLE 5.6: LM IMPLEMENTATION CAPABILITY MEASUREMENT ITEMS

Operational definition of **LM Implementation Capability**: the organization’s proficiency in consistently deploying a standard approach when undertaking lean-based work efforts and work flows improvements.

**Survey Question Framing**: With respect to the lean-based initiatives in your department, how strongly do you agree or disagree with the following statements … Questions anchored on a five point scale of “Strongly Disagree” to “Strongly Agree”

<table>
<thead>
<tr>
<th>Item #</th>
<th>Original Measurement Item For Evaluation</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>We use charts to determine whether the implementations of our processes are in control.</td>
<td>Adapted from McKone, Schroeder &amp; Cua (1999)</td>
</tr>
<tr>
<td>2</td>
<td>Our organization forms cross-functional teams to solve problems.</td>
<td>Adapted from Zu, Fredendall &amp; Douglas (2008)</td>
</tr>
<tr>
<td>3</td>
<td>In our organization, members of a lean-based improvement team have their roles and responsibilities specifically identified and documented.</td>
<td>Adapted from Zu, Fredendall &amp; Douglas (2008)</td>
</tr>
<tr>
<td>4</td>
<td>All lean-based project team members are committed to the same project goals.</td>
<td>Pinto, Pinto &amp; Prescott (1993)</td>
</tr>
<tr>
<td>5</td>
<td>Our organization always uses a similar problem solving structured methodology on lean-based initiatives.</td>
<td>Created</td>
</tr>
<tr>
<td>6</td>
<td>Our organization always solicits opinion leaders to act as a project leader or to champion the cause of lean-based improvement initiatives.</td>
<td>Adapted from Mehra &amp; Inman (1992)</td>
</tr>
<tr>
<td>7</td>
<td>Our organization always commits appropriate resources for the execution of lean-based projects.</td>
<td>Adapted from Institute for Healthcare Improvement (2011)</td>
</tr>
<tr>
<td>8</td>
<td>Our organization conducts a thorough review of all potential alternatives to solving a problem before selecting a solution to execute.</td>
<td>Adapted from Zu, Fredendall &amp; Douglas (2008)</td>
</tr>
<tr>
<td>9</td>
<td>Our organization keeps records about how each lean-based improvement project is conducted.</td>
<td>Zu, Fredendall &amp; Douglas (2008)</td>
</tr>
<tr>
<td>10</td>
<td>All lean-based improvement projects are reviewed regularly during the process against stated objectives.</td>
<td>Adapted from Zu, Fredendall &amp; Douglas (2008)</td>
</tr>
<tr>
<td>11</td>
<td>Detailed execution plans are created for each designed lean-based solution.</td>
<td>Created</td>
</tr>
</tbody>
</table>

*Note: Final measurement items included in the survey are (in original format) in italics

portfolio (program) as a whole has a diverse set of performance objectives; thus LM Competence is a multidimensional construct. This multidimensional construct focuses on the operational
performance of the LM program and refers to the portfolio of LM projects the organization has initiated over the past three years. While all projects emphasize continuous improvement, the outcomes enhance PT and QT resulting in several internal organizational outcomes including lower costs, higher quality and greater throughput. I operational define (see Table 5.7) LM Competence as the proficiency of the organization to deploy a systematic, relentless, problem-focused, facts-driven, and team-based paring of waste (and its sources) from operational systems in order to (1) improve throughput-focused work flows and (2) increase the productivity and value-add ratio of all work efforts on an ongoing basis. The possession of a greater Lean Competence affects greater Lean-Based Benefits.

5.2.4 Environmental Uncertainty

Environmental Uncertainty refers to the degree to which an organization’s external environment in terms of its competitors, actions, technology, resources and consumer tastes and preferences, is characterized by an absence of a perceived pattern, predictability, and expected change (Fynes et al., 2004; Srinivasan, 2011). Environmental Uncertainty impacts the ability of the organization to anticipate and plan for environmental conditions and can be very problematic for firms attempting to maximize value capture and meet consumer needs. Environmental Uncertainty is comprised of three distinct categories: dynamism (both unpredictable and instable) complexity and munificence. Dynamism is the rate of change or instability and unpredictability of the environment (Dess & Beard, 1984), complexity is the refers to the amount of different external forces with which an organization interacts (Gaur et al., 2011) and munificence is the extent to which the environment (resource scarcity) can support sustained growth (Starbuck, 1976).
TABLE 5.7: LM COMPETENCE MEASUREMENT ITEMS

Operational definition of **LM Competence**: the proficiency of the organization to deploy a systematic, relentless, problem-focused, facts-driven, and team-based paring of waste (and its sources) from operational systems in order to (1) improve throughput-focused work flows and (2) increase the productivity and value-add ratio of all work efforts on an ongoing basis.

**Survey Question Framing**: With respect to the lean-based initiatives in your department, how strongly do you agree or disagree with the following statements … Questions anchored on a five point scale of “Strongly Disagree” to “Strongly Agree”

<table>
<thead>
<tr>
<th>Item #</th>
<th>Original Measurement Item For Evaluation</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>A systematic approach to lean-based efforts in the organization is used.</td>
<td>Created</td>
</tr>
<tr>
<td>2</td>
<td><em>The lean-based efforts in the organization are relentless.</em></td>
<td>Created</td>
</tr>
<tr>
<td>3</td>
<td><em>Facts drive the development of lean-based improvements in the organization.</em></td>
<td>Created</td>
</tr>
<tr>
<td>4</td>
<td>A team-based approach is taken to the lean-based efforts in the organization.</td>
<td>Created</td>
</tr>
<tr>
<td>5</td>
<td><em>Lean-based initiatives in the organization are problem focused.</em></td>
<td>Created</td>
</tr>
<tr>
<td>6</td>
<td><em>The lean-based initiatives in the organization have been effective at enhancing productive work flows.</em></td>
<td>Created</td>
</tr>
<tr>
<td>7</td>
<td><em>The lean-based initiatives in the organization have been effective at enhancing the proportion of value-adding activities of work efforts.</em></td>
<td>Created</td>
</tr>
<tr>
<td>8</td>
<td><em>The quality of our organization’s products and services has been improved over the past 3 years.</em></td>
<td>Adapted from Zu, Fredendall &amp; Douglas (2008)</td>
</tr>
<tr>
<td>9</td>
<td><em>The process variability in our organization has decreased over the past 3 years.</em></td>
<td>Adapted from Zu, Fredendall &amp; Douglas (2008)</td>
</tr>
<tr>
<td>10</td>
<td><em>The speed of our product and service delivery has increased over the past 3 years.</em></td>
<td>Adapted from Zu, Fredendall &amp; Douglas (2008)</td>
</tr>
<tr>
<td>11</td>
<td><em>Our organization diffuses ideas across department lines so as to spread lean-based improvement learning.</em></td>
<td>Created</td>
</tr>
<tr>
<td>12</td>
<td>We have recently discussed what we did right or wrong on a particular lean-based project.</td>
<td>Janz &amp; Prasarnphanich (2003)</td>
</tr>
<tr>
<td>13</td>
<td>Our organization continually seeks to improve all aspects of work flows and work efforts on an ongoing basis.</td>
<td>Created</td>
</tr>
</tbody>
</table>

*Note: Final measurement items included in the survey are (in original format) in italics*
I operationally define Environmental Uncertainty (see Table 5.8) as the degree of dynamism, complexity and munificence in the organization’s operating surroundings. Higher degrees of Environmental Uncertainty inhibit the effective leveraging of Lean Competence into Lean Benefits.

**TABLE 5.8: ENVIRONMENTAL UNCERTAINTY MEASUREMENT ITEMS**

Operational definition of Environmental Uncertainty: the degree of dynamism, complexity and munificence in the organization’s operating surroundings.

Survey Question Framing: With respect to the lean-based initiatives in your department, how strongly do you agree or disagree with the following statements … Questions anchored on a five point scale of “Strongly Disagree” to “Strongly Agree”

<table>
<thead>
<tr>
<th>Item #</th>
<th>Original Measurement Item For Evaluation</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><em>The overall demand levels for our organization's products and services are unknown.</em></td>
<td>Adapted from Swamidass &amp; Newell (1987)</td>
</tr>
<tr>
<td>2</td>
<td><em>The competition for our organization's supply of skilled resources is unknown.</em></td>
<td>Adapted from Swamidass &amp; Newell (1987)</td>
</tr>
<tr>
<td>3</td>
<td><em>The amount of competition for our organization's customers is constantly changing.</em></td>
<td>Adapted from Swamidass &amp; Newell (1987)</td>
</tr>
<tr>
<td>4</td>
<td>Our organization is totally unaware of the potential competitive threats to our business.</td>
<td>Adapted from Sharfman &amp; Dean (1991)</td>
</tr>
<tr>
<td>5</td>
<td><em>Government regulations controlling our industry are unstable.</em></td>
<td>Adapted from Swamidass &amp; Newell (1987)</td>
</tr>
<tr>
<td>6</td>
<td><em>The public's political views and attitudes towards our industry is in flux.</em></td>
<td>Adapted from Swamidass &amp; Newell (1987)</td>
</tr>
<tr>
<td>7</td>
<td><em>The diversity and technical intricacy of our product and services is always changing.</em></td>
<td>Adapted from Sharfman &amp; Dean (1991)</td>
</tr>
<tr>
<td>8</td>
<td><em>The amount of instability or turbulence in the industry is high.</em></td>
<td>Adapted from Aldrich (1979)</td>
</tr>
<tr>
<td>9</td>
<td><em>Consumer needs and preferences for products and services offered by our organization are changing.</em></td>
<td>Created</td>
</tr>
</tbody>
</table>

*Note: Final measurement items included in the survey are (in original format) in italics*
5.2.5 Lean-Based Benefits

The benefits of a LM system manifest themselves in perceived value generated for customers. Depending on the system, customers can include multiple stakeholders. Smith & Colgate’s (2007) typology of value generation separates out value into four categories: functional/instrumental, experiential/hedonic, symbolic/expressive and cost/sacrifice. This segmentation of value produces a more complex view of the benefits of an organization’s value generating initiatives and what various customers may value and experience as outcomes of their efforts. The complex nature of healthcare and the various stakeholder value perspectives, in concert with the objectives of a LM program of initiatives, permit certain aspects of Smith and Colgate’s typology to be used to distinguish between the various Lean Benefits. Smith and Colgate (2007) typology is defined as follows:

- "Functional/instrumental value is concerned with the extent to which a product (good or service) has desired characteristics, is useful, or performs a desired function." (pg.10)
- "Experiential/hedonic value is concerned with the extent to which a product creates appropriate experiences, feelings, and emotions for the customer." (pg.10)
- "Symbolic/expressive value is concerned with the extent to which customers attach or associate psychological meaning to a product." (pg.10)
- Cost/sacrifice value is concerned with “the minimization of costs and other sacrifices that may be involved in the purchase, ownership and use of a product.”(pg.13)

Lean-Based Benefits reflect the degree in which functional efficiencies derived from the organization's LM Competence meets current customer needs; the degree of benefits are assessed using outcome criteria (Hackman & Wageman, 1995). The Lean-Based Benefits of a LM Competence include economic, functional and experiential measures. Although non-financial
benefits may not impact current economic outcomes, it is expected that over time they will likely enhance future financial performance; thus their benefits are not purely non-financial. Thus an increase in patient satisfaction may not impact current-state operating income, but future-state operating income will benefit from increased market share, revenues and the allocation of fixed costs over a greater number of procedures as a result of increased patient satisfaction.

Smith & Colgate’s (2007) framework does not seek to identify all types of value that may be perceived by customers, but takes a strategic orientation in identifying types of value that could generate points of differentiation and comparative marketplace advantages; firms may emphasize different elements of customer value to differentiate themselves and create comparative advantages in the marketplace. Thus, beneficial values are context specific (E.G. expected customer value generated by a hospital will differ from that of a steel mill) and firms may focus on various aspects of value for strategic differentiation, however the framework is a useful tool to segment value. In particular, the hospital context under study has many stakeholders each seeking differing values from LM that may or may not overlap. Lean-Based Benefits is operationally defined (see Table 5.9) by the combination of economic value, functional value and experiential value derived from an organization’s lean-based activities which results in positive outcomes for the organization and its customers. Using a hospital context, I will operationally define each of these three value categories.

5.2.5.1 Economic Value

I operationally define (see Table 5.9) Economic Value as the extent to which lean-based initiatives generate reduced financial cost, psychological cost, personal investment and risk for customers. In the hospital context this category of value is likely to be experienced by payers, owners, employees and patients.
### TABLE 5.9: LEAN-BASED BENEFITS MEASUREMENT ITEMS

Operational definition of **Lean-Based Benefits**: the combination of economic value, functional value and experiential value derived from an organization’s lean-based activities which results in positive outcomes for the organization and its customers.

- **Economic Value**: the extent to which lean-based initiatives generate reduced financial cost, psychological cost, personal investment and risk for customers.
- **Functional Value**: the extent to which lean-based initiatives provide greater customer utility through improved outcomes.
- **Experiential Value**: the extent to which lean-based initiatives create customer outcomes that are memorable, individualized, and enriching.

**Survey Question Framing**: With respect to the lean-based initiatives in your department, how strongly do you agree or disagree with the following statements … Questions anchored on a five point scale of “Strongly Disagree” to “Strongly Agree”

<table>
<thead>
<tr>
<th>Item #</th>
<th>Original Measurement Item For Evaluation</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><em>Our lean-based initiatives have resulted in greater overall customer satisfaction with our products and services.</em></td>
<td>Adapted from Marley, Collier &amp; Goldstein (2004)</td>
</tr>
<tr>
<td>2</td>
<td><em>Our lean-based initiatives have resulted in lower overall costs for our customers.</em></td>
<td>Created</td>
</tr>
<tr>
<td>3</td>
<td><em>Our lean-based initiatives have resulted in improvements in quality outcomes for our customers.</em></td>
<td>Adapted from Rungtusanatham, Forze, Koka, Salvador &amp; Nie (2005)</td>
</tr>
<tr>
<td>4</td>
<td><em>Our customers seem happy with our responsiveness to their problems as a result of our lean-based initiatives.</em></td>
<td>Adapted from Rungtusanatham, Forze, Koka, Salvador &amp; Nie (2005)</td>
</tr>
<tr>
<td>5</td>
<td><em>Our lean-based initiatives result in more fulfilling experiences for our customers.</em></td>
<td>Adapted from Marley, Collier &amp; Goldstein (2004)</td>
</tr>
<tr>
<td>6</td>
<td><em>Our lean-based initiatives have resulted in improved access to our products and services for our customers</em></td>
<td>Created</td>
</tr>
<tr>
<td>7</td>
<td><em>Our lean-based initiatives have enhanced the long-run level of profitability of our organization.</em></td>
<td>Adapted from Douglas &amp; Fredenhall (2004)</td>
</tr>
<tr>
<td>8</td>
<td><em>Our lean-based initiatives have enhanced the competitiveness of our organization.</em></td>
<td>Created</td>
</tr>
<tr>
<td>9</td>
<td><em>Employee morale has improved as a result of the lean-based initiatives in the organization.</em></td>
<td>Created</td>
</tr>
</tbody>
</table>

*Note: Final measurement items included in the survey are (in original format) in italics*
5.2.5.2 Functional Value

I operationally define (see Table 5.9) Functional Value as the extent to which lean-based initiatives provide greater customer utility through improved outcomes. In the hospital context these beneficial outcomes of LM will likely be experienced as increased productive throughput and quality throughput by employees and patients.

5.2.5.3 Experiential Value

I operationally define (see Table 5.9) Experiential Value as the extent to which lean-based initiatives create customer outcomes that are memorable, individualized, and enriching. In the hospital context this value will likely be experienced by patients and their families, employees, owners and donors.

5.2.6 Control Variables

In accordance with the literature in health care management and operations management, I will use the following control variables: hospital size (White et al., 1999, Shah & Ward, 2003), the number of years that Lean has been used (Shah & Ward, 2003), and the degree of technological sophistication (Westphal et al., 1997; Landon et al., 2006).

Despite the structural inertial effects that may be present (Hannan & Freeman, 1984), large firms are more likely to implement lean practices than their smaller counterparts (White et al., 1999; Shah & Ward, 2003), including hospitals (Moch, 1976). As such, I will use the number of staffed beds as a proxy for hospital size (Westphal et al., 1997) as a control variable to assess the effect of firm size on LM Competence.

It is easier to continue with existing routines than to create or borrow new ones, even if the new routines are inherently superior (Nelson & Winter, 1982; Hannan & Freeman, 1984). Firms with greater experience in deploying LM should have an advantage in the development of
a LM Competence. To control for this potential effect, I use the number of years that Lean has been in place at the firm as a control variable for LM Competence.

Technological sophistication can act as an incentive to process improvement adoption (Westphal et al., 1997) as well as a potential advantage to implementation (enhanced computer systems and data sharing ability). With no access to hospital secondary data on technology investments, I used respondent data for this control variable.

A plethora of other control variables could have been used however consistency in their significance in the literature does not suggest their inclusion necessary. As an example, the presence of unions and facility age (Shah & Ward, 2003) were shown to have limited impact. Level of competitive pressure, ownership type and financial metrics (Westphal et al., 1997) were deemed too difficult to attain for a thesis level study, so for reasons of expedience and cost, they were excluded from the study.

5.2.7 Measurement Instrument Development

“Good measurement is a prerequisite for good empirical science” (Menor & Roth, 2007: 830). Once the operational definitions of the constructs have been completed, the development of the survey instrument is essentially a three step process: I) generate items for testing through interviews with practitioners, other experts and the pertinent literature II) pre-test the items with expert judges for item purification, and III) design and pilot test the instrument (Menor & Roth, 2007). Step I was completed and documented in Tables 5.1 through 5.9.

The distinct advantage of survey research is that the items and their associated questions can be tailored to address a particular research question and the relevant population under study (Fink, 2003). Given the costs of executing surveys to meet statistical power requirements and the challenge of getting responses given the deluge of surveys potential respondents receive, it is
critical that the upfront design stages are managed and executed effectively. This extra planning helps ensure that subsequent survey results will more likely be valid and reliable. While I attempted to utilize existing scales whenever possible to represent the constructs in my research project, I found no scales in the literature, and I thus had to create measurement scales myself.

5.2.7.1 Pre-Testing

Potential scale items were generated through a comprehensive literature review and the case study data collected in my initial qualitative research phase (see Tables 5.1 to 5.9). These potential scale items were subjected to rigorous empirical scrutiny in an effort to assess their perceived adequacy. I used two rounds of item sorting exercises. Round One consisted of a convenience sample of six judges consisting of three doctoral students and three business school professors. All six specialized in the field of operations management and thus had expertise relative to LM. Since hospitals was my target population, Round Two consisted of a convenient sample of eight hospital practitioners who were interviewees in the case study research and thus possessed the appropriate knowledge and experience with LM initiatives. The function of pre-testing is not to form measurement scales per se, but to use a non-survey sample to indicate a preliminary/tentative item level adequacy (Menor & Roth, 2007).

For each item sorting round, judges were provided with a list of items and construct definitions. Judges were asked to read the construct definitions and then to match each randomized item with the one construct that it best fit; a modified Q-sort (McKeown & Thomas, 1988). These judgements were subsequently used to inform retention or elimination of items in both rounds, as well as potential revisions to the wording of items between Round One and Round Two (see Figure 5.3 for the initial pre-testing instrument).
After the first round of pre-testing, each item was assessed and a determination was made to retain the item in its current form, revise the wording or eliminate it from further consideration (see Table 5.10). Items where there was sufficient agreement exhibited between judges (all six judges matched with the intended construct) were retained in their current format. Items that exhibited excessive variation in responses\(^4\), or a clear disconnect with the intended construct were eliminated from further consideration\(^5\). The wording of all other items was scrutinized for opportunities for clarifying modifications and emphasis on more appropriate aspects of the construct; revisions were made in an effort to improve measurement item reliability and validity in the second round.

After the second round of pre-testing, items were simply retained or removed from the survey instrument; no revisions were permitted as a third round of pre-testing was not scheduled to assess the impact of further amendments to item wording. Items with 75\% agreement (high) between judges (6/8) were retained. LM Climate, LM Implementation Capability and LM Competence required further scrutiny of the items to ensure adequate content validity in the final scales as an insufficient number of items scored 50\% agreement (moderate) between judges. Lower levels of inter-judge agreement is to be expected in the second round of pre-testing when practitioners act as judges (higher levels of variance are to be expected and thus this round is a more stringent test of an item’s adequacy) so even moderate support for a measurement item is compelling (Menor & Roth, 2007). Higher internal consistency is expected in the first round because academics are more used to a matching orientation. In each construct, I examined each individual item scores in each round of pre-testing along with its importance given the construct

\(^4\) E.G. “Our department’s care givers function as a team.” Received matches to the following construct definitions: LM Culture (3), LM Climate (1), LM Supervision (1), LM Skills (1).

\(^5\) E.G. “A team-based approach is taken to the lean-based efforts in the organization.” Intended to reflect LM Competence, but received zero matches to that definition.
<table>
<thead>
<tr>
<th>Item Description</th>
<th>Construct</th>
<th>Total Matched</th>
<th>Action</th>
<th>Reasoning For Action</th>
<th>Revised Item Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>We effectively utilize cross-functional teams as a method to approach lean-based initiatives.</td>
<td>LM Skills</td>
<td>3</td>
<td>Review</td>
<td>Effectively too results oriented * method too process</td>
<td>We are able to operate in cross-functional teams on lean-based initiatives</td>
</tr>
<tr>
<td>We provide ongoing training for our departmental employees on problem solving techniques.</td>
<td>LM Skills</td>
<td>5</td>
<td>Review</td>
<td>Remove departmental reference to emphasis departmental action and focus on individuals</td>
<td>Employees are provided with ongoing training on problem solving techniques and focus on individuals</td>
</tr>
<tr>
<td>We provide lean-based improvement training to hourly employees throughout the organization on an ongoing basis.</td>
<td>LM Skills</td>
<td>4</td>
<td>Review</td>
<td>Remove organizational reference to emphasis organization and focus on individuals</td>
<td>Hourly employees are provided with lean-based improvement training and focus on individuals</td>
</tr>
<tr>
<td>We provide lean-based improvement training to managers and supervisors throughout the organization on an ongoing basis.</td>
<td>LM Skills</td>
<td>3</td>
<td>Review</td>
<td>Remove organizational reference to emphasis organization and focus on individuals</td>
<td>Managers and supervisors are provided with lean-based improvement training on an ongoing basis</td>
</tr>
<tr>
<td>We provide training on statistical techniques (such as histograms and control charts) on an ongoing basis.</td>
<td>LM Skills</td>
<td>5</td>
<td>Retain</td>
<td>Sufficient agreement between judges</td>
<td>We provide training on statistical techniques (such as histograms and control charts) on an ongoing basis</td>
</tr>
<tr>
<td>A high level of importance is placed on developing a proficiency in communication.</td>
<td>LM Skills</td>
<td>5</td>
<td>Retain</td>
<td>Sufficient agreement between judges</td>
<td>A high level of importance is placed on developing a proficiency in communication.</td>
</tr>
<tr>
<td>Our department's care giver function as a team.</td>
<td>LM Skills</td>
<td>1</td>
<td>Eliminate</td>
<td>Too much variance in responses</td>
<td>N/A</td>
</tr>
<tr>
<td>We provide ongoing training on project management tools and techniques to our departmental employees.</td>
<td>LM Skills</td>
<td>5</td>
<td>Review</td>
<td>Remove departmental reference to emphasis organization and focus on individuals</td>
<td>We provide ongoing training on project management tools and techniques to employees.</td>
</tr>
<tr>
<td>We have established lean-based training to do our jobs well on lean-based initiatives within the department.</td>
<td>LM Skills</td>
<td>5</td>
<td>Review</td>
<td>Remove departmental reference to emphasis organization and focus on individuals</td>
<td>We provide ongoing training on lean-based initiatives within the department.</td>
</tr>
<tr>
<td>Employees that are involved in the implementation of lean-based initiatives were also involved in the development of the solution.</td>
<td>LM Skills</td>
<td>2</td>
<td>Review</td>
<td>Breadth of skills not captured in wording</td>
<td>We are capable of contributing to the development of lean-based solutions and the implementation of the solutions</td>
</tr>
<tr>
<td>Ongoing training in conflict resolution is given to managers and supervisors throughout the organization.</td>
<td>LM Skills</td>
<td>3</td>
<td>Review</td>
<td>Remove organizational reference to emphasis organization and focus on individuals</td>
<td>Ongoing training in conflict resolution is given to managers and supervisors.</td>
</tr>
<tr>
<td>Employees are cross-trained in this department so that they can fill in for one another.</td>
<td>LM Skills</td>
<td>6</td>
<td>Retain</td>
<td>Sufficient agreement between judges</td>
<td>Employees are cross-trained in this department so that they can fill in for one another.</td>
</tr>
<tr>
<td>The organization's senior leaders are committed to employee lean-based improvement training.</td>
<td>LM Leadership</td>
<td>6</td>
<td>Retain</td>
<td>Sufficient agreement between judges</td>
<td>The organization's senior leaders are committed to employee lean-based improvement training.</td>
</tr>
<tr>
<td>The organization's senior leaders have demonstrated the ability to set and communicate organizational goals for lean-based programs.</td>
<td>LM Leadership</td>
<td>6</td>
<td>Retain</td>
<td>Sufficient agreement between judges</td>
<td>The organization's senior leaders have demonstrated the ability to set and communicate organizational goals for lean-based programs.</td>
</tr>
<tr>
<td>The organization's supervisors encourage the employees who work for them to function as a team.</td>
<td>LM Leadership</td>
<td>6</td>
<td>Retain</td>
<td>Sufficient agreement between judges</td>
<td>The organization's supervisors encourage the employees who work for them to function as a team.</td>
</tr>
<tr>
<td>The organization's supervisors encourage people to set and support lean improvement programs.</td>
<td>LM Leadership</td>
<td>6</td>
<td>Retain</td>
<td>Sufficient agreement between judges</td>
<td>The organization's supervisors encourage people to set and support lean improvement programs.</td>
</tr>
<tr>
<td>The organization's supervisors encourage people to set and communicate organizational goals for lean-based programs.</td>
<td>LM Leadership</td>
<td>6</td>
<td>Retain</td>
<td>Sufficient agreement between judges</td>
<td>The organization's supervisors encourage people to set and communicate organizational goals for lean-based programs.</td>
</tr>
<tr>
<td>The organization's supervisors encourage people to set and communicate operational goals for the organization.</td>
<td>LM Leadership</td>
<td>6</td>
<td>Retain</td>
<td>Sufficient agreement between judges</td>
<td>The organization's supervisors encourage people to set and communicate operational goals for the organization.</td>
</tr>
<tr>
<td>Our direct supervisor(s) empower us to act as a team.</td>
<td>LM Management</td>
<td>6</td>
<td>Retain</td>
<td>Sufficient agreement between judges</td>
<td>Our direct supervisor(s) empower us to act as a team.</td>
</tr>
<tr>
<td>Our direct supervisor(s) listens to our problems and concerns.</td>
<td>LM Management</td>
<td>6</td>
<td>Retain</td>
<td>Sufficient agreement between judges</td>
<td>Our direct supervisor(s) listens to our problems and concerns.</td>
</tr>
<tr>
<td>Our direct supervisor(s) gives fair evaluations of our work.</td>
<td>LM Management</td>
<td>6</td>
<td>Retain</td>
<td>Sufficient agreement between judges</td>
<td>Our direct supervisor(s) gives fair evaluations of our work.</td>
</tr>
<tr>
<td>The organization's supervisors encourage people to work for them to exchange opinions and ideas.</td>
<td>LM Management</td>
<td>5</td>
<td>Retain</td>
<td>Sufficient agreement between judges</td>
<td>The organization's supervisors encourage people to work for them to exchange opinions and ideas.</td>
</tr>
<tr>
<td>The organization's supervisors encourage the employees who work for them to function as a team.</td>
<td>LM Management</td>
<td>5</td>
<td>Retain</td>
<td>Sufficient agreement between judges</td>
<td>The organization's supervisors encourage the employees who work for them to function as a team.</td>
</tr>
<tr>
<td>The organization's front-line supervisors regularly provide lean-based coaching.</td>
<td>LM Management</td>
<td>4</td>
<td>Retain</td>
<td>Sufficient agreement between judges</td>
<td>The organization's front-line supervisors regularly provide lean-based coaching.</td>
</tr>
<tr>
<td>The organization's supervisors frequently hold group meetings where the people who work for them can really discuss things.</td>
<td>LM Management</td>
<td>4</td>
<td>Retain</td>
<td>Sufficient agreement between judges</td>
<td>The organization's supervisors frequently hold group meetings where the people who work for them can really discuss things.</td>
</tr>
<tr>
<td>Our front-line supervisors are more likely to tell us something than to send an email.</td>
<td>LM Management</td>
<td>6</td>
<td>Retain</td>
<td>Sufficient agreement between judges</td>
<td>Our front-line supervisors are more likely to tell us something than to send an email.</td>
</tr>
<tr>
<td>Front-line employees trust their supervisors and feel safe discussing any work related issues with them.</td>
<td>LM Management</td>
<td>4</td>
<td>Revise</td>
<td>Change emphasis managerial skill and emphasis emphasis from line employee perception</td>
<td>Front-line supervisors create a safe environment for discussing any work related issues.</td>
</tr>
<tr>
<td>Front-line employees respect their direct supervisor(s) in this organization.</td>
<td>LM Management</td>
<td>3</td>
<td>Review</td>
<td>Change emphasis managerial skill and emphasis emphasis from line employee perception</td>
<td>Front-line supervisors respect their direct supervisor(s) in this organization.</td>
</tr>
<tr>
<td>Front-line employees respect their direct supervisor(s) in this organization.</td>
<td>LM Management</td>
<td>2</td>
<td>Review</td>
<td>Change emphasis managerial skill and emphasis emphasis from line employee perception</td>
<td>Front-line employees respect their direct supervisor(s) in this organization.</td>
</tr>
<tr>
<td>Our problem solving through the removal of all waste is more of a belief and value than a policy or practice.</td>
<td>LM Climate</td>
<td>1</td>
<td>Review</td>
<td>Change emphasis managerial skill and emphasis emphasis from line employee perception</td>
<td>Our problem solving through the removal of all waste is more of a belief and value than a policy or practice.</td>
</tr>
<tr>
<td>Our problem solving through the removal of all waste is more of a belief and value than a policy or practice.</td>
<td>LM Climate</td>
<td>2</td>
<td>Review</td>
<td>Change emphasis managerial skill and emphasis emphasis from line employee perception</td>
<td>Our problem solving through the removal of all waste is more of a belief and value than a policy or practice.</td>
</tr>
<tr>
<td>Our organization rewards group sharing and team performance as opposed to individual performance.</td>
<td>LM Climate</td>
<td>4</td>
<td>Review</td>
<td>Change emphasis managerial skill and emphasis emphasis from line employee perception</td>
<td>Our organization rewards group sharing and team performance as opposed to individual performance.</td>
</tr>
<tr>
<td>Continuous improvement is stressed in all work processes throughout the organization.</td>
<td>LM Climate</td>
<td>4</td>
<td>Review</td>
<td>Change emphasis managerial skill and emphasis emphasis from line employee perception</td>
<td>Continuous improvement is stressed in all work processes throughout the organization.</td>
</tr>
<tr>
<td>Our organization’s assumptions, incentives, and reward systems are appropriate for employee involvement and development in lean-based initiatives.</td>
<td>LM Climate</td>
<td>3</td>
<td>Review</td>
<td>Change emphasis managerial skill and emphasis emphasis from line employee perception</td>
<td>Our organization’s assumptions, incentives, and reward systems are appropriate for employee involvement and development in lean-based initiatives.</td>
</tr>
<tr>
<td>When we are on a difficult lean-based assignment, we can usually count on getting assistance from our boss and coworkers.</td>
<td>LM Climate</td>
<td>2</td>
<td>Eliminate</td>
<td>Too much variance in judge’s responses; not clearly tied to practices, policies and procedures</td>
<td>When we are on a difficult lean-based assignment, we can usually count on getting assistance from our boss and coworkers.</td>
</tr>
<tr>
<td>Our organization’s members are continually willing to challenge each other's thinking about their processes.</td>
<td>LM Climate</td>
<td>4</td>
<td>Revise</td>
<td>Emphasis departmental level and remove emphasis emphasis from line employee perception</td>
<td>Our organization’s members are continually willing to challenge each other's thinking about their processes.</td>
</tr>
</tbody>
</table>

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TABLE 5.10: PHASE I PRE-TEST RESULTS
Our organization is process driven and not expert driven. LM Culture 1 Review emphasize organizational values and not actions Our organization is driven by a belief in the processes and not by a belief in the experts.

Our organization continues to search for additional learning and further improvement after installation of new processes. LM Culture 1 Review emphasize belief in continuous improvement Our organization believes in continuously searching for additional learning and further improvements even after the installation of new processes.

Employees are encouraged to try new ideas or models of new ideas and learn through experimentation. LM Culture 0 Review move to Lean Climate; this is more of a practice than a value or belief; add “department” reference and employees to my department by trying new ideas or models of new ideas to learn through experimentation. Our organization is not afraid of anything we want without consulting our direct supervisors.

Employee teams are encouraged to try and solve their own problems through their own innovations/improvements as much as possible. LM Culture 1 Review reward to emphasize belief of organization Our organizations believes that employee teams should try and solve their own problems through their own improvement efforts.

Our organization places its customers' needs above all others. LM Culture 4 Review change “places” to “values” Our organization values its customer's needs above all others.

Front-line employees believe there is a strong commitment to continuous improvement at all levels of this organization. LM Culture 5 Retain sufficient agreement between judges Front-line employees believe there is a strong commitment to continuous improvement at all levels of this organization.

Employee's awareness in the organization continually analyzes its work processes to look for ways of doing a better job. LM Culture 2 Review emphasize collective understanding Our organization employees believe that continually assessing their work processes is key to finding ways of doing a better job.

Saying that embody organizational wisdom about process improvement are often told within the department. LM Culture 5 Review change “department” to “organization” to emphasize organization level assessment Our organization employees believes that embody organizational wisdom about process improvement are often told within the organization.

Stories are told within the organization about lean-based improvement accomplishments of past employees. LM Culture 4 Review add “often” to tell and add end of sentence for consistency Stories about lean-based improvement accomplishments of past employees are often told within the organization.

Our organization believes that employee learning is an investment, not an expense. LM Culture 5 Retain sufficient agreement between judges Our organization believes that employee learning is an investment, not an expense.

We use charts to determine whether the implementations of our processes are in control. LM Implementation Capability 4 Review add reference to lean-based initiatives We use charts to determine whether the implementations of the processes of our lean-based initiatives are in control.

Our organization forms cross-functional teams to solve problems. LM Implementation Capability 0 Review emphasize use of and not just formation of teams Our organization uses cross-functional teams to solve lean-based problems.

In our organization, members of a lean-based improvement team then roles and responsibilities are clearly identified and understood. LM Implementation Capability 2 Review emphasize usage of and documentation and identification of roles and responsibilities Our organization, specifically identified and documented roles and responsibilities for lean-based improvement team members.

All lean-based project team members are committed to the same project goals. LM Implementation Capability 0 Review emphasize obtaining commitment and alignment Our organization achieve commitment and alignment for lean-based project goals.

Our organization always uses a similar problem solving structured methodology on lean-based initiatives. LM Implementation Capability 4 Review emphasize the same and not similar and consistency Our organization always use a structurally consistent methodology for lean-based initiatives.

Our organization conducts a thorough review of all potential alternatives to solving a problem before selecting a solution to execute. LM Implementation Capability 1 Review emphasize the project team (not the organization) and remove “conducts a thorough” Our organization conducts a thorough review of all potential alternatives to solving a problem before selecting a solution to execute.

Our organization keeps records about how each lean-based improvement project is conducted. LM Implementation Capability 1 Retain Our organization keeps records about how each lean-based improvement project is conducted.

All lean-based improvement projects are reviewed regularly during the process against stated objectives. LM Implementation Capability 3 Review add project to description of objectives and change markedly to “periodically” All lean-based improvement projects are periodically reviewed during the improvement process against stated project objectives.

Detailed execution plans are created for each designated lean-based initiative. LM Implementation Capability 5 Retain sufficient agreement between judges Detailed execution plans are created for each designated lean-based initiative.

A systematic approach to lean-based efforts in the organization is used. LM Competence 2 Eliminate not related to competency at deriving benefits from lean-based initiatives Our organization uses a systematic approach to lean-based efforts in the organization.

The lean-based efforts in the organization are relentless. LM Competence 3 Review emphasize departmental results from relentless efforts Our organization uses a relentless approach to lean-based efforts in the organization.

Facts drive the development of lean-based improvements in the organization. LM Competence 3 Review emphasize departmental results from the influence of facts. Facts are an influential component in the development of lean-based improvements in our department.

A team-based approach is taken to the lean-based efforts in the organization. LM Competence 0 Eliminate not related to competency at deriving benefits from lean-based initiatives Our organization uses a team-based approach to lean-based efforts in the organization.

Lean-based initiatives in the organization are process focused. LM Competence 2 Review emphasize departmental results from the influence of facts. Lean-based initiatives are a process focused approach in our department.

The lean-based initiatives in the organization have been effective at enhancing productive work flows. LM Competence 3 Review change “department” to “departmental” LM Competence 3 Review emphasize departmental productivity Our lean-based initiatives have been effective at enhancing productive work flows.

The lean-based initiatives in the organization have been effective at enhancing the proportion of value-adding activities of work efforts. LM Competence 5 Review change “department” to “departmental” Our lean-based initiatives have been effective at enhancing the proportion of value-adding activities of work efforts.

The quality of our organization’s products and services has been improved over the past 3 years. LM Competence 5 Review emphasize the impact of lean-based initiatives on enhancing the quality of our department’s products and services over the past 3 years. The deployment of lean-based initiatives has improved the quality of our organization’s products and services.

The process variability in our organization has decreased over the past 3 years. LM Competence 3 Review emphasize the impact of lean-based initiatives on reducing the department’s process variability The deployment of lean-based initiatives has reduced process variability in our department over the past 3 years.

The speed of our product and service delivery has increased over the past 3 years. LM Competence 3 Review emphasize the impact of lean-based initiatives on the department’s speed of delivery The deployment of lean-based initiatives has increased the speed of our department’s product and service delivery over the past 3 years.

Our organization diffuses ideas across department lines so as to spread lean-based learning. LM Competence 0 Review emphasize result of accelerated learning through departmental diffusion Our department’s diffusion of lean-based learning to other departments has resulted in accelerated learning within the organization.

We have recently discussed what we did right or wrong on a particular lean-based project. LM Competence 0 Review emphasize impact of discussion on future project Our organization has recently discussed what we did right or wrong on a particular lean-based project.

Our organization continually seeks to improve all aspects of work flows and work efforts on an ongoing basis. LM Competence 3 Review emphasize department utilization for improvement Our organization continually seeks to improve all aspects of work flows and work efforts on an ongoing basis.

The overall benefits of our organization’s products and services are unknown. Environmental Uncertainty 6 Retain sufficient agreement between judges The overall benefits of our organization’s products and services are unknown.

The competition for our organization’s supply of skilled resources is unknown. Environmental Uncertainty 6 Retain sufficient agreement between judges The competition for our organization’s supply of skilled resources is unknown.

The amount of competition for our organization’s customers is constantly changing. Environmental Uncertainty 6 Retain sufficient agreement between judges The amount of competition for our organization’s customers is constantly changing.

Our organizations totally unaware of the potential competitive threats to our business. Environmental Uncertainty 5 Retain sufficient agreement between judges Our organization is totally unaware of the potential competitive threats to our business.

Government regulations controlling our industry are unstable. Environmental Uncertainty 6 Retain sufficient agreement between judges Government regulations controlling our industry are unstable.

The public’s political views and attitudes towards our industry is in flux. Environmental Uncertainty 6 Retain sufficient agreement between judges The public’s political views and attitudes towards our industry is in flux.

The diversity and technical intricacy of our product and services is always changing. Environmental Uncertainty 6 Retain sufficient agreement between judges The diversity and technical intricacy of our product and services is always changing.

The amount of instability or turbulence in the industry is high. Environmental Uncertainty 5 Retain sufficient agreement between judges The amount of instability or turbulence in the industry is high.

Consumer needs and preferences for products and services offered by our organization are changing. Environmental Uncertainty 5 Retain sufficient agreement between judges Consumer needs and preferences for products and services offered by our organization are changing.
operational definition before determining its inclusion in the final measurement instrument. LM Culture had one item out of nine with a score of 5/8 included in the final measurement scale.

Although a third round of pre-testing would have been desired, I chose to move forward with the measurement items in their current state. Having used both academic and informed industry judges (hospital practitioners) for initial pre-testing, and exercising my own informed researcher knowledge to the screening of measurement items, I determined that a third round was not necessary.

Measurement items for Lean-Based Benefits were not subjected to pre-testing. At the time of pre-testing, secondary data from a consulting firm was to be made available to measure this construct. However, subsequent to the completion of pre-testing, the consulting firm did not provide the data and I had to use the measurement items without pre-testing. For reasons of expediency, the measurement items associated with this construct were not pre-tested. However, I subjected these items along with the LM Competence items to a two factor principal components analysis to assess concerns of unidimensionality and have reported this in Chapter Six. The results of the principal components analysis were solely relied upon for assessing measurement item adequacy for this scale. This test eliminated three items from the proposed Lean-Based Benefits scale.

5.3 Summary

Through a two-phased pre-testing exercise, I refined and eliminated potential items from my survey (See Table 5.11) in an effort to enhance reliability and validity of the items. This foundational pre-testing enables me to confidently move forward to the deployment of my multi-item scales within a survey instrument. The second stage confirmatory analysis of survey data
collected from key respondents to assess the reliability and validity of the newly constructed, multi-item scales will be outlined in Chapter Six.

**TABLE 5.11: PRE-TEST SUMMARY RESULTS**

<table>
<thead>
<tr>
<th>Construct</th>
<th>Initial Items</th>
<th>Items Eliminated after Round I</th>
<th>Items Refined after Round I</th>
<th>Items With 50% Agreement of all Judges</th>
<th>Items Eliminated After Two Rounds</th>
<th>Final Items Retained For Survey</th>
</tr>
</thead>
<tbody>
<tr>
<td>LM Skills</td>
<td>12</td>
<td>1</td>
<td>7</td>
<td>7 (6)</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>LM Executive Leadership</td>
<td>12</td>
<td>0</td>
<td>1</td>
<td>12 (9)</td>
<td>3</td>
<td>9</td>
</tr>
<tr>
<td>LM Supervision</td>
<td>10</td>
<td>0</td>
<td>1</td>
<td>10 (9)</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td>LM Climate</td>
<td>12</td>
<td>1</td>
<td>11</td>
<td>3 (0)</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>LM Culture</td>
<td>12</td>
<td>0</td>
<td>10</td>
<td>9 (8)</td>
<td>3</td>
<td>9</td>
</tr>
<tr>
<td>LM Implementation Capability</td>
<td>11</td>
<td>0</td>
<td>9</td>
<td>4 (1)</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>LM Competence</td>
<td>13</td>
<td>2</td>
<td>11</td>
<td>6 (3)</td>
<td>5</td>
<td>8</td>
</tr>
<tr>
<td>Environmental Uncertainty</td>
<td>9</td>
<td>0</td>
<td>0</td>
<td>9 (8)</td>
<td>1</td>
<td>9</td>
</tr>
</tbody>
</table>

*Note: items with greater than 75% round two judge agreement in parentheses*
CHAPTER 6 – CONFIRMATORY QUANTITATIVE SURVEY

6.1 Introduction

Based on the literature and my case study research, I adapted a set of metrics for my descriptive research model that was tested for tentative reliability and validity (Menor & Roth, 2007) in Chapter Five. In this chapter, I will (I) use key respondent data collected through a survey instrument to determine whether one or more variables are associated with, or are antecedents of, one or more outcome variables in my descriptive research model, (II) assess the measurement model used in that survey, and (III) assess the structural model proposed in the descriptive research model.

Given the exploratory nature of my research I am using Partial Least Squares structural equation modeling (PLS-SEM) as an analysis tool. PLS-SEM is more oriented to theory building and maximizes variance explained. PLS-SEM is often compared to co-variance based structural equation modeling (CB-SEM) (see Table 6.1). Each has qualities that fit specific types of research objectives and data. Since the primary objective of my research is development and explanation of variance of the constructs, PLS-SEM is the appropriate method (Hair et al., 2014) compared to more theory confirming approach CB-SEM. Without a global goodness of fit measure, the confirmatory power of PLS-SEM is limited, but PLS-SEM and CB-SEM results typically do not differ by much and as such PLS - SEM results can be a good proxy for CB-SEM results (Hair et al., 2014) especially in research where the goal is predictive in nature.
TABLE 6.1: PLS-SEM COMPARISON TO CB-SEM

<table>
<thead>
<tr>
<th>PLS-SEM</th>
<th>CB-SEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>▪ Goal to predict or identify key target and/or driver constructs</td>
<td>▪ Goal is theory testing, confirmation or comparing alternative theories</td>
</tr>
<tr>
<td>▪ Only recursive relationships within the structural model</td>
<td>▪ Non-recursive relationships may occur within the structural model</td>
</tr>
<tr>
<td>▪ The structural model may be complex</td>
<td>▪ The structural model is not overly complex</td>
</tr>
<tr>
<td>▪ A global goodness-of-fit is not required</td>
<td>▪ A global goodness-of-fit is required</td>
</tr>
<tr>
<td>▪ Allows for formative constructs</td>
<td>▪ No solely formative constructs</td>
</tr>
<tr>
<td>▪ Non normal data distribution and/or small sample size</td>
<td>▪ Normal distributed data and large sample size</td>
</tr>
<tr>
<td></td>
<td>▪ Co-variation of error terms is required for further model specification</td>
</tr>
</tbody>
</table>

Adapted from Hair et al., 2014

6.2 Survey Background

The time frame under consideration for this confirmatory study is cross-sectional. The unit of analysis is the LM program as represented by the portfolio of projects initiated at the emergency department within a hospital. While LM is an approach that strives to embed itself across an entire organization, typical deployment is at the departmental level with initiatives more narrowly focused, concentrating on improvements within individual departments. While this more focused and concentrated approach can yield significant benefits, it is not ideal, and can be prone to producing isolated pockets of lean improvements that have little cumulative effect on the customers’ perceptions of value produced by the entire value system (Mann, 2009). This examination in US hospitals will seek to better understand organizational variation, through the examination of department level comparisons (specifically emergency departments) across multiple hospital organizations. Building upon the literature and empirical case study research, this quantitative survey will incorporate primary perceptual data obtained through this survey instrument. I will outline my methodology in the following sections.
6.2.1 Study Population

The hospital industry has historically viewed itself as unique, different from other businesses and reluctant to embrace manufacturing-like practices (Jarrett, 1998). Hospitals are multifaceted social organizations with complex cultural characteristics and a variety of stakeholders (Hopp & Lovejoy, 2012) making them an excellent domain to assess my hypotheses. Empirical research into process improvement in hospitals is prescient, and can provide much needed information to hospital administrators and health care policy makers in these challenging financial and public health times (Green, 2012).

An industry trend is the consolidation of individual, stand-alone hospitals into networks of hospitals under single ownership. A network or group of hospitals is comprised of two or more hospitals owned, sponsored, or contract managed by a central organization that work together to coordinate and deliver a broad spectrum of services to their community (Ho, 2006; American Hospital Association, 2013). Examples include: Partners Healthcare, Kaiser Permanente, Mayo Clinic Health System and the Shriners Hospitals for Children. Consolidation or centralization can provide a source of efficiency, but can also create system level coordination issues.

This study is not designed to determine advantages or disadvantages for hospitals within networks over stand-alone hospitals, however similar to the treatment of plants within an organization; hospitals within networks will be treated individually to ensure consistency across the sample. Questions to respondents will be framed to focus answers on hospital and department level dimensions and not on the system. This ensures that respondents’ answers are consistently focused across hospitals and department resources, capabilities and competencies and not system level attributes enabling comparisons.
6.2.2 Sampling Frame

I will use a sampling frame of panel partners used by Qualtrics Inc.\(^6\) (see Figure 6.1). My sampling focus is on emergency departments in US hospitals to minimize confounding effects from variables outside my study. Emergency departments are typically the first to undergo process improvements and act as a gateway to other areas of the hospital thus making them a fruitful area for LM deployment and study.

**FIGURE 6.1: QUALTRICS INC. METHODOLOGY**

Sample design is a step often overlooked in operations management research (Rungtusanatham et al., 2003). Two issues to address are sample size and the randomness of the sample. Sample size is principally an issue of concern for the requirements of statistical analysis (I.E. margin of error). Randomness is a concern for ensuring the sample is representative of the

---

\(^6\) The online survey company, Qualtrics (www.qualtrics.com, Provo, Utah, USA), administered my survey. They contacted a subset of their panel partners based on criteria I provided and asked panel members to take part in the study. Members of the panels received compensation from Qualtrics based on the estimated time it would take them to complete the survey. I paid Qualtrics a fee for this service.
population under study. Using PLS SEM for modelling complex models works better with smaller sample sizes than co-variance based SEM (Chin & Newsted, 1999). Given my research model design, and the endogenous dependent variable LM Competence having seven independent predictor variables at the structural level (this represents the largest regression performed), a sample size of 140 cases would be sufficient (20 cases per predictor variable)(Peng & Lai, 2012; Chin, 2010). My sample size of 201 is more than adequate for the model being examined (Chin, 2010; Hair, Hult, Ringle & Sarstedt, 2014). Randomness is discussed in the section 6.2.3 Data Collection.

LM is best examined from the frontline – at the “gemba”. In hospitals, nurses are the key personnel in delivering service and solving problems (Tucker, Edmondson & Spear, 2002). Nurses can provide the best perspective on the realities of LM implementation and preparation capabilities. Using Qualtrics Inc. as a survey partner (Wright & Skagerberg, 2012), I am querying at the “gemba” for the data. We were able to gather a sample of 201 respondents; all emergency room nurses from across the United States who had participated in a lean initiative within their emergency department.

6.2.3 Data Collection

I chose to administer the survey electronically, since previous research has suggested that surveys conducted electronically are comparable to print surveys and result in fewer missing responses and more efficient data collection (Boyer, Olson, Callantone & Jackson, 2002). I partnered with Qualtrics to distribute my survey. The data was generated using Qualtrics software, Version 56686 of the Qualtrics Research Suite. Copyright © 2014 Qualtrics. Qualtrics and all other Qualtrics product or service names are registered trademarks or trademarks of
Qualtrics, Provo, UT, USA. http://www.qualtrics.com. For reasons noted earlier, I targeted emergency room nurses as my key respondents at the departmental level.

Prior to survey launch, I ran a channel check to gauge internal response rates from the Qualtrics Panel partners. For a fee of $500, Qualtrics distributed a survey to members of its panels. Initial screening of health care practitioners from two panel partners was conducted. Potential survey participants were asked three qualifying questions (see Table 6.2).

**TABLE 6.2: THREE KEY RESPONDENT QUALIFYING QUESTIONS**

<table>
<thead>
<tr>
<th>Q1 What type of healthcare professional are you?</th>
</tr>
</thead>
<tbody>
<tr>
<td>○ Nurse</td>
</tr>
<tr>
<td>○ Nurse Practitioner</td>
</tr>
<tr>
<td>○ Physician Assistant</td>
</tr>
<tr>
<td>○ Physician</td>
</tr>
<tr>
<td>○ Pharmacist</td>
</tr>
<tr>
<td>○ Other: ____________________</td>
</tr>
<tr>
<td>○ I am not in a healthcare profession.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Q2 In which of the following environments do you primarily work?</th>
</tr>
</thead>
<tbody>
<tr>
<td>○ Emergency Room</td>
</tr>
<tr>
<td>○ Hospital</td>
</tr>
<tr>
<td>○ Clinic</td>
</tr>
<tr>
<td>○ Physician Office</td>
</tr>
<tr>
<td>○ Other: ____________________</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Q3 Have you participated in any Emergency Department improvement initiative focused upon the elimination of waste in work efforts and work flows over the past three years?</th>
</tr>
</thead>
<tbody>
<tr>
<td>○ Yes</td>
</tr>
</tbody>
</table>
| ○ No
Based on the number of panel participants required to get 200 positive responses (Q1: Nurse, Q2: Emergency Room, and Q3: Yes) an acceptable response rate of 31% was estimated. Based on a response rate of 30%, an estimate time of ten minutes to complete the survey, and the challenge of specifically targeting emergency room nurses and providing enough incentive to get them to participate in an electronic survey, it was agreed that participants would receive a $33 incentive and I would pay Qualtrics US$74.90 per response (including the incentive). A contract was signed and a US$10,000 deposit was paid.

I loaded the measurement items on the Qualtrics platform and designed the survey in two parts. Part One included the three qualifying questions as well as a supplemental set of two questions to help identify the hospital of the respondent (see Table 6.3). These data were used to gather hospital specific data for this research (number of beds) and will be used in future research to gather additional hospital specific data. After the initial 10% of target respondents was attained (20 out of 200), I consulted with the Qualtrics team to ensure there were no issues with the survey methodology, and they continued to gather responses until the agreed upon 200 was attained. I scrutinized the responses from all 200 respondents and rejected four based on a combination of overly fast completion times, and straight-lining (Hair et al., 2014). These four rejections were replaced with five additional respondents by re-opening the survey to the panels.

In total there were 1,527 respondents to Part One. Of those respondents, 95% answered, nurse, 48% answered emergency department and 29% answered yes; 308 (20%) qualified to move on to Part Two and were provided with a brief description of the survey (see Appendix C). Of those who qualified, 299 (97%) granted their consent to participate of which 273 took Part Two and I received the first 205 respondents (including four rejected respondents).
A final assessment of average survey time and response rates was conducted. Response rates were higher than forecasted so the price per response was reduced to US$71.26. I paid the final invoice of US$4,256.

**TABLE 6.3: TWO KEY RESPONDENT HOSPITAL IDENTIFICATION QUESTIONS**

| In order to cross reference your perspectives about your hospital's capabilities, with publicly available data from the Centers for Medicaid & Medicare Services (CMS) on performance and patient satisfaction, we require you to provide us with your hospital name and location. This hospital identifying information will solely be used as a cross-referencing tool to link the two sets of data. The name and/or location of the hospital will be confidential and never used in any publication from this study. |
| Q4 The name of my hospital is: |
| Q5 My hospital is located in the city of: |

In total, 273 (89%) out of the 308 who qualified for the survey, finished the survey; however my contract was for 200 respondents and therefore my sample size is 201. Malhotra & Grover (1998) argued that response rates for electronic surveys should be reduced from 20% to 10%, but Boyer et al. (2002) found that both mail and electronic methods had similar response rates. 273 completed responses from the initial pool of 1,527 potential respondents is an 18% response rate. Given the prequalifying done, the response rate is 89% (273 out of 308).

Descriptive statistics on the respondents’ nursing experience (Table 6.4), experience at the hospital (Table 6.5) and age (Table 6.6) show a tendency for respondents to have more nursing experience and seniority at the hospital. Age is more broadly dispersed amongst categories. These distributions along with the geographical dispersion of key respondents and the Qualtrics methods satisfied any concerns I had with the randomness of the sample.
TABLE 6.4: KEY RESPONDENT NURSING EXPERIENCE

<table>
<thead>
<tr>
<th>I have been a professional nurse for:</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>less than three years</td>
<td>6</td>
<td>3.0</td>
</tr>
<tr>
<td>more than three years but less than six years</td>
<td>26</td>
<td>12.9</td>
</tr>
<tr>
<td>more than six years but less than ten years</td>
<td>48</td>
<td>23.9</td>
</tr>
<tr>
<td>more than ten years but less than fifteen years</td>
<td>37</td>
<td>18.4</td>
</tr>
<tr>
<td>more than fifteen years</td>
<td>84</td>
<td>41.8</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>201</td>
<td>100</td>
</tr>
</tbody>
</table>

TABLE 6.5: KEY RESPONDENT HOSPITAL SENIORITY

<table>
<thead>
<tr>
<th>I have worked in this organization for:</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>less than one year</td>
<td>5</td>
<td>2.5</td>
</tr>
<tr>
<td>more than one year but less than three years</td>
<td>27</td>
<td>13.4</td>
</tr>
<tr>
<td>more than three years but less than six years</td>
<td>27</td>
<td>13.4</td>
</tr>
<tr>
<td>more than six years but less than ten years</td>
<td>33</td>
<td>16.4</td>
</tr>
<tr>
<td>more than ten years</td>
<td>109</td>
<td>54.2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>201</td>
<td>100</td>
</tr>
</tbody>
</table>

TABLE 6.6: KEY RESPONDENT AGE

<table>
<thead>
<tr>
<th>My age is:</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>younger than 25</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>25 to 34</td>
<td>42</td>
<td>20.9</td>
</tr>
<tr>
<td>35 to 44</td>
<td>51</td>
<td>25.4</td>
</tr>
<tr>
<td>45 to 54</td>
<td>51</td>
<td>25.4</td>
</tr>
<tr>
<td>55 or older</td>
<td>57</td>
<td>28.4</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>201</td>
<td>100</td>
</tr>
</tbody>
</table>

All measurement model scale items were measured with a five-point Likert scale with 1= strongly disagree to 5= strongly agree. Respondents were asked to “Please indicate the extent to which you agree or disagree with the / following statements as they pertain to your hospital emergency / department's lean management initiatives”; the higher the score, the more agreement with the statement.

Electronic surveys can lead to greater efficiency and data accuracy (Klassen & Jacobs, 2001). They’re more cost effective, convenient and enhance the ability to reach subjects (Ding, Hu, Verma & Wardell, 2009). By using Qualtrics as a partner, I was able to pre-screen respondents, rapidly collect a sample of 201 emergency nurses, eliminate missing data and filter
out poor quality observations. After development of my survey, responses were collected over a
nine day period until my predetermined sample size of 200 was achieved.

Data for the control variable size (staffed beds) was collected from the American Hospital
Directory (http://www.ahd.com/state_statistics.html) during a one week period from June 16th to
23rd, 2014. All other data was collected from the survey of key respondents.

There was no missing data in the sample. As part of the survey instrument design,
respondents were forced to answer all questions before completing the survey. Therefore, no
missing data techniques were required.

6.2.4 Common Method Bias

Common method bias refers to measurement error resulting from variance due to the
measurement method utilized (Podsakoff, MacKenzie, Lee & Podsakoff, 2003). The potential
problems of self-reports and common method bias are well documented (Podsakoff & Organ,
1986; Bagozzi & Yi, 1990). It is present when correlations between measures can be explained
by the fact that the same individual provides the responses for all measurement scales rather than
by any true relationship between the constructs (Podsakoff et al., 2003). But, “if trait reliabilities
of individual items are high and convergent and discriminant validity are achieved, we may
conclude that perceptual measures can be used” (Ketokivi & Schroeder, 2004: 252).

The careful development of measurement items, construction of measurement scales and
design of the survey questioning (Brannick, Chan, Conway, Lance & Spector, 2010; Pace, 2010)
led to adequate levels of reliability and validity (see section 6.3), thus self-reporting by
knowledgeable employees is not inferior to secondary archival data (Ketokivi & Schroeder,
2004) and can be used as an adequate source of data on the department under study. However,
the parameter estimates may still exhibit some bias (Ketokivi & Schroeder, 2004), but there is no
consensus among researchers regarding the conditions under which common method bias invalidates empirical results (Siemson, Roth & Oliveira, 2010).

To test for the potential existence of common method bias, I used Harmon’s one-factor test by conducting an un-rotated principal component factor analysis in SPSS restricting it to one factor with no rotation. The test resulted in 36.3% of variance explained in one factor. In this test, common method bias would be deemed present if the factor analysis using all relevant measurement items results in the majority of co-variance occurring in a single factor (Podsakoff & Organ, 1986). Common method bias is not present given the results of the Harmon one-factor test.

6.2.5 Non-Response Bias

Nonresponse bias was tested by comparing the first 20% of respondents to the last 20% of respondents using Levene’s statistic for homogeneity of variance and analysis of variance (Armstrong & Overton, 1977). One item out of 52 in the measurement model demonstrated non-random variance; LS_4 (“We have enough lean-based training to do our jobs well on lean-based initiatives’’); the results show that on this variable (F-score .001; p-value .034) the two groups vary significantly on their responses to this question. Because all other variable differences between the two groups were not significant, the findings from this examination suggest that nonresponse bias is not present in my sample.

6.3 Measurement Model Testing

Latent variables are phenomena of theoretical interest and have a long history of assessment in research (E.G. Nunally, 1978; Churchill, 1979; Duncan, 1984). Latent variables cannot be directly observed and have to be assessed by manifest measures which are observable (Diamantopoulos, Riefler & Roth, 2008). In this context, a measurement model describes
relationships between a latent variable (construct) and its measures (items, indicators), while the structural model details the relationships between different constructs (Edwards & Bagozzi, 2000). “The reason for drawing a distinction between the measurement model and the structural model is that proper specification of the measurement model is necessary before meaning can be assigned to the analysis of the structural model” (Anderson & Gerbing, 1982: 453).

Having completed two rounds of measurement item pre-testing to assess the adequacy of each potential item, I now turn to stage two of the Menor & Roth (2007) method of measurement scale validation. One of the major sources of error in survey based research is measurement error (Malhotra & Grover, 1998). I conducted several tests to maximize reliability and validity of my newly created multi-item scales (measurement model) to minimize measurement error in my study (Litwin, 1995). In particular, because of the pre-testing described in Chapter Five, I performed Principal Components Analysis on all the scales used with the resulting measurement properties exceeding all minimum acceptable standards and demonstrating sound convergent and discriminant validity (Fornell & Larcker 1981; O’Leary-Kelly & Vokurka, 1998).

Initially the data was loaded into IBM SPSS Statistics Version 21. Descriptive statistics for all 70 potential measurement items were calculated; means, standard deviation, kurtosis and skewness for each measurement item are listed in Table 6.7. In addition, the data was loaded into SmartPLS 2.0M3 and the factor loading scores were calculated for each measurement item on its related construct (see Table 6.7). Standard errors for kurtosis were 0.34 and for skewness was 0.17.
### TABLE 6.7: MEASUREMENT ITEM DESCRIPTIVE STATISTICS

<table>
<thead>
<tr>
<th>Construct: LM Skills</th>
<th>Measurement Items</th>
<th>Loading</th>
<th>Mean</th>
<th>St. Dev.</th>
<th>Kurtosis</th>
<th>Skewness</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1. Employees are provided with ongoing training on problem solving techniques</td>
<td>0.82</td>
<td>3.69</td>
<td>0.97</td>
<td>0.06</td>
<td>-0.78</td>
</tr>
<tr>
<td></td>
<td>2. We provide training in the basic statistical techniques (such as histograms and control charts) on an ongoing basis.</td>
<td>0.64</td>
<td>2.96</td>
<td>1.11</td>
<td>-0.93</td>
<td>-0.15</td>
</tr>
<tr>
<td></td>
<td>3. We provide ongoing training on project management tools and techniques to employees</td>
<td>0.80</td>
<td>3.32</td>
<td>0.97</td>
<td>-0.69</td>
<td>-0.42</td>
</tr>
<tr>
<td></td>
<td>4. We have enough lean-based training to do our jobs well on lean-based initiatives</td>
<td>0.79</td>
<td>3.24</td>
<td>0.97</td>
<td>-0.74</td>
<td>-0.20</td>
</tr>
<tr>
<td></td>
<td>5. Ongoing training in conflict resolution is given to managers and supervisors</td>
<td>0.63</td>
<td>3.60</td>
<td>1.00</td>
<td>0.10</td>
<td>-0.81</td>
</tr>
<tr>
<td></td>
<td>6. Employees are cross-trained in this department so that they can fill in for others if necessary.</td>
<td>0.40</td>
<td>3.39</td>
<td>1.19</td>
<td>-0.80</td>
<td>-0.48</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Construct: LM Supervision</th>
<th>Measurement Items</th>
<th>Loading</th>
<th>Mean</th>
<th>St. Dev.</th>
<th>Kurtosis</th>
<th>Skewness</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1. Our direct supervisor(s) empower as opposed to direct us on lean-based activities.</td>
<td>0.74</td>
<td>3.27</td>
<td>1.00</td>
<td>-0.65</td>
<td>-0.27</td>
</tr>
<tr>
<td></td>
<td>2. Our direct supervisor(s) listens to our problems and concerns.</td>
<td>0.83</td>
<td>3.67</td>
<td>0.99</td>
<td>0.22</td>
<td>-0.80</td>
</tr>
<tr>
<td></td>
<td>3. Our direct supervisor(s) gives fair evaluations of our work.</td>
<td>0.76</td>
<td>3.70</td>
<td>1.02</td>
<td>0.12</td>
<td>-0.82</td>
</tr>
<tr>
<td></td>
<td>4. The organization’s supervisors encourage people who work for them to exchange opinions and ideas.</td>
<td>0.78</td>
<td>3.59</td>
<td>1.03</td>
<td>-0.14</td>
<td>-0.63</td>
</tr>
<tr>
<td></td>
<td>5. The organization’s front-line supervisors regularly provide lean-based coaching.</td>
<td>0.70</td>
<td>3.13</td>
<td>1.06</td>
<td>-0.81</td>
<td>-0.22</td>
</tr>
<tr>
<td></td>
<td>6. The organization’s supervisors frequently hold group meetings where the people who work for them can really discuss things together.</td>
<td>0.69</td>
<td>3.40</td>
<td>1.09</td>
<td>-0.51</td>
<td>-0.59</td>
</tr>
<tr>
<td></td>
<td>7. Our front-line supervisors are more likely to tell us something face-to-face than to send a memo.</td>
<td>0.57</td>
<td>3.01</td>
<td>1.16</td>
<td>-1.02</td>
<td>-0.08</td>
</tr>
<tr>
<td></td>
<td>8. Front-line supervisors create a safe environment for discussing any work related issues.</td>
<td>0.81</td>
<td>3.43</td>
<td>1.02</td>
<td>-0.08</td>
<td>-0.65</td>
</tr>
</tbody>
</table>
Construct: LM Executive Leadership

<table>
<thead>
<tr>
<th>Measurement Items</th>
<th>Loading</th>
<th>Mean</th>
<th>St. Dev.</th>
<th>Kurtosis</th>
<th>Skewness</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The organization’s senior leaders are committed to employee lean-based improvement training</td>
<td>0.83</td>
<td>3.35</td>
<td>1.02</td>
<td>-0.40</td>
<td>-0.40</td>
</tr>
<tr>
<td>2. The organization’s senior leaders have demonstrated the ability to set and communicate organizational goals for lean-based programs.</td>
<td>0.83</td>
<td>3.59</td>
<td>1.02</td>
<td>0.07</td>
<td>-0.82</td>
</tr>
<tr>
<td>3. The organization’s senior leaders visibly demonstrate personal commitment to lean-based improvement on a consistent basis.</td>
<td>0.73</td>
<td>3.44</td>
<td>1.09</td>
<td>-0.36</td>
<td>-0.65</td>
</tr>
<tr>
<td>4. Our organization’s senior leaders inspire employees to contribute to lean-based initiatives.</td>
<td>0.46</td>
<td>3.54</td>
<td>0.96</td>
<td>-0.88</td>
<td>-0.34</td>
</tr>
<tr>
<td>5. The organization’s senior leaders assume responsibility for lean-based performance improvements.</td>
<td>0.70</td>
<td>3.31</td>
<td>1.07</td>
<td>-0.35</td>
<td>-0.59</td>
</tr>
<tr>
<td>6. Our organization’s senior leaders create and communicate a vision focused on lean-based improvement.</td>
<td>0.87</td>
<td>3.58</td>
<td>0.97</td>
<td>-0.06</td>
<td>-0.62</td>
</tr>
<tr>
<td>7. The organization’s goals, objectives and strategies are communicated to me by senior leaders.</td>
<td>0.73</td>
<td>3.69</td>
<td>1.04</td>
<td>0.35</td>
<td>-0.92</td>
</tr>
<tr>
<td>8. The long-run competitive strategy of my organization has been communicated to me by senior leaders.</td>
<td>0.68</td>
<td>3.51</td>
<td>1.11</td>
<td>-0.31</td>
<td>-0.70</td>
</tr>
<tr>
<td>9. We see our organization’s senior leaders at the front-line of service delivery on a regular basis.</td>
<td>0.60</td>
<td>2.53</td>
<td>1.17</td>
<td>-0.93</td>
<td>0.32</td>
</tr>
</tbody>
</table>

Construct: LM Climate

<table>
<thead>
<tr>
<th>Measurement Items</th>
<th>Loading</th>
<th>Mean</th>
<th>St. Dev.</th>
<th>Kurtosis</th>
<th>Skewness</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Employees are not laid-off, right-sized or fired as a result of lean-based initiatives in our department.</td>
<td>0.58</td>
<td>3.58</td>
<td>0.99</td>
<td>0.25</td>
<td>-0.72</td>
</tr>
<tr>
<td>2. Our department rewards group sharing and team performance as opposed to individual performance.</td>
<td>0.72</td>
<td>3.17</td>
<td>1.00</td>
<td>-0.75</td>
<td>-0.23</td>
</tr>
<tr>
<td>3. Continuous improvement is stressed in all work processes throughout our department.</td>
<td>0.85</td>
<td>4.02</td>
<td>0.84</td>
<td>1.94</td>
<td>-1.13</td>
</tr>
<tr>
<td>4. Our department’s incentive systems reward employee involvement and development in lean-based initiatives.</td>
<td>0.73</td>
<td>2.99</td>
<td>1.07</td>
<td>-0.91</td>
<td>-0.08</td>
</tr>
<tr>
<td>5. Our department’s supervisors are incented and rewarded for lean-based improvement.</td>
<td>0.58</td>
<td>3.22</td>
<td>0.94</td>
<td>0.06</td>
<td>-0.43</td>
</tr>
<tr>
<td>6. Our department’s members are willing to challenge each other’s thinking about their processes.</td>
<td>0.77</td>
<td>3.58</td>
<td>0.92</td>
<td>0.42</td>
<td>-0.72</td>
</tr>
</tbody>
</table>
### Construct: LM Culture

<table>
<thead>
<tr>
<th>Measurement Items</th>
<th>Loading</th>
<th>Mean</th>
<th>St. Dev.</th>
<th>Kurtosis</th>
<th>Skewness</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Our organization is driven by a belief in the processes and not by a belief in the experts.</td>
<td>0.61</td>
<td>3.15</td>
<td>0.89</td>
<td>-0.20</td>
<td>-0.34</td>
</tr>
<tr>
<td>2. Our organization believes in continuing the search for additional learning and further improvements even after the installation of new process.</td>
<td>0.86</td>
<td>3.70</td>
<td>0.93</td>
<td>0.57</td>
<td>-0.83</td>
</tr>
<tr>
<td>3. In our organization it is understood that we can do almost anything we want without consulting our direct supervisor(s).</td>
<td>0.28</td>
<td>2.03</td>
<td>0.95</td>
<td>-0.05</td>
<td>0.71</td>
</tr>
<tr>
<td>4. Our organization believes that employee teams should try and solve their own problems through their own improvement efforts.</td>
<td>0.56</td>
<td>3.38</td>
<td>0.89</td>
<td>0.20</td>
<td>-0.71</td>
</tr>
<tr>
<td>5. Our organization values its customers’ needs above all others.</td>
<td>0.58</td>
<td>3.87</td>
<td>1.03</td>
<td>0.73</td>
<td>-1.01</td>
</tr>
<tr>
<td>6. Front-line employees believe there is a strong commitment to continuous improvement at all levels of this organization.</td>
<td>0.33</td>
<td>3.26</td>
<td>1.00</td>
<td>-1.21</td>
<td>0.05</td>
</tr>
<tr>
<td>7. Sayings that embody organizational wisdom about process improvement are often told within the organization.</td>
<td>0.82</td>
<td>3.23</td>
<td>0.90</td>
<td>-0.23</td>
<td>-0.44</td>
</tr>
<tr>
<td>8. Stories about lean-based improvement accomplishments of past employees are often told within the organization.</td>
<td>0.61</td>
<td>2.97</td>
<td>1.04</td>
<td>-0.80</td>
<td>0.03</td>
</tr>
<tr>
<td>9. Our organization believes that employee learning is an investment, not an expense.</td>
<td>0.66</td>
<td>3.56</td>
<td>1.13</td>
<td>-0.61</td>
<td>-0.53</td>
</tr>
</tbody>
</table>

### Construct: LM Implementation Capability

<table>
<thead>
<tr>
<th>Measurement Items</th>
<th>Loading</th>
<th>Mean</th>
<th>St. Dev.</th>
<th>Kurtosis</th>
<th>Skewness</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. We use charts to determine whether the implementations of the processes of our lean-based initiatives are in control.</td>
<td>0.71</td>
<td>3.44</td>
<td>1.01</td>
<td>-0.41</td>
<td>-0.50</td>
</tr>
<tr>
<td>2. Commitment to project objectives is obtained from every member of a lean-based project team to ensure that goal alignment occurs.</td>
<td>0.83</td>
<td>3.29</td>
<td>0.99</td>
<td>-0.64</td>
<td>-0.27</td>
</tr>
<tr>
<td>3. Our organization always uses the same problem solving structured methodology as a consistent framework for lean-based projects.</td>
<td>0.48</td>
<td>3.13</td>
<td>1.03</td>
<td>-0.76</td>
<td>-0.24</td>
</tr>
<tr>
<td>4. Our organization commits appropriate resources for the execution of lean-based projects.</td>
<td>0.75</td>
<td>3.25</td>
<td>1.05</td>
<td>-0.57</td>
<td>-0.52</td>
</tr>
<tr>
<td>5. Lean-base project teams review all potential alternatives to solving a problem before selecting a solution to execute.</td>
<td>0.87</td>
<td>3.41</td>
<td>0.97</td>
<td>-0.22</td>
<td>-0.64</td>
</tr>
<tr>
<td>6. Detailed execution plans are created for each designed lean-based solution.</td>
<td>0.85</td>
<td>3.45</td>
<td>0.90</td>
<td>-0.48</td>
<td>-0.44</td>
</tr>
</tbody>
</table>
### Construct: LM Competence

<table>
<thead>
<tr>
<th>Measurement Items</th>
<th>Loading</th>
<th>Mean</th>
<th>St. Dev.</th>
<th>Kurtosis</th>
<th>Skewness</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The relentless lean-based efforts in our department deliver value for customers (internal and/or external) and the firm.</td>
<td>0.82</td>
<td>3.36</td>
<td>1.03</td>
<td>-0.28</td>
<td>-0.53</td>
</tr>
<tr>
<td>2. Facts are an influential component in the development of lean-based improvements in our department.</td>
<td>0.72</td>
<td>3.62</td>
<td>0.93</td>
<td>0.30</td>
<td>-0.74</td>
</tr>
<tr>
<td>3. Lean-based initiatives in our department focus on the most critical problems.</td>
<td>0.69</td>
<td>3.16</td>
<td>1.04</td>
<td>-0.69</td>
<td>-0.28</td>
</tr>
<tr>
<td>4. The lean-based initiatives in our department have been effective at enhancing the productivity of work flows.</td>
<td>0.79</td>
<td>3.37</td>
<td>1.08</td>
<td>-0.31</td>
<td>-0.67</td>
</tr>
<tr>
<td>5. The lean-based initiatives in our department have been effective at enhancing the proportion of value-adding activities of work efforts.</td>
<td>0.91</td>
<td>3.37</td>
<td>0.95</td>
<td>-0.20</td>
<td>-0.60</td>
</tr>
<tr>
<td>6. The deployment of lean-based initiatives has improved the quality of our department’s products and services over the past 3 years.</td>
<td>0.82</td>
<td>3.30</td>
<td>1.08</td>
<td>-0.45</td>
<td>-0.58</td>
</tr>
<tr>
<td>7. The deployment of lean-based initiatives has reduced process variability in our department over the past 3 years.</td>
<td>0.85</td>
<td>3.29</td>
<td>0.91</td>
<td>-0.26</td>
<td>-0.60</td>
</tr>
<tr>
<td>8. The deployment of lean-based initiatives has increased the speed of our department's product and service delivery over the past 3 years.</td>
<td>0.78</td>
<td>3.36</td>
<td>1.09</td>
<td>-0.37</td>
<td>-0.62</td>
</tr>
<tr>
<td>9. Our department's diffusion of lean-based learnings to other departments has resulted in accelerated learning within the organization.</td>
<td>0.77</td>
<td>3.10</td>
<td>0.98</td>
<td>-0.30</td>
<td>-0.21</td>
</tr>
</tbody>
</table>

### Construct: Environmental Uncertainty

<table>
<thead>
<tr>
<th>Measurement Items</th>
<th>Loading</th>
<th>Mean</th>
<th>St. Dev.</th>
<th>Kurtosis</th>
<th>Skewness</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The overall demand levels for our organization's products and services are unknown.</td>
<td>0.61</td>
<td>2.53</td>
<td>0.97</td>
<td>-0.35</td>
<td>0.59</td>
</tr>
<tr>
<td>2. The competition for our organization's supply of skilled resources is unknown.</td>
<td>0.71</td>
<td>2.50</td>
<td>0.96</td>
<td>-0.35</td>
<td>0.57</td>
</tr>
<tr>
<td>3. The amount of competition for our organization's customers is constantly changing.</td>
<td>0.14</td>
<td>3.74</td>
<td>0.94</td>
<td>0.18</td>
<td>-0.79</td>
</tr>
<tr>
<td>4. Government regulations controlling our industry are unstable.</td>
<td>0.48</td>
<td>3.74</td>
<td>0.98</td>
<td>-0.45</td>
<td>-0.50</td>
</tr>
<tr>
<td>5. The public's political views and attitudes towards our industry is in flux.</td>
<td>-0.43</td>
<td>3.31</td>
<td>1.07</td>
<td>-0.35</td>
<td>-0.59</td>
</tr>
<tr>
<td>6. The diversity and technical intricacy of our product and services is always changing.</td>
<td>0.29</td>
<td>4.04</td>
<td>0.80</td>
<td>1.25</td>
<td>-0.92</td>
</tr>
<tr>
<td>7. The amount of instability or turbulence in the industry is high.</td>
<td>0.32</td>
<td>3.91</td>
<td>0.93</td>
<td>-0.14</td>
<td>-0.68</td>
</tr>
<tr>
<td>8. Consumer needs and preferences for products and services offered by our organization are changing.</td>
<td>-0.39</td>
<td>3.92</td>
<td>0.87</td>
<td>1.46</td>
<td>-1.10</td>
</tr>
</tbody>
</table>
Prior to testing the structural model, all items from the survey were tested for adequate loadings on their respective constructs. The reliability (internal consistency) for each scale is measured by Cronbach's alpha (Cronbach & Meehl, 1955), the most widely accepted measure. Cronbach's alpha will generally increase as the intercorrelations among test items increase; achieving a minimum threshold value of 0.70 (Cronbach, 1951) for the Cronbach’s Alpha suggests that the set of items in the scale measures a single unidimensional latent construct. (Gefen, Straub, & Boudreau, 2000). Nunally (1978) further states that permissible item factor loadings can be slightly lower (0.60) for newer scales; so while a 0.70 threshold should be used for existing scales, a threshold of 0.60 will be used for my new scales. Items loading below 0.60 were dropped, items above 0.70 were retained and items in between 0.60 and 0.70 were reviewed
to assess their content validity and thus retention in the scales. The following sixteen measurement items were dropped from the measurement scales for inadequate loadings (loadings listed in parentheses): LM Skills item #6 (.40), LM Executive Leadership Item #4 (.46), LM Supervision Item #7 (.57), LM Climate Item #1 (.57) and Item #5 (.57), LM Culture Item #3 (.28), Item #4 (.56), Item #5 (.58) and Item #6 (.33), LM Implementation Capability Item #3 (.48), Environmental Uncertainty Item #3 (.14), Item #4 (.48), Item #5 (-.43), Item #6 (.29), Item #7 (.32) and Item #8 (-.39).

The dropping of six out of eight measurement items from the Environmental Uncertainty construct was quite unexpected given that seven out of the eight items were adapted from existing scales and the construct has been extensively used in the literature. This is counterintuitive until I considered the make-up of key respondents; emergency department nurses are less likely to possess the insights to provide consistent responses to the questions. Given the externally-focused nature of the construct, key respondents in this sample provide less reliable responses. The deletion of these potential measurement items are sample based; in hindsight, hospital executives would have been a better sample of respondents for this construct.

Eleven of the remaining items had factor loadings below 0.70 but above 0.60. After reviewing the content of the respective questions, I determined that each item was important to the operationalization of their respective constructs and thus should remain in the measurement model. For example Lean-Based Benefits Item #2 (“Our lean-based initiatives have resulted in lower overall costs for our customers”) is very important to the financial value facet of the construct and as such was retained despite the < 0.70 loading.

LM Competence and Lean-Based Benefits showed a high degree of cross loadings. I opted to run a two factor Principal Components Analysis (PCA) on only these two constructs to
assess potential cross loading issues and minimize potential discriminant validity issues. This was particularly important given that potential Lean-Based Benefit measurement items were not subjected to the two rounds of pretesting. Using IBM SPSS Statistics Version 21, I ran a Principal Components Analysis (PCA) utilizing a Promax oblique rotation with Kaiser normalization. The rotations converged in three iterations and indicated the removal of three items from the measurement model; LCOMP_3 loaded higher on the Lean-Based Benefits construct while LB_7 and LB_8 loaded higher on the LM Competence construct (See Table 6.8). After the removal of the three items I ran another PCA utilizing a Promax oblique rotation with Kaiser normalization; all items loaded on the designed constructs (See Table 6.9) except LB_9. At this point I considered the wording of LCOMP_6 ("The deployment of lean-based initiatives has improved the quality of our department's products and services over the past 3 years.") and LCOMP_8 ("The deployment of lean-based initiatives has increased the speed of our department's product and service delivery over the past 3 years.") because of their high loadings on both constructs under analysis. Given the emphasis of the language of both items on the benefits of lean and the high loadings on the same construct as the Lean-Based Benefits' items, I decided to remove both items for discriminant validity concerns. After the removal of the LB_9, LCOMP_6 and LCOMP_8, I ran another PCA utilizing a Promax oblique rotation with Kaiser normalization; all items loaded on the designed constructs (See Table 6.10).

After the removal of twenty-two items, I ran the descriptive research model in SmartPLS 2.0 M3 with all potential remaining measurement items included in the model. LM Culture Item #1 now had a factor score of 0.57 and was removed from the model leaving a total of 47 items in the measurement model. Lower order construct overview results are in Table 6.11. Detailed final results with all 23 inadequate measurement items removed (including LM Culture Item #1) are in
Table 6.12. The repeated indicator approach (Hair et al., 2014) was used for the higher order construct LM Preparation Capability.

**TABLE 6.8 TWO FACTOR PCA STRUCTURE MATRIX – LM COMPETENCE & LEAN-BASED BENEFITS**

**LM Competence:** the proficiency of the organization to deploy a systematic, relentless, problem-focused, facts-driven, and team-based paring of waste (and its sources) from operational systems in order to (1) improve throughput-focused work flows and (2) increase the productivity and value-add ratio of all work efforts on an ongoing basis.

**Lean-Based Benefits:** the combination of economic value, functional value and experiential value derived from an organization’s lean-based activities which results in positive outcomes for the organization and its customers.

<table>
<thead>
<tr>
<th>Component</th>
<th>1</th>
<th>2</th>
<th>Communalties</th>
</tr>
</thead>
<tbody>
<tr>
<td>LCOMP_1</td>
<td>.769</td>
<td>.793</td>
<td>.556</td>
</tr>
<tr>
<td>LCOMP_2</td>
<td>.485</td>
<td>.717</td>
<td>.716</td>
</tr>
<tr>
<td>LCOMP_3</td>
<td>.703</td>
<td>.637</td>
<td>.704</td>
</tr>
<tr>
<td>LCOMP_4</td>
<td>.727</td>
<td>.828</td>
<td>.767</td>
</tr>
<tr>
<td>LCOMP_5</td>
<td>.711</td>
<td>.841</td>
<td>.689</td>
</tr>
<tr>
<td>LCOMP_6</td>
<td>.816</td>
<td>.834</td>
<td>.515</td>
</tr>
<tr>
<td>LCOMP_7</td>
<td>.628</td>
<td>.741</td>
<td>.527</td>
</tr>
<tr>
<td>LCOMP_8</td>
<td>.771</td>
<td>.807</td>
<td>.598</td>
</tr>
<tr>
<td>LCOMP_9</td>
<td>.577</td>
<td>.773</td>
<td>.704</td>
</tr>
<tr>
<td>LB_1</td>
<td>.921</td>
<td>.681</td>
<td>.850</td>
</tr>
<tr>
<td>LB_2</td>
<td>.628</td>
<td>.540</td>
<td>.857</td>
</tr>
<tr>
<td>LB_3</td>
<td>.861</td>
<td>.738</td>
<td>.835</td>
</tr>
<tr>
<td>LB_4</td>
<td>.911</td>
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<td>LB_5</td>
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<td>LB_6</td>
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<td>LB_7</td>
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<tr>
<td>LB_9</td>
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<td>.762</td>
<td>.727</td>
</tr>
</tbody>
</table>
### TABLE 6.9 REVISED TWO FACTOR PCA STRUCTURE MATRIX – LM

**COMPETENCE & LEAN-BASED BENEFITS**

<table>
<thead>
<tr>
<th>Structure Matrix</th>
<th>Component</th>
<th>1</th>
<th>2</th>
<th>Communalities</th>
</tr>
</thead>
<tbody>
<tr>
<td>LCOMP_1</td>
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<td>.691</td>
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Extraction Method: Principal Component Analysis.
Rotation Method: Promax with Kaiser Normalization.
### TABLE 6.10: REVISED V2 TWO FACTOR PCA STRUCTURE MATRIX – LM

**COMPETENCE & LEAN-BASED BENEFITS**

<table>
<thead>
<tr>
<th>Structure Matrix</th>
<th>Component</th>
<th>1</th>
<th>2</th>
<th>Communalities</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LCOMP_1</td>
<td>.754</td>
<td>.792</td>
<td>.690</td>
</tr>
<tr>
<td></td>
<td>LCOMP_2</td>
<td>.496</td>
<td>.711</td>
<td>.508</td>
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<td></td>
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<td>.704</td>
<td>.833</td>
<td>.711</td>
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<td></td>
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<td>.875</td>
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<td>LCOMP_7</td>
<td>.582</td>
<td>.800</td>
<td>.640</td>
</tr>
<tr>
<td></td>
<td>LCOMP_9</td>
<td>.572</td>
<td>.787</td>
<td>.619</td>
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<td>.842</td>
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<td>.860</td>
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<td>.870</td>
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<td>.679</td>
<td>.799</td>
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</tbody>
</table>

Extraction Method: Principal Component Analysis.
Rotation Method: Promax with Kaiser Normalization.
TABLE 6.11: LOWER ORDER CONSTRUCT OVERVIEW RESULTS

<table>
<thead>
<tr>
<th>First Order Constructs</th>
<th>Composite Reliability</th>
<th>R Square</th>
<th>Cronbachs Alpha</th>
<th>Communality</th>
<th>Redundancy</th>
</tr>
</thead>
<tbody>
<tr>
<td>LM Skills</td>
<td>0.55</td>
<td>0.53</td>
<td>0.80</td>
<td>0.55</td>
<td>0.29</td>
</tr>
<tr>
<td>LM Executive Leadership</td>
<td>0.62</td>
<td>0.85</td>
<td>0.91</td>
<td>0.62</td>
<td>0.53</td>
</tr>
<tr>
<td>LM Supervision</td>
<td>0.61</td>
<td>0.82</td>
<td>0.89</td>
<td>0.61</td>
<td>0.49</td>
</tr>
<tr>
<td>LM Climate</td>
<td>0.56</td>
<td>0.70</td>
<td>0.74</td>
<td>0.56</td>
<td>0.39</td>
</tr>
<tr>
<td>LM Culture</td>
<td>0.58</td>
<td>0.75</td>
<td>0.76</td>
<td>0.58</td>
<td>0.44</td>
</tr>
<tr>
<td>LM Implementation Capability</td>
<td>0.62</td>
<td>0.85</td>
<td>0.85</td>
<td>0.62</td>
<td>0.00</td>
</tr>
<tr>
<td>LM Competence</td>
<td>0.65</td>
<td>0.68</td>
<td>0.89</td>
<td>0.65</td>
<td>-0.01</td>
</tr>
<tr>
<td>Environmental Uncertainty</td>
<td>0.79</td>
<td>0.73</td>
<td>0.79</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Lean-Based Benefits</td>
<td>0.76</td>
<td>0.65</td>
<td>0.93</td>
<td>0.76</td>
<td>0.01</td>
</tr>
</tbody>
</table>

Composite Reliability: 0.93  AVE: 0.62  Cronbach's: 0.91

TABLE 6.12: FINAL SET MEASUREMENT ITEM DESCRIPTIVE STATISTICS

Construct: LM Executive Leadership

Definition: the efforts of the organization’s senior leadership to explicitly communicate the purpose and objectives of lean-based initiatives, engender commitment from direct reporting personnel, provide oversight, and engage personnel involved in those initiatives in a visible, persistent and authentic manner.

<table>
<thead>
<tr>
<th>Measurement Items (8)</th>
<th>Loading</th>
<th>Mean</th>
<th>St. Dev.</th>
<th>Kurtosis</th>
<th>Skewness</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The organization's senior leaders are committed to employee lean-based improvement training</td>
<td>0.84</td>
<td>3.35</td>
<td>1.02</td>
<td>-0.40</td>
<td>-0.40</td>
</tr>
<tr>
<td>2. The organization’s senior leaders have demonstrated the ability to set and communicate organizational goals for lean-based programs.</td>
<td>0.84</td>
<td>3.59</td>
<td>1.02</td>
<td>0.07</td>
<td>-0.82</td>
</tr>
<tr>
<td>3. The organization’s senior leaders visibly demonstrate personal commitment to lean-based improvement on a consistent basis.</td>
<td>0.79</td>
<td>3.44</td>
<td>1.09</td>
<td>-0.36</td>
<td>-0.65</td>
</tr>
<tr>
<td>5. The organization’s senior leaders assume responsibility for lean-based performance improvements.</td>
<td>0.73</td>
<td>3.31</td>
<td>1.07</td>
<td>-0.35</td>
<td>-0.59</td>
</tr>
<tr>
<td>6. Our organization’s senior leaders create and communicate a vision focused on lean-based improvement.</td>
<td>0.84</td>
<td>3.58</td>
<td>0.97</td>
<td>-0.06</td>
<td>-0.62</td>
</tr>
<tr>
<td>7. The organization’s goals, objectives and strategies are communicated to me by senior leaders.</td>
<td>0.76</td>
<td>3.69</td>
<td>1.04</td>
<td>0.35</td>
<td>-0.92</td>
</tr>
<tr>
<td>8. The long-run competitive strategy of my organization has been communicated to me by senior leaders.</td>
<td>0.76</td>
<td>3.51</td>
<td>1.11</td>
<td>-0.31</td>
<td>-0.70</td>
</tr>
<tr>
<td>9. We see our organization’s senior leaders at the front-line of service delivery on a regular basis.</td>
<td>0.71</td>
<td>2.53</td>
<td>1.17</td>
<td>-0.93</td>
<td>0.32</td>
</tr>
</tbody>
</table>
### Construct: LM Skills

**Definition:** the project management, problem solving, communication and teamwork abilities that employees could utilize during lean-based initiatives.

<table>
<thead>
<tr>
<th>Measurement Items (5)</th>
<th>Loading</th>
<th>Mean</th>
<th>St. Dev.</th>
<th>Kurtosis</th>
<th>Skewness</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Employees are provided with ongoing training on problem solving techniques</td>
<td>0.81</td>
<td>3.69</td>
<td>0.97</td>
<td>0.06</td>
<td>-0.78</td>
</tr>
<tr>
<td>2. We provide training in the basic statistical techniques (such as histograms and control charts) on an ongoing basis.</td>
<td>0.73</td>
<td>2.96</td>
<td>1.11</td>
<td>-0.93</td>
<td>-0.15</td>
</tr>
<tr>
<td>3. We provide ongoing training on project management tools and techniques to employees</td>
<td>0.78</td>
<td>3.32</td>
<td>0.97</td>
<td>-0.69</td>
<td>-0.42</td>
</tr>
<tr>
<td>4. We have enough lean-based training to do our jobs well on lean-based initiatives</td>
<td>0.77</td>
<td>3.24</td>
<td>0.97</td>
<td>-0.74</td>
<td>-0.20</td>
</tr>
<tr>
<td>5. Ongoing training in conflict resolution is given to managers and supervisors</td>
<td>0.62</td>
<td>3.60</td>
<td>1.00</td>
<td>0.10</td>
<td>-0.81</td>
</tr>
</tbody>
</table>

**Composite Reliability:** 0.86  **AVE:** 0.55  **Cronbach's:** 0.80

### Construct: LM Supervision

**Definition:** the efforts of front-line managers to consistently coach, support, motivate, and empower their personnel to work collaboratively and productively on lean-based initiatives.

<table>
<thead>
<tr>
<th>Measurement Items (7)</th>
<th>Loading</th>
<th>Mean</th>
<th>St. Dev.</th>
<th>Kurtosis</th>
<th>Skewness</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Our direct supervisor(s) empower as opposed to direct us on lean-based activities.</td>
<td>0.74</td>
<td>3.27</td>
<td>1.00</td>
<td>-0.65</td>
<td>-0.27</td>
</tr>
<tr>
<td>2. Our direct supervisor(s) listens to our problems and concerns.</td>
<td>0.82</td>
<td>3.67</td>
<td>0.99</td>
<td>0.22</td>
<td>-0.80</td>
</tr>
<tr>
<td>3. Our direct supervisor(s) gives fair evaluations of our work.</td>
<td>0.77</td>
<td>3.70</td>
<td>1.02</td>
<td>0.12</td>
<td>-0.82</td>
</tr>
<tr>
<td>4. The organization’s supervisors encourage people who work for them to exchange opinions and ideas.</td>
<td>0.81</td>
<td>3.59</td>
<td>1.03</td>
<td>-0.14</td>
<td>-0.63</td>
</tr>
<tr>
<td>5. The organization’s front-line supervisors regularly provide lean-based coaching.</td>
<td>0.75</td>
<td>3.13</td>
<td>1.06</td>
<td>-0.81</td>
<td>-0.22</td>
</tr>
<tr>
<td>6. The organization’s supervisors frequently hold group meetings where the people who work for them can really discuss things together.</td>
<td>0.75</td>
<td>3.40</td>
<td>1.09</td>
<td>-0.51</td>
<td>-0.59</td>
</tr>
<tr>
<td>8. Front-line supervisors create a safe environment for discussing any work related issues.</td>
<td>0.83</td>
<td>3.43</td>
<td>1.02</td>
<td>-0.08</td>
<td>-0.65</td>
</tr>
</tbody>
</table>

**Composite Reliability:** 0.92  **AVE:** 0.61  **Cronbach's:** 0.89
**Construct: LM Climate**

**Definition:** the operational environment that exists in which policies, practices and procedures exist to facilitate the undertaking of collaborative and productive lean-based initiatives.

<table>
<thead>
<tr>
<th>Measurement Items (4)</th>
<th>Loading</th>
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<th>St. Dev.</th>
<th>Kurtosis</th>
<th>Skewness</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Our department rewards group sharing and team performance as opposed to individual performance.</td>
<td>0.73</td>
<td>3.17</td>
<td>1.00</td>
<td>-0.75</td>
<td>-0.23</td>
</tr>
<tr>
<td>3. Continuous improvement is stressed in all work processes throughout our department.</td>
<td>0.73</td>
<td>4.02</td>
<td>0.84</td>
<td>1.94</td>
<td>-1.13</td>
</tr>
<tr>
<td>4. Our department’s incentive systems reward employee involvement and development in lean-based initiatives.</td>
<td>0.79</td>
<td>2.99</td>
<td>1.07</td>
<td>-0.91</td>
<td>-0.08</td>
</tr>
<tr>
<td>6. Our department's members are willing to challenge each other's thinking about their processes.</td>
<td>0.76</td>
<td>3.58</td>
<td>0.92</td>
<td>0.42</td>
<td>-0.72</td>
</tr>
</tbody>
</table>

Composite Reliability: **0.84**  
AVE: **0.56**  
Cronbach's: **0.74**

**Construct: LM Culture**

**Definition:** the collective views and beliefs held within the organization that reflect the norms, values and assumptions that exist with regards to the importance and functioning of lean-based initiatives.

<table>
<thead>
<tr>
<th>Measurement Items (4)</th>
<th>Loading</th>
<th>Mean</th>
<th>St. Dev.</th>
<th>Kurtosis</th>
<th>Skewness</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Our organization believes in continuing the search for additional learning and further improvements even after the installation of new process.</td>
<td>0.81</td>
<td>3.70</td>
<td>0.93</td>
<td>0.57</td>
<td>-0.83</td>
</tr>
<tr>
<td>7. Sayings that embody organizational wisdom about process improvement are often told within the organization.</td>
<td>0.76</td>
<td>3.23</td>
<td>0.90</td>
<td>-0.23</td>
<td>-0.44</td>
</tr>
<tr>
<td>8. Stories about lean-based improvement accomplishments of past employees are often told within the organization.</td>
<td>0.70</td>
<td>2.97</td>
<td>1.04</td>
<td>-0.80</td>
<td>0.03</td>
</tr>
<tr>
<td>9. Our organization believes that employee learning is an investment, not an expense.</td>
<td>0.78</td>
<td>3.56</td>
<td>1.13</td>
<td>-0.61</td>
<td>-0.53</td>
</tr>
</tbody>
</table>

Composite Reliability: **0.85**  
AVE: **0.58**  
Cronbach's: **0.76**
**Construct: LM Implementation Capability**

**Definition:** the organization’s proficiency in consistently deploying a standard approach when undertaking lean-based work efforts and work flows improvements.

<table>
<thead>
<tr>
<th>Measurement Items (5)</th>
<th>Loading</th>
<th>Mean</th>
<th>St. Dev.</th>
<th>Kurtosis</th>
<th>Skewness</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. We use charts to determine whether the implementations of the processes of our lean-based initiatives are in control.</td>
<td>0.71</td>
<td>3.44</td>
<td>1.01</td>
<td>-0.41</td>
<td>-0.50</td>
</tr>
<tr>
<td>2. Commitment to project objectives is obtained from every member of a lean-based project team to ensure that goal alignment occurs.</td>
<td>0.82</td>
<td>3.29</td>
<td>0.99</td>
<td>-0.64</td>
<td>-0.27</td>
</tr>
<tr>
<td>4. Our organization commits appropriate resources for the execution of lean-based projects.</td>
<td>0.80</td>
<td>3.25</td>
<td>1.05</td>
<td>-0.57</td>
<td>-0.52</td>
</tr>
<tr>
<td>5. Lean-base project teams review all potential alternatives to solving a problem before selecting a solution to execute.</td>
<td>0.85</td>
<td>3.41</td>
<td>0.97</td>
<td>-0.22</td>
<td>-0.64</td>
</tr>
<tr>
<td>6. Detailed execution plans are created for each designed lean-based solution.</td>
<td>0.76</td>
<td>3.45</td>
<td>0.90</td>
<td>-0.48</td>
<td>-0.44</td>
</tr>
</tbody>
</table>

**Composite Reliability:** 0.89  **AVE:** 0.62  **Cronbach’s:** 0.85

**Construct: LM Competence**

**Definition:** the proficiency of the organization to deploy a systematic, relentless, problem-focused, facts-driven, and team-based paring of waste (and its sources) from operational systems in order to (1) improve throughput-focused work flows and (2) increase the productivity and value-add ratio of all work efforts on an ongoing basis.

<table>
<thead>
<tr>
<th>Measurement Items (6)</th>
<th>Loading</th>
<th>Mean</th>
<th>St. Dev.</th>
<th>Kurtosis</th>
<th>Skewness</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The relentless lean-based efforts in our department deliver value for customers (internal and/or external) and the firm.</td>
<td>0.83</td>
<td>3.36</td>
<td>1.03</td>
<td>-0.28</td>
<td>-0.53</td>
</tr>
<tr>
<td>2. Facts are an influential component in the development of lean-based improvements in our department.</td>
<td>0.70</td>
<td>3.62</td>
<td>0.93</td>
<td>0.30</td>
<td>-0.74</td>
</tr>
<tr>
<td>4. The lean-based initiatives in our department have been effective at enhancing the productivity of work flows.</td>
<td>0.85</td>
<td>3.37</td>
<td>1.08</td>
<td>-0.31</td>
<td>-0.67</td>
</tr>
<tr>
<td>5. The lean-based initiatives in our department have been effective at enhancing the proportion of value-adding activities of work efforts.</td>
<td>0.88</td>
<td>3.37</td>
<td>0.95</td>
<td>-0.20</td>
<td>-0.60</td>
</tr>
<tr>
<td>7. The deployment of lean-based initiatives has reduced process variability in our department over the past 3 years.</td>
<td>0.78</td>
<td>3.29</td>
<td>0.91</td>
<td>-0.26</td>
<td>-0.60</td>
</tr>
<tr>
<td>9. Our department's diffusion of lean-based learnings to other departments has resulted in accelerated learning within the organization.</td>
<td>0.78</td>
<td>3.10</td>
<td>0.98</td>
<td>-0.30</td>
<td>-0.21</td>
</tr>
</tbody>
</table>

**Composite Reliability:** 0.92  **AVE:** 0.65  **Cronbach’s:** 0.89
Construct: Environmental Uncertainty

**Definition:** the degree of dynamism, complexity and munificence in the organization’s operating surroundings

<table>
<thead>
<tr>
<th>Measurement Items (2)</th>
<th>Loading</th>
<th>Mean</th>
<th>St. Dev.</th>
<th>Kurtosis</th>
<th>Skewness</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The overall demand levels for our organization's products and services are unknown.</td>
<td>0.85</td>
<td>2.53</td>
<td>0.97</td>
<td>-0.35</td>
<td>0.59</td>
</tr>
<tr>
<td>2. The competition for our organization's supply of skilled resources is unknown.</td>
<td>0.92</td>
<td>2.50</td>
<td>0.96</td>
<td>-0.35</td>
<td>0.57</td>
</tr>
</tbody>
</table>

**Composite Reliability:** 0.88  **AVE:** 0.79  **Cronbach’s:** 0.73

Construct: Lean-Based Benefits

**Definition:** the combination of economic value, functional value and experiential value derived from an organization’s lean-based activities which results in positive outcomes for the organization and its customers.

<table>
<thead>
<tr>
<th>Measurement Items (6)</th>
<th>Loading</th>
<th>Mean</th>
<th>St. Dev.</th>
<th>Kurtosis</th>
<th>Skewness</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Our lean-based initiatives have resulted in greater overall customer satisfaction with our products and services.</td>
<td>0.91</td>
<td>3.48</td>
<td>1.00</td>
<td>0.12</td>
<td>-0.71</td>
</tr>
<tr>
<td>2. Our lean-based initiatives have resulted in lower overall costs for our customers.</td>
<td>0.66</td>
<td>2.95</td>
<td>0.94</td>
<td>-0.20</td>
<td>-0.12</td>
</tr>
<tr>
<td>3. Our lean-based initiatives have resulted in improvements in quality outcomes for our customers.</td>
<td>0.87</td>
<td>3.46</td>
<td>1.04</td>
<td>0.20</td>
<td>-0.83</td>
</tr>
<tr>
<td>4. Our customers seem happier with our responsiveness to their problems as a result of our lean-based initiatives.</td>
<td>0.92</td>
<td>3.37</td>
<td>1.02</td>
<td>-0.08</td>
<td>-0.60</td>
</tr>
<tr>
<td>5. Our lean-based initiatives result in more fulfilling experiences for our customers.</td>
<td>0.93</td>
<td>3.38</td>
<td>1.03</td>
<td>-0.12</td>
<td>-0.57</td>
</tr>
<tr>
<td>6. Our lean-based initiatives have resulted in improved access to our products and services for our customers</td>
<td>0.89</td>
<td>3.42</td>
<td>1.03</td>
<td>-0.05</td>
<td>-0.75</td>
</tr>
</tbody>
</table>

**Composite Reliability:** 0.95  **AVE:** 0.76  **Cronbach’s:** 0.93

Reliable values indicate the degree to which operational measures are free from random error and measure the construct in a consistent manner. When using only one form of a measure for each construct there should be a high degree of inter-correlation between the items that
comprise the scale for that construct (internal consistency). In my study, I use Fornell & Larcker’s (1981) measure of internal consistency which they called composite reliability and the traditional Cronbach’s Alpha (Cronbach, 1951).

The factor item individual loadings as well as the constructs’ respective Cronbach’s alpha (1951) and composite reliability scores (Fornell & Larcker, 1981) all exceeded acceptable standards. All factor loadings exceed the 0.60 threshold (Nunally, 1978) for new scales. All items exhibit low to moderate skewness (Bulmer, 1979) with the exception of item #3 of the LM Climate construct (‘Continuous improvement is stressed in all work processes throughout our department.’). A negative skewness statistic of -1.13 is slightly high (Bulmer, 1979), but given the lower levels of skewness of the other three items in the scale, this item should not present an issue. Kurtosis of all items is low, demonstrating a relative flatness of the distribution curve. This is positive to my research as values for items are more disbursed within the five point Likert scale.

Multivariate normality is not required for PLS to estimate parameter values, however it could become an issue when testing for significance (Barclay, Higgins & Thompson, 1995) if not for the use of bootstrapping. Aside from the exception noted above, none of the measurement items exhibit skewness or kurtosis values in excess of an absolute value of 1.0. A clear cut-off for measurement of skewness of kurtosis as an indication of deviation from multivariate normality has not been established, however these measures not approach exceeding the 2.0 (skewness) and 7.0 (kurtosis) measures noted to indicate significant issues with univariate normality (Muthen & Kaplan, 1992; Curran, West & Finch, 1996).

Essential to theory building and testing is construct validity (Anderson & Gerbing, 1988). Construct validity is the extent to which the items in a scale measure the abstract or theoretical
construct (Carmines & Zeller, 1979). Critical components of construct validation is the measurement of convergent and discriminant validity (Campbell & Fiske, 1959). Testing of construct validity concentrates not only on finding out whether or not an item loads significantly on the factor it is measuring (convergent), but also on ensuring that it measures no other factors (discriminant) (Campbell & Fiske, 1959). If the scales pass both tests, they will be deemed to adequately operationalize the constructs.

Convergent validity reflects the extent to which there is consistency in measurements across multiple operationalizations (Campbell & Fiske, 1959). Convergent validity measures the similarity or communality between the individual items measuring the same construct; in essence “the extent to which the blocks of items strongly agree (i.e., converge) in their representation of the underlying construct they were created to measure” (Chin, 2010: 674). Convergent validity was tested using Fornell and Larcker’s (1981) Average Variance Extracted (AVE) measure. AVE measures the amount of variance explained by the items in the construct. An AVE greater than .50 manifests a construct that explains more variance in its indicators than error (Fornell & Larcker, 1981) (the construct explains more of the variance than the error term) and is thus the minimum measure acceptable for a construct (Wetzels, Odekerken-Schroder & van Oppen, 2009).

Each of the nine lower order constructs demonstrated an AVE measure of greater than 0.50. In addition, I calculated the AVE of the higher order construct LM Preparation Capability by squaring the loadings of its five reflective lower order constructs and then dividing by five (Fornell & Larcker, 1981). When estimating the higher order construct, I used the repeated indicator approach (Hair et al., 2014). Its advantage lies in its ability to estimate the constructs simultaneously instead of the lower and higher order dimensions separately (Becker, Klein &
The AVE of LM Preparation Capability is 0.73 (See Table 6.13) and its composite reliability is 0.93. All five lower order constructs that reflect the higher order LM Preparation Capability construct have factor loadings exceeding 0.70.

Discriminant validity refers to the independence of the dimensions (Bagozzi, Yi & Phillips, 1991); the extents to which measures of the constructs are distinctly different from each other. Discriminant validity measures the extent to which the individual items of a construct are unique and do not measure any other constructs. Specifically, I assess whether each item loads more highly on their own construct than on other constructs and that all constructs share more variance with their own measures than with other constructs. I will seek support for discriminant validity by comparing the squared item loadings and cross-loadings. Chin (2010) argues that this method provides “a more intuitive interpretation since it represents the percentage overlap between an item and any construct (including its intended one). All items load higher on their intended construct than on other constructs (See Table 6.14), however many items load fairly high on other items and LM Supervision Item #5 loads extremely high on LM Executive Leadership, but not higher than its intended construct. The lack of cross loadings suggests that

<table>
<thead>
<tr>
<th>Number of Items</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>AVE</td>
<td>0.730</td>
</tr>
<tr>
<td>Composite Reliability</td>
<td>0.931</td>
</tr>
<tr>
<td>LM Skills</td>
<td>0.731 0.534 0.466</td>
</tr>
<tr>
<td>LM Executive Leadership</td>
<td>0.922 0.851 0.149</td>
</tr>
<tr>
<td>LM Supervision</td>
<td>0.903 0.816 0.184</td>
</tr>
<tr>
<td>LM Climate</td>
<td>0.835 0.697 0.303</td>
</tr>
<tr>
<td>LM Culture</td>
<td>0.868 0.754 0.246</td>
</tr>
<tr>
<td>SUM</td>
<td>4.259 3.651 1.349</td>
</tr>
</tbody>
</table>
my scales possess adequate discriminant validity, however this test is rather liberal – more likely to establish discriminant validity (Hair, Ringle & Sarstedt, 2011).

Another more conservative test of discriminant validity is the Fornell and Larcker criterion (1981). It requires taking the construct correlations table and replacing the horizontal with constructs AVE and squaring all latent variable correlations. This permits comparison of the latent variable correlations with the AVE of each construct. In essence, does the construct share more variance with its own measurement items (indicators) than it does with any other construct? The results in Table 6.15 show that all constructs demonstrate discriminant validity (Fornell & Larcker, 1981).

The descriptive research model’s measurement items and scales have been adapted and now demonstrate internal consistency, reliability, convergent and discriminant validity. I now turn to assessing the co-alignment model and finally the structural model.

### 6.4 Co-Alignment Model

The proposed LM Preparation Capability higher order construct proposed is a parsimonious representation of the co-alignment of the constructs LM Skills, LM Executive Leadership, LM Supervision, LM Climate and LM Culture. If no co-alignment is present in the model, then the need for a higher order construct is lost. LM Preparation Capability is proposed to be reflected in the five dimensions and represents the organization’s degree of strategic readiness for the deployment of LM. These individual (skills, leadership, and supervision) and institutional (climate and culture) considerations are embedded in LM Preparation Capability and act
### TABLE 6.14: MEASUREMENT ITEM CROSS LOADINGS

| SK_1  | 0.81 | 0.51 | 0.48 | 0.49 | 0.50 | 0.47 | 0.48 | -0.18 | 0.42 |
| SK_2  | 0.73 | 0.38 | 0.30 | 0.24 | 0.34 | 0.41 | 0.40 | 0.04  | 0.34 |
| SK_3  | 0.78 | 0.41 | 0.38 | 0.40 | 0.39 | 0.41 | 0.40 | 0.03  | 0.37 |
| SK_4  | 0.77 | 0.53 | 0.45 | 0.39 | 0.45 | 0.53 | 0.51 | -0.09 | 0.39 |
| SK_5  | 0.62 | 0.45 | 0.39 | 0.33 | 0.43 | 0.35 | 0.42 | -0.22 | 0.36 |
| EL_1  | 0.53 | 0.84 | 0.64 | 0.56 | 0.67 | 0.62 | 0.59 | -0.15 | 0.50 |
| EL_2  | 0.56 | 0.84 | 0.66 | 0.60 | 0.66 | 0.64 | 0.62 | -0.28 | 0.49 |
| EL_3  | 0.57 | 0.79 | 0.61 | 0.56 | 0.59 | 0.62 | 0.61 | -0.16 | 0.59 |
| EL_5   | 0.56 | 0.73 | 0.59 | 0.53 | 0.61 | 0.63 | 0.66 | -0.09 | 0.55 |
| EL_6   | 0.51 | 0.84 | 0.63 | 0.58 | 0.61 | 0.61 | 0.59 | -0.24 | 0.48 |
| EL_7   | 0.35 | 0.76 | 0.53 | 0.52 | 0.53 | 0.51 | 0.45 | -0.25 | 0.36 |
| EL_8   | 0.37 | 0.76 | 0.58 | 0.53 | 0.56 | 0.55 | 0.45 | -0.17 | 0.36 |
| EL_9   | 0.42 | 0.71 | 0.49 | 0.45 | 0.51 | 0.48 | 0.47 | -0.04 | 0.43 |
| SU_1   | 0.45 | 0.56 | 0.74 | 0.58 | 0.54 | 0.54 | 0.59 | -0.10 | 0.50 |
| SU_2   | 0.37 | 0.51 | 0.82 | 0.54 | 0.50 | 0.55 | 0.56 | -0.25 | 0.48 |
| SU_3   | 0.37 | 0.48 | 0.77 | 0.55 | 0.45 | 0.51 | 0.52 | -0.13 | 0.44 |
| SU_4   | 0.44 | 0.63 | 0.81 | 0.64 | 0.64 | 0.55 | 0.57 | -0.19 | 0.47 |
| SU_5   | 0.56 | 0.74 | 0.75 | 0.60 | 0.70 | 0.68 | 0.63 | -0.15 | 0.54 |
| SU_6   | 0.38 | 0.61 | 0.75 | 0.60 | 0.59 | 0.55 | 0.50 | -0.08 | 0.40 |
| SU_7   | 0.38 | 0.57 | 0.83 | 0.56 | 0.56 | 0.54 | 0.54 | -0.17 | 0.40 |
| CL_2   | 0.34 | 0.48 | 0.54 | 0.73 | 0.51 | 0.46 | 0.51 | -0.07 | 0.44 |
| CL_3   | 0.36 | 0.62 | 0.55 | 0.73 | 0.57 | 0.53 | 0.52 | -0.26 | 0.47 |
| CL_4   | 0.44 | 0.47 | 0.58 | 0.79 | 0.60 | 0.56 | 0.54 | -0.16 | 0.52 |
| CL_6   | 0.38 | 0.49 | 0.57 | 0.76 | 0.50 | 0.55 | 0.52 | -0.16 | 0.41 |
| CU_1   | 0.42 | 0.63 | 0.66 | 0.63 | 0.81 | 0.57 | 0.54 | -0.23 | 0.44 |
| CU_7   | 0.49 | 0.55 | 0.50 | 0.57 | 0.76 | 0.54 | 0.56 | -0.12 | 0.49 |
| CU_8   | 0.40 | 0.53 | 0.44 | 0.43 | 0.70 | 0.47 | 0.46 | -0.13 | 0.39 |
| CU_9   | 0.39 | 0.58 | 0.62 | 0.57 | 0.78 | 0.50 | 0.54 | -0.28 | 0.48 |
| LIC_1  | 0.33 | 0.50 | 0.45 | 0.51 | 0.46 | 0.71 | 0.48 | -0.13 | 0.34 |
| LIC_2  | 0.43 | 0.54 | 0.56 | 0.56 | 0.51 | 0.82 | 0.61 | -0.09 | 0.51 |
| LIC_4  | 0.53 | 0.65 | 0.69 | 0.60 | 0.63 | 0.80 | 0.72 | -0.14 | 0.63 |
| LIC_5  | 0.53 | 0.64 | 0.60 | 0.55 | 0.59 | 0.85 | 0.64 | -0.12 | 0.48 |
| LIC_6  | 0.49 | 0.58 | 0.50 | 0.53 | 0.49 | 0.76 | 0.53 | -0.10 | 0.38 |
| LCOMP_1 | 0.49 | 0.56 | 0.58 | 0.56 | 0.55 | 0.60 | 0.83 | -0.18 | 0.74 |
| LCOMP_2 | 0.43 | 0.51 | 0.53 | 0.54 | 0.50 | 0.57 | 0.70 | -0.22 | 0.52 |
| LCOMP_4 | 0.48 | 0.61 | 0.58 | 0.57 | 0.63 | 0.65 | 0.85 | -0.16 | 0.70 |
| LCOMP_5 | 0.49 | 0.60 | 0.62 | 0.58 | 0.53 | 0.67 | 0.88 | -0.22 | 0.70 |
| LCOMP_7 | 0.46 | 0.54 | 0.55 | 0.49 | 0.52 | 0.57 | 0.78 | -0.12 | 0.60 |
| LCOMP_9 | 0.54 | 0.60 | 0.61 | 0.61 | 0.60 | 0.65 | 0.78 | -0.17 | 0.59 |
| EU_1   | -0.08 | -0.16 | -0.13 | -0.18 | -0.20 | -0.11 | -0.18 | 0.85 | -0.11 |
| EU_2   | -0.13 | -0.22 | -0.21 | -0.21 | -0.25 | -0.15 | -0.21 | 0.92 | -0.15 |
| LB_1   | 0.45 | 0.52 | 0.54 | 0.57 | 0.53 | 0.51 | 0.72 | -0.16 | 0.91 |
| LB_2   | 0.37 | 0.43 | 0.50 | 0.43 | 0.44 | 0.47 | 0.53 | -0.03 | 0.66 |
| LB_3   | 0.48 | 0.57 | 0.55 | 0.54 | 0.54 | 0.59 | 0.74 | -0.17 | 0.87 |
| LB_4   | 0.43 | 0.49 | 0.47 | 0.54 | 0.51 | 0.50 | 0.71 | -0.13 | 0.92 |
| LB_5   | 0.46 | 0.52 | 0.52 | 0.55 | 0.53 | 0.52 | 0.72 | -0.18 | 0.93 |
| LB_6   | 0.46 | 0.58 | 0.53 | 0.57 | 0.53 | 0.60 | 0.72 | -0.11 | 0.89 |
TABLE 6.15: FORNELL & LARCKER DISCRIMINANT VALIDITY TEST

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>LM Skills</td>
<td>0.55</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LM Executive Leadership</td>
<td>0.39</td>
<td>0.62</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LM Supervision</td>
<td>0.30</td>
<td>0.57</td>
<td>0.61</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LM Climate</td>
<td>0.26</td>
<td>0.47</td>
<td>0.56</td>
<td>0.56</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LM Culture</td>
<td>0.33</td>
<td>0.57</td>
<td>0.54</td>
<td>0.53</td>
<td>0.58</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LM Implementation Capability</td>
<td>0.35</td>
<td>0.55</td>
<td>0.52</td>
<td>0.49</td>
<td>0.47</td>
<td>0.62</td>
<td>0.65</td>
<td></td>
<td>0.79</td>
</tr>
<tr>
<td>LM Competence</td>
<td>0.34</td>
<td>0.48</td>
<td>0.50</td>
<td>0.48</td>
<td>0.47</td>
<td>0.58</td>
<td>0.65</td>
<td></td>
<td>0.76</td>
</tr>
<tr>
<td>Environmental Uncertainty</td>
<td>0.01</td>
<td>0.05</td>
<td>0.04</td>
<td>0.05</td>
<td>0.06</td>
<td>0.02</td>
<td>0.05</td>
<td>0.79</td>
<td></td>
</tr>
<tr>
<td>Lean-Based Benefits</td>
<td>0.26</td>
<td>0.36</td>
<td>0.35</td>
<td>0.38</td>
<td>0.35</td>
<td>0.37</td>
<td>0.64</td>
<td>-0.15</td>
<td>0.76</td>
</tr>
</tbody>
</table>

synergistically and complimentary (Venkatraman, 1989). I have hypothesized that they are co-aligned and complementary, consistent with a systematic approach to LM deployment.

If co-alignment is considered a pattern of co-variation among a set of theoretically related constructs (Menor, 2000), and since the pattern of co-variation among the lower order constructs is captured by the unobservable higher order construct LM Preparation Capability, one would expect high levels of co-variation between the five lower order constructs if the higher order LM Preparation Capability was removed from the descriptive research model. To test the need for a higher order construct, I will compare two models:

I) Complementary Direct Effects Model with no higher order construct allowing each of the five dimensions to form LM Competence directly. (Figure 6.2)

II) Co-alignment Model with the higher order construct LM Preparation Capability present (Figure 6.3)
The relationship between the construct LM Culture and LM Competence is not significant (0.12; T-statistic 1.48) in the Complementary Direct Effects Model without the presence of the higher order construct. In addition, all correlations between lower order constructs as reported in PLS are significant (see Table 6.16). The combination of the high correlation levels between lower order latent variables and the lack of significance in the
relationship of LM Culture and LM Competence indicate co-alignment and the presence of a higher order latent construct.

In the co-alignment model with the presence of a higher order construct LM Preparation Capability (see Figure 6.3), all factor loadings of the lower order constructs are strong and significant. R² values for each lower order construct are high with the exception of LM Skills which is moderate relative to the other constructs, but still greater than 50% threshold (Schmiedel, von Brocke & Recker, 2014). The relationship between the higher order construct LM Preparation Capability and LM Competence is strong and significant. The only deficiency in Model II relative to Model I is a slight reduction in R² for the LM Competence construct.

**FIGURE 6.3: CO-ALIGNMENT MODEL II – HIGHER ORDER CONSTRUCT PRESENT**

In summary, the presence of a higher order construct as a parsimonious representation of the co-alignment between the five lower order constructs is substantiated; the results suggest that LM Skills, LM Executive Leadership, LM Supervision, LM Climate and LM Culture are distinct, yet interrelated factors that may reflect the conceptualized LM Preparation Capability higher order latent construct. “The lower order constructs are reflectively measured constructs
themselves that can be distinguished from each other but are correlated” (Becker, Klein & Wetzels, 2012). Proposition 1 and hypotheses 1A, 1B, 1C, 1D and 1E (see table 6.17) are all supported. Given that, I move forward to examining the structural model in its present form with the presence of the second order latent construct LM Preparation Capability.

**TABLE 6.17: HYPOTHESES DESCRIPTIONS**

| P1 | LM Preparation Capability is a multidimensional higher order construct reflecting the synergistic degree of organizational readiness for LM deployment through the co-alignment of LM Skills, LM Executive Leadership, LM Supervision, LM Climate and LM Culture. |
| H1a | LM Skills positively reflects the organizations LM Preparation Capability. |
| H1b | LM Executive Leadership positively reflects the organizations LM Preparation Capability. |
| H1c | LM Supervision positively reflects the organizations LM Preparation Capability. |
| H1d | LM Climate positively reflects the organizations LM Preparation Capability. |
| H1e | LM Culture positively reflects the organizations LM Preparation Capability. |

6.5 Structural Model Testing

6.5.1 Hypothesized Structural Model

Having established the soundness of my measures, I subsequently used them to test my hypotheses. Coefficients for the model paths (see Figure 6.4) were estimated using the PLS Algorithm while bootstrapping with 500 sub samples and 201 cases to generate path estimates significance levels (see Figure 6.4; Table 6.19). In testing for moderation I utilized product terms.

To assess the predictive relevance of the model, I ran a blindfolding analysis in SmartPLS. Given my sample size of 201, I selected 7 as my omission distance ensuring it was not equally divisible by my sample size. I ran blindfolding for each construct separately in the model and ran the analysis. The blindfold analyzed the model’s data by omitting every 7th data point in the endogenous construct’s indicators (Chin, 1998; Hair et al., 2014). The omitted values were treated like missing values (Smart PLS uses a mean value replacement algorithm). The data
including missing values calculated for the omitted values and the data from the entire real data set are used as inputs for the $Q^2$ calculation. Only endogenous constructs that have reflective measurement model specification and single item endogenous constructs (both reflective and formative) are subjected to the blindfolding procedure. The $Q^2$ measures reflect how well the path model can predict the originally observed values (Hair et al., 2014). Measures of 0.35, 0.15 and 0.02 indicate strong, moderate and weak predictive abilities for each construct (Hair, Ringle & Sarstedt, 2013). All measures exceeded zero (see Table 6.18), and six of seven exhibited strong predictive ability (Hair et al., 2014). There is support for the model’s predictive relevance.

**TABLE 6.18: $Q^2$ VALUES THROUGH BLINDFOLDING**

<table>
<thead>
<tr>
<th>Construct</th>
<th>Sum of Squared Prediction Errors</th>
<th>Sum of Squared Observations</th>
<th>$Q^2$ Value</th>
<th>Predictive Strength</th>
</tr>
</thead>
<tbody>
<tr>
<td>LM Skills</td>
<td>1005</td>
<td>716.50</td>
<td>0.287</td>
<td>Moderate</td>
</tr>
<tr>
<td>LM Executive Leadership</td>
<td>1608</td>
<td>768.73</td>
<td>0.522</td>
<td>Substantial</td>
</tr>
<tr>
<td>LM Supervision</td>
<td>1407</td>
<td>718.48</td>
<td>0.489</td>
<td>Substantial</td>
</tr>
<tr>
<td>LM Culture</td>
<td>804</td>
<td>454.06</td>
<td>0.435</td>
<td>Substantial</td>
</tr>
<tr>
<td>LM Climate</td>
<td>804</td>
<td>490.06</td>
<td>0.391</td>
<td>Substantial</td>
</tr>
<tr>
<td>LM Supervision</td>
<td>1206</td>
<td>687.13</td>
<td>0.430</td>
<td>Substantial</td>
</tr>
<tr>
<td>Lean-Based Benefits</td>
<td>1206</td>
<td>618.99</td>
<td>0.487</td>
<td>Substantial</td>
</tr>
</tbody>
</table>

The effect of control variables are typically measured on the dependent variable. Early in my conceptualization, I determined that the control variables affected the LM Competence and not the benefits derived from LM, therefore the effects of the control variables are measured in relation to the LM Competence construct and not the Lean-Based Benefits construct.
FIGURE 6.4: STRUCTURAL MODEL MEASURES

Note: T-Statistics in parentheses
P-score <0.05 *, <0.01 **, <0.001 ***
### TABLE 6.19: STRUCTURAL MODEL PATH COEFFICIENTS & T-STATISTICS

<table>
<thead>
<tr>
<th>Model Path</th>
<th>T-Statistic</th>
<th>Loading</th>
</tr>
</thead>
<tbody>
<tr>
<td>LM Preparation Capability - LM Skills</td>
<td>14.14***</td>
<td>.73</td>
</tr>
<tr>
<td>LM Preparation Capability - LM Culture</td>
<td>41.21***</td>
<td>.87</td>
</tr>
<tr>
<td>LM Preparation Capability - LM Climate</td>
<td>34.60***</td>
<td>.84</td>
</tr>
<tr>
<td>LM Preparation Capability - LM Executive Leadership</td>
<td>68.91***</td>
<td>.92</td>
</tr>
<tr>
<td>LM Preparation Capability - LM Supervision</td>
<td>6.11***</td>
<td>.90</td>
</tr>
<tr>
<td>LM Preparation Capability - LM Competence</td>
<td>3.76***</td>
<td>.55</td>
</tr>
<tr>
<td>LM Competence – Lean Benefits</td>
<td>4.51***</td>
<td>.59</td>
</tr>
<tr>
<td>Control Variable Size – LM Competence</td>
<td>1.27</td>
<td>-.04</td>
</tr>
<tr>
<td>Control Variable Technology Sophistication – LM Competence</td>
<td>0.46</td>
<td>-.03</td>
</tr>
<tr>
<td>Control Variable Organizational Deployment Experience with LM – LM Competence</td>
<td>0.50</td>
<td>-.02</td>
</tr>
<tr>
<td>LM Implementation Capability - LM Competence</td>
<td>2.58*</td>
<td>.40</td>
</tr>
<tr>
<td>LM Implementation Capability Moderating LM Preparation Capability - LM Competence</td>
<td>0.22</td>
<td>-.06</td>
</tr>
<tr>
<td>Environmental Uncertainty – Lean Benefits</td>
<td>1.49</td>
<td>-.25</td>
</tr>
<tr>
<td>Environmental Uncertainty Moderating LM Competence – Lean Benefits</td>
<td>1.92</td>
<td>.32</td>
</tr>
</tbody>
</table>

**Note:** * p<0.05; ** p<0.01; *** p<0.001

The effects of all three control variables on LM Competence were non-significant. Size of the hospital based on staffed beds had a coefficient of -0.04 and t-statistic of 1.27;
technological sophistication had a coefficient of -0.03 and a t-statistic of 0.46, and organizational lean deployment experience had a coefficient of -0.02 and a t-statistic of 0.50.

Hypothesis 2 (LM Preparation Capability has a positive effect on LM Competence; a greater level of LM preparation capability likely results in a greater level of LM Competence) was supported. The path had a coefficient of 0.55 (t-statistic 3.55; p-value < .001) exhibiting a strong effect. Chin (1998) suggests $R^2$ values of 0.67, 0.33 and 0.19 are substantial, moderate and weak respectively. Given the $R^2$ value of 68.4, the predictive power of this relationship is substantial.

Hypothesis 3 (LM Implementation Capability positively moderates the effect of LM Preparation Capability on LM Competence; the degree of this positive moderation increases with the level of LM Implementation Capability) was not supported (t-statistic 0.22).

Hypothesis 4 (LM Competence has a positive effect on Lean-Based Benefits; a greater level of LM Competence likely results in a greater level of Lean-Based Benefits) was supported. The structural path had a coefficient of 0.59 (t-statistic 4.51; p-value < .001) exhibiting a strong effect. A measure of the predictive power of the model is the $R^2$ values of the endogenous constructs (Barclay, Higgins & Thompson, 1995). The predictive power of this relationship ($R^2 = 64.8\%$) is moderate, yet almost substantial (Chin, 1998).

Hypothesis 5 (Environmental Uncertainty negatively moderates the effect of LM Competence on Lean-Based Benefits; the degree of this negative moderation increases with the level of Environmental Uncertainty) was not supported. The structural path was non-significant (t-statistic of 1.92). This is very close to the significance level for a p-value of <0.05. The direct effect of Environmental Uncertainty on Lean-Based Benefits was also non-significant (t-statistic of 1.49). Given the discussion in section 6.3 on the surprising results of the reliability and
validity of the measurement items associated with Environmental Uncertainty construct, and the surprising positive coefficient of the moderating effect (0.32), I have not modified this relationship in the post hoc mediated alternative model (see section 6.5.2).

In summary, the hypotheses regarding the co-alignment model, all direct effects of the lower order dimensions of the higher order LM Preparation Capability, the direct effect of LM Preparation Capability on LM Competence and LM Competence on Lean-Based Benefits are all supported by the data from key respondents. The two moderating effects hypothesized were not supported.

### 6.5.2 Alternative Mediated Structural Model

Using a product terms approach in PLS to test for moderation necessitated estimation of both the moderating and direct effect of the hypothesized moderating latent variable. This approach revealed that LM Implementation Capability had a direct effect on LM Competence with a coefficient of 0.40 (t-statistic of 2.58; p-value < 0.05). This is a significant and moderately strong relationship. The strength of this relationship, in concert with lack of support for the originally hypothesized moderating relationship, led to the investigation of an alternative model to the descriptive research model. In this alternative post hoc model, LM Implementation Capability acts as a partial mediator (and not a moderator) of the relationship between LM Preparation Capability and LM Competence.

LM Preparation Capability can affect LM Implementation Capability. Possession of greater amounts of LM Skills can have a positive impact on an organization’s ability to efficiently deploy Lean-based initiatives. Institutional attributes (LM Climate and LM Culture) as well as individual attributes (LM Executive Leadership and LM Supervision) can positively impact the organization’s ability to execute Lean-based initiatives. As such, the greater an
organization’s LM Preparation Capability, the more likely the organization will be able to deliver value through the efficient deployment of the Lean-based initiatives it designs. While a portion of LM Preparation Capability will directly result in greater LM Competence, it will also have a portion that is mediated by its ability to execute Lean-based initiatives as represented by LM Implementation Capability.

A mediated model (Baron & Kenny, 1986) is presented in Figure 6.5 with the associated structural model path coefficients and t-scores. Coefficients for the model paths were estimated using the PLS Algorithm while bootstrapping with 500 sub samples and 201 cases to generate path estimates significance levels.

To test if LM Implementation Capability mediates the relationship between LM Preparation Capability and LM Competence I used the Sobel test (Preacher & Hayes, 2004). The test was significant (Sobel = 4.61; p < .001). Since the structural path from LM Preparation Capability to LM Competence was also highly significant (t-statistic 6.25; p-value <0.001), the model indicates that LM Implementation Capability is a partial mediator between LM Preparation Capability and LM Competence. Variations in LM preparation Capability significantly account for variations in LM Implementation Capability and LM Competence. Variations in LM Implementation Capability significantly account for variations in LM Competence. The total effect (0.822) of LM Preparation Capability on LM Competence is a combination of the direct effect (0.529), and the indirect effect partially mediated by LM Implementation Capability (0.807*0.363 = 0.293). The direct effect of LM Implementation Capability on LM Competence is .070.
Although full mediation is the gold standard (Zhou, Lynch & Chen, 2010), the majority of articles conclude with partial mediation (Iacobucci, 2008); that is, mediation is usually accompanied by a direct effect. From a theoretical perspective, a significant reduction in the direct effect (bringing it close to zero) of LM Preparation Capability on LM Competence would demonstrate that a LM Implementation Capability as a mediator is potent (Baron & Kenny, 1984). The results of this model suggest a less potent mediation. In addition, the $R^2$ of the relationships are exceed or are close to the 0.67 categorization threshold of substantial (Chin, 1998). The post hoc complementary partially mediated model (Zhou, Lynch & Chen, 2010) the is a better representation of the relationship between LM Preparation Capability, LM Implementation Capability and their effect on LM Competence than the originally hypothesized moderating relationship.
6.6 Summary

The principal purpose of this chapter was to develop reliable and valid measures for the latent constructs described in my research model and to estimate the structural relationships given those measures. As reported in the previous chapters, the conceptually and theoretically developed higher order LM Preparation Capability construct is posited to be reflected by the lower order LM Skills, LM Executive Leadership, LM Supervision, LM Climate and LM Culture constructs. LM Implementation Capability is posited to moderate the relationship between LM Preparation Capability and LM Competence and Environmental Uncertainty is posited to moderate the relationship between LM Competence and Lean-Based Benefits. In turn, each of these constructs is posited to be reflected by an internally consistent and unidimensional multi-item scale. The model’s measurement and structural model demonstrated support for most hypotheses outlined in this research however hypothesized moderators and control variables demonstrated non-significant results. What is evident is the significant effect of LM Preparation Capability and its importance in developing a LM Competence within the organization. The model’s support (or lack thereof) of my hypotheses and the post hoc mediated model will be discussed more in Chapter Seven.
CHAPTER 7 – DISCUSSION

7.1 Research Motivation

The major objective of this thesis has been to rigorously study the antecedents of productive LM deployment through an exploration of the potential underlying capabilities and dimensions that impact the development of a LM Competence and subsequent capture of Lean-Based Benefits. This study targeted both informants at the “gemba” and outcomes focused on value and provided by the value creators themselves. Specifically, this thesis studied four questions in regard to this phenomenon:

**RQ1:** In what way is LM Preparation Capability distinct from LM Implementation Capability with respect to LM pursuits of operational performance?

**RQ2:** What is the pattern of co-variation of LM Skills, LM Executive Leadership, LM Supervision, LM Climate and LM Culture and their respective determination of LM Preparation Capability?

**RQ3:** To what degree does a LM Preparation Capability impact LM Competence and what is the moderating effect of an organization’s LM Implementation Capability on its ability to optimize the operational functionality potential of its LM Preparation Capability in a LM Competence?

**RQ4:** To what degree does a LM Competence impact Lean-Based Benefits and what is the moderating effect of Environmental Uncertainty on an organization’s attainment of Lean-Based Benefits from its LM Competence?

Guided by a value generation compass and based on resource advantage theory of competition arguments and resource orchestration tenets, the answers to these research questions
were pursued through a novel conceptualization framework of LM Deployment, the methodological development of measurement instruments and the analysis of empirical survey-based data collected from 201 key respondents employed as US hospital emergency department nurses, experienced in the deployment of lean-based initiatives within their departments. Since a strong contextual understanding is important when studying organizational capabilities (Ethiraj et al., 2005), studying a single industry within a single country allowed me to devote sufficient time to understanding the complexities of LM deployment in US hospitals more deeply (Yin, 2009) and facilitated comparisons among multiple organizations within that industry (Fox-Wolfgramm, Boal & Hunt, 1998).

The US health care industry sector was chosen for empirical study given the increasing urgency to address waste within the health care system; converging pressures (E.G. emphasis on better quality outcomes, faster access times, rising costs) on the system (IHI, 2011) have policy makers and administrators searching for strategies to improve performance. Within the health care industry, hospitals were selected as the context for study due to the inefficiencies, errors, spiraling costs and resource constraints (Pocha, 2010) currently being experienced. As they attempt to address these challenges, many hospitals have become rather skilled at achieving project level improvements; however the difficulty of achieving organizational level results has proven to be much more challenging (IHI, 2011).

The complexity of a hospital’s social organization and the varied stakeholders involved present unique challenges for the deployment of LM (Hopp & Lovejoy, 2012); the debate as to whether Lean can be successfully deployed in a US hospital environment has been ongoing (Radnor & Boaden, 2008; De Souza, 2009), providing fertile context for the study of LM deployment. Given the existence of argumentation that little evidence of a complete lean
philosophy being applied within the health care system (Poksinska, 2010), and the contrasting presence of apparent exemplar lean hospitals (E.G. see Kenney’s [2011] chronicling of the effort to adopt and deploy LM at Virginia Mason Medical Center), a study of why and how some hospitals succeed and others fail is both prescient, potentially informative and likely valuable to both scholars and practitioners alike.

Given today’s environmental and organizational demands and challenges, hospital administrators are currently deploying or considering the deployment of Lean (IHI, 2005). Emergency Departments, due to their role as both a gateway to the inpatient aspects of the hospital and its outpatient functionality, are often the initial point – or trial run– for Lean implementation in hospitals. Given that LM deployment usually occurs at the department level, the emergency department was chosen as the focal hospital department studied in this thesis.

My initial conceptualization of productive LM deployment, consisting of two distinct LM capabilities (preparation and implementation), had not been previously researched empirically. As such, I embarked on a four-phased approach in an effort to answer my research questions: (1) theorization, (2) conceptualization, (3) item pre-testing and measurement purification, and (4) survey-based analysis and findings. I will frame my discussion accordingly.

7.2 Theorization

Porter (1996) observed that systematic operational effectiveness and improvement approaches improve the short-term performances of adopting organizations, but ultimately provide little in the way of sustainable strategic advantage given that such best practices adoption only result in competitive convergence. Implicit to Porter’s reasoning is the belief that once an operational improvement approach is selected for adoption by management, then the effectiveness of its deployment is homogeneous within the industry; a given. From an industrial
organization economics (I-O) perspective this may make sense, but from personal experience (as a practitioner and management consultant) and from a resource based perspectives (Barney, 1991), this seemed unlikely; not all continuous improvement projects or programs are deployed with the same degree of success (Hayes & Upton, 1998). With Lean, the effective deployment of concepts, tools, and practices is anything but a given; the institutional and individual dimensions of the organization require substantial cultivation, orchestration and leveraging for Lean to succeed. If this heterogeneity of deployment was true, what theorization not only contrasted Porter’s (1996) view of deployment homogeneity, but underpinned the distinction between mere possession of resources and capabilities, from the mindful and purposeful utilization of them.

In searching for theoretical underpinnings to my initial conceptualization of LM deployment, I was introduced to two under-exploited strategic perspectives: (1) resource advantage (R-A) theory of competition (Hunt & Morgan, 2005) and (2) resource orchestration (Sirmon, Hitt, Ireland & Gilbert, 2011). As far as the business strategy and operations management literatures are concerned, these two theoretical perspectives are rarely used. While it would have been easy (and likely more expedient) to root my argumentation in more well know and utilized resource based perspectives (E.G. the resource based view [Barney, 1991]), when I began to immerse myself in these alternative theories, it became clear how they provided unique insights into LM deployment as well as better support for my conceptualization of the phenomenon.

R-A theory is an evolutionary, general theory of competition that describes the process of competition (Hunt & Morgan, 2005) by drawing upon the resource-based view (RBV) of the firm (Barney, 1991), dynamic capabilities theory (Teece, Pisano & Schuen, 1997), competency theory (Prahalad & Hamel, 1990) as well as I-O based theory of strategy (Porter, 1996). R-A
theory explains that marketplace positioning advantages are derived from comparative advantages in resources relative to those possessed by the competition. R-A theory assumes that the constant struggle for advantage and superior financial performance is dynamic in nature and thus disruptive to the concept of equilibrium (Hunt & Morgan, 2005) prevalent in other resource and I-O based theories. Organizations (and by extension management) are not simply viewed as passive responders reacting to a changing environment by best matching resources to market opportunities, but as proactive participants who anticipate opportunities and mindfully, purposefully and strategically acquire, develop or construct the required resources, capabilities and competencies to create value adding offerings that capitalize on a perpetually changing environment; no equilibrium (Hunt & Morgan, 2005).

The ongoing pursuit of comparative resource advantages is the major force of dynamism in R-A theory based competition as organizations continually seek marketplace positioning competitive advantages. This continual and dynamic pursuit of comparative resource advantages in an effort to generate marketplace competitive advantages provides enhanced explanatory insight (as opposed to theories based on some equilibrium) into the potential value derived from continuous improvements achieved through successful LM deployment. A foundational supposition underlying my research is that in the “strategically ready” LM deployment model, LM preparation and implementation capabilities are heterogeneous amongst organizations and that the mere possession of a unique lean-based resource or capability (a bundle of complementary lean-based resources) does not presume that it will be utilized to its full potential. A such, the more well know and utilized resource based theories seem unsuitable for framing my conceptualization. A more appropriate theoretical framing for my conceptualization of “strategically ready” LM deployment is R-A Theory.
From a resource based perspective, possessing or having access to valuable, rare, inimitable and organisable resources is a requirement for attaining a competitive advantage (Barney, 1991). Yet resource possession or access alone is insufficient (Hansen, Perry & Reese, 2004); they must be managed. To capitalize on opportunities and/or mitigate threats for the organization to realize a competitive advantage, resources must be effectively mobilized, coordinated and deployed (Sirmon, Hitt, Arregle & Campbell, 2010). Resource orchestration (Sirmon et al., 2011) recognizes that more than simple resource possession is important to achieving suitable operational and organizational performance (Helfat & Winter, 2011).

Comparative resource advantages create the potential to generate competitive marketplace advantages, but only when well-orchestrated.

My belief is that the strategic and operations management scholars could, and should, make better use of these two under-utilized theories. Extending the theorization and conceptualization of operational management decision making with the use of R-A theory argumentation and resource orchestration tenets would be beneficial to improving scholarly contribution and managerial understanding of resource based topics.

7.3 Conceptualization

Meaningful managerial and theoretical insights often emerge from rigorous scholarly conceptualization (MacInnis, 2011). While much of the operations management literature on Lean has focused on the presence of concepts, tools and practices (Shah & Ward, 2007), little empirical research had investigated the institutional and individual antecedent dimensions that underpin the successful deployment of Lean. These dimensions have certainly been acknowledged, and intuitively make for common sense, yet beyond the recognition of their need and importance to successful Lean deployment, the empirical study of the degree of their
importance or significance of their role, has not been published. My background as an elite level sports coach and athlete exposed me to the fundamental understanding that preparation was a necessity for success; exceptional “game-time” execution was based on exceptional preparation. In terms of team sports, that preparation included the development of individual skills and attributes (dimensions) as well as group ones. Unfortunately, in my career as a management consultant, I often encountered in practice the omitting (or plain avoidance) of the harder, long-term preparation work in favour of the shorter-term rush to rapid results. This “just do it” type approach to deploying Lean emphasized the implementation of lean-based concepts, tools and practices in an effort to rapidly reduce waste by “grabbing the low hanging fruit”. While this approach resulted in temporary improvements, it rarely, if ever, embedded Lean within the organization.

My conceptualization of LM deployment highlights the need for adopting firms to undertake a more mindful and productively purposeful approach to LM deployment. This “strategically ready” approach places explicit focus on the productiveness of managerial decisions and actions critical to ensuring the efficient and effective long-term deployment of Lean. My conceptualization distinguishes Lean from LM; Lean being the deployment of concepts, tools and practices while LM represents the systematic, strategic, mindful and purposeful approach to managing and improving the efficient and effective throughput functionality of operational work efforts and work flows. LM requires significant preparation to ensure systematic embedding of the approach. In the end, a reluctance to do the heavy lifting required (preparing the organization for lean deployment) results in a failure to instill enduring competency and long-term embedment of Lean. Typically, management subsequently places blame on the ineffectiveness of the Lean approach without adequately examining the failure of
provisioning the necessary organizational preparation. They move onto the next improvement “flavour of the month” with similar results.

Conceptually, a “strategically ready” LM deployment approach ostensibly reflects a LM competence (Bhasin, 2012) based upon the possession of a LM Preparation Capability and a LM Implementation Capability. In concert, these capabilities enable the organization to efficiently and effectively deploy a LM Competence in pursuit of Lean-Based Benefits for and from customers. The cultivation, orchestration, activation and leveraging of lean-based resources and LM capabilities are ultimately associated with the creation of enhanced value for customers through improved operational performance (Eroglu & Hofer, 2011).

Although my initial conceptualization was based on an examination and understanding of the theoretical underpinnings, operations management and Lean literature, to further saturate my conceptualization I embarked on a series of case studies. This phase of my research journey was extremely helpful in guiding refinements to my conceptualization and understanding of the phenomenon. I would advise all doctoral students to conduct such studies to enhance their comprehension of the nuances of the problem under study. Similar to effective LM, comprehension requires an up close inspection; my belief is that case studies (or at least seeing the phenomenon up close) provide a better perspective into the issue than the prism formed by a purely academic review of the existing literature.

The data form my case study research and subsequent analysis of that data (notes from 70 interviews) confirmed that indeed preparation and implementation capabilities were distinct. Interviewees generally felt that although continuity of some personnel was beneficial to the project’s overall success, LM required different sets of skills or capabilities at these two distinct stages. In addition, many interviewees commented on the temporal aspect of developing
organization capabilities and the importance of preparation preceding implementation of Lean; the notion that the better organizational preparation, led to better adoption of Lean. This confirmation of the conceptualization of a distinction between preparing (strategically readying the organization and its personnel) and implementing (executing lean-based initiatives) in concert with the richness of the interview data substantiated my conceptual research model design and gave me confidence moving forward with my research agenda and essentially answered my first research question. Additionally, this research phase enhanced my understanding of the dimensions that comprised a LM Preparation Capability and ultimately led to a modification to my initial conceptualization of this capability.

From the interview data, the distinction between LM and Lean also became much clearer. LM emphasizes the firm’s managerial and executional deployment efforts associated with its lean-based initiatives. Lean on the other hand refers to the tools, concepts, practices and eventual outcomes of its lean-based efforts. Active management of its lean-based initiatives program incorporates cultivation of resources into capabilities and activation/leveraging of capabilities into a competence. Management is strategically readying the organization for the deployment of Lean in contrast to the “just do it” approach of rapid application of tools, concepts and practices without preparation. These perspectives and enhanced clarity, collectively informed revisions to my initial Conceptual Research Model as now depicted in Figure 3.4.

7.4 Item Pre-Testing and Measurement Purification

The relative ease of electronic distribution has increased the use of surveys for a variety of business purposes (E.G. assessing existing customer satisfaction, gathering voice of the customer perspectives). The use of survey based research has steadily increased in operations management as academia has followed suit (Ding, Hu, Verma & Wardell, 2009). But this steady
increase in surveys of all sorts has led to the emergence of “survey fatigue” (Menor, 2000). The adage “garbage in; garbage out” has never been more crucial to survey research as potential respondents grow tired of surveys. Given the costs of my survey research (over $14,000), front-end analysis of the adequacy of my measurement items was a necessity. In addition, since I was creating new measurement scales (albeit primarily adapted from existing scales in operations management) for new LM constructs, poor survey design would have been disastrous to my thesis.

Through the review and analysis of my case study data and scrutiny of the existing literature, I was able to not only create a descriptive model of the phenomenon under study, but quickly operationalize definitions to be used for potential measurement item selection, adaptation and creation. Those items were subjected to two rounds of pre-testing with knowledgeable judges, not to form measurement scales per se, but to indicate a preliminary/tentative item-level adequacy (Menor & Roth, 2007). Item sorting and systematic analysis provided additional rigor and richness to the scale development and my understanding of the phenomenon. This rigor enhanced item purity prior to the expensive survey investment, and increased the probability of measurement scale reliability and validity. Ironically, akin to the value of preparation before implementation in LM, the results of my research, and in particular my measurement scales, lend credence to the value of preparation in survey design before survey deployment.

Preliminary assessment of item reliability and validity (pre-instrument construction) was critical given that pre-existing measurement scales for the constructs under study were unavailable. The resultant LM measurement scales not only permitted me to assess the values and associations between constructs in my model, but are a contribution to the body of operations management knowledge; new scales for the measurement of LM Skills, LM
Executive Leadership, LM Supervision, LM Culture, LM Climate, LM Implementation Capability, LM Competence and Lean-Based Benefits are all new instruments. These distinctive measurement instruments are formed from a more precise definition of LM and help identify the key drivers (individual and institutional facets) of LM Competence. The instruments enable management to uncover the relative importance of each facet and inform more mindful and purposeful actions based on those results.

Without the research discipline and rigor provided through exploratory case study research and pre-testing of potential items with practitioners (not just academics and/or MBA students), I doubt the successful development of all these measurement scales would have occurred. Like my endorsement of going to the “gemba” and case study research, I strongly advocate the use of practitioners as part of the pre-testing process to provide a more stringent test of adequacy of measures and their associated items. At this stage of the discussion I will turn to the last three research questions and the findings that support or refute the hypotheses examined.

7.5 Survey-Based Analysis and Findings

7.5.1 LM Preparation Capability

Per R-A theory, operational resources are generally replicable across firms; however operational capabilities and competencies are firm specific. Through the measurement of the institutional and individual dimensions that reflect the conceptualization of a LM Preparation Capability, I was able to assess its importance in the development of a LM Competence for the organization. Through examination of both (1) a direct effects model without the presence of the parsimonious, higher order LM Preparation construct and (2) the conceptualized co-alignment model, I was able to demonstrate the significance of the correlation of the lower order dimensional constructs (see Table 6.16) as well as the non-significant relationship between LM
Culture and LM Competence without the higher order construct presence (see Figure 6.2). This notion of co-alignment is a theoretical representation of a co-varying resource configuration that is most parsimoniously represented by a higher order factor model. Given my theorization and the estimation of the models using the empirical data, the co-alignment model is the most suitable specification of my theoretical representation. This should be viewed as an empirical specification of the theoretical representation and not as an empirical representation of the measurement model. As such the relationship means that as LM Preparation Capability increases, on average, each of the five facets of LM Preparation are expected to increase as per resource orchestration tenets. In addition as LM Preparation Capability increases, LM Competence should increase as per R-A Theory.

With the co-alignment model (see Figure 6.3) all five lower order constructs have very meaningful (Meehl, 1990) factor loadings. Chin (1998) suggests $R^2$ values of 0.67, 0.33 and 0.19 are substantial, moderate and weak respectively. Given the $R^2$ value of the lower order constructs, the predictive power of the relationship between LM Preparation Capability and LM Supervision ($R^2 = 81.6\%, 0.90, p <.001$), LM Executive Leadership ($R^2 = 85.1\%, 0.92, p <.001$), LM Culture ($R^2 = 75.4\%, 0.87, p <.001$), and LM Climate ($R^2 = 69.7\%, 0.84, p <.001$), are all substantial. The relationship between LM Preparation Capability and LM Skills ($R^2 = 53.4\%, 0.75, p <.001$), is moderate. Given that “the purpose of a mathematical model is to summarize data, to formalize the dynamics of a behavioral process, and to make predictions” (Cudeck & Henley, 2003: 378) and that PLS focuses on variance explained (the predictive capability of the model) (Chin, 2010) the conceptualized co-alignment model and the associations between the higher order and lower order constructs measured, the reflective factors are strong indicators of a LM Preparation Capability. In addition, given the reporting of the standardized path parameters,
the relative importance of the facets can be observed; LM Executive Leadership and LM Supervision being the most critical and LM Skills the least critical.

As conceptually developed, LM Preparation Capability was posited to represent the organization’s degree of strategic readiness for the deployment of LM and reflects the organization’s proficiency at the ongoing process of developing the institution, and its individuals, for the successful deployment of a LM program. It is represented by five latent factors each reflected by a distinct and unidimensional multi-item scale. These scales were tested for reliability and validity and re-specified based on the test results. A contribution of this research is thus not only the empirical demonstration of a LM Preparation Capability, but the scales to measure the reflective latent factors of that higher order construct.

7.5.2 LM Competence

Conceptualized as the proficiency of the organization to deploy a systematic, relentless, problem-focused, facts-driven, and team-based paring of waste (and its sources) from operational systems in order to (1) improve throughput-focused work flows and (2) increase the productivity and value-add ratio of all work efforts on an ongoing basis, LM Competence represented the ability of the organization to activate its LM Preparation Capability through the application of its LM Implementation Capability. It was hypothesized that LM Implementation Capability did not have a direct effect on LM Competence, but that it moderated the relationship between LM Preparation Capability and LM Competence.

As modeled, LM Preparation Capability had a meaningful and substantial association with LM Competence ($R^2 = 68.4\%, 0.55, p < .001$); a one unit increase in LM Preparation Capability results in a 0.55 unit increase in LM Competence. What makes this relationship interesting is the co-alignment specification. It is the synergies of these five facets that create the
causal ambiguity and resource comparative advantage. As per R-A Theory, the LM Preparation Capability is an organizational resource that is not easily replicated and thus a rare and valuable resource achieved through the orchestration and cultivation of the five synergistic facets.

The hypothesized moderating effect of LM Implementation Capability did not surface. However, in PLS, a direct effect path must be included with the moderating effect; as such a direct effect of LM Implementation Capability on LM Competence showed a significant relationship (0.40, p <.05). As such the associations measured in the structural part of the model suggest a very meaningful degree of LM Competence variation is rooted in LM Preparation Capability and potentially directly in LM Implementation Capability as well (see Section 7.5.4 for further discussion).

Similar to the five dimensions of LM Preparation Capability, distinct scales were developed for LM Competence and LM Implementation Capability. These scales were also tested for reliability and validity and re-specified based on the test results. A contribution of this research is thus not only the empirical demonstration of a meaningful and substantial relationship between LM Preparation Capability and LM Competence, but the scales to measure LM Competence and LM Implementation Capability. From my understanding of the literature, and the best of my knowledge, this is the first direct empirical measure of LM Competence in the literature. Others have measured LM success based on the degree of Lean (concepts, tools and practices) adoption, but this measurement scale attempts to specifically gauge the degree of success on the various LM definition dimensions so it is a more valid approach to reflecting LM deployment success.
7.5.3 Lean-Based Benefits

The realization of the comparative resource advantages of a LM Competence manifests in the Lean-Based Benefits derived from marketplace competitive advantages. Conceptualized as the combination of economic value, functional value and experiential value derived from an organization’s lean-based activities which results in positive outcomes for the organization and its customers, Lean-Based Benefits were hypothesized to be formed by the organization’s degree of LM Competence, negatively moderated by Environmental Uncertainty.

As modeled, LM Competence had a meaningful and substantial association with Lean-Based Benefits ($R^2 = 64.8\%$, 0.59, $p < .001$); a one unit increase in LM Competence results in a 0.59 unit increase in Lean-Based Benefits. Given the strength of the LM Competence measures, and the discriminant validity challenges addressed (See Tables 6.8, 6.9, and 6.10), this result is not surprising, yet still significant. Lean Based Benefits measures the non-operational value focused outcomes of the LM deployment efforts. While LM Competence tries to gauge the success of the LM outputs, Lean-Based Benefits gauges outcomes. As such, support for this hypothesis reflects that higher levels of LM Competence are a basis for creating likely marketplace competitive advantages.

The hypothesized moderating effect of Environmental Uncertainty did not materialize. Given that only two items remained to measure three facets of Environmental Uncertainty, a Type II error potential was higher. Given the prevailing use of this construct in the literature, the results were surprising; however the high number of item removals from the scale after estimation with the empirical data leads me to believe that these issues are sample specific. This was the one problematic measure in my study. In retrospect, an improvement in this research would have been not to ask emergency department nurses to evaluate this construct, but to
approach more senior executives in the hospital to answer these questions. Nonetheless, given the data collected there was no moderating effect.

While the scale for Lean-Based Benefits is a contribution to the research on LM, the measurement scale used for Environmental Uncertainty is less so given its prevalence in the literature and the number of items (two) in this model.

7.5.4 Post Hoc Partial Mediation Model

Recall that Womack & Jones (2007) stated that learning the system takes ten years of practice under expert guidance, and Bhasin & Burcher (2006) posited that the firm should see the LM process as a long-term journey. Yet, organizations can experience short-term gains based on simple execution of the Lean-based concepts, tools and practices. My conceptualization of LM Competence took a long-term perspective, taking into consideration the requisite capabilities to embed the approach within the organization. The data did not support the original model specification. What the data does support is a partial mediation role of LM Implementation Capability in the LM Preparation Capability and LM Competence relationship. While, the longer-term perspective and emphasis on LM Preparation Capability as an influencer of LM Competence was not flawed, the conclusion that none of the value of LM Implementation would directly affect LM Competence was mistaken. As such, when I re-specified my descriptive research model post hoc, to include a partial mediated path (see figure 6.5), LM Implementation Capability was shown to partially mediate the relationship between LM Preparation Capability and LM Competence; that is, the mediation is accompanied by a direct effect. From a theoretical perspective, a significant reduction in the direct effect (bringing it close to zero) of LM Preparation Capability on LM Competence would demonstrate that a LM Implementation Capability as a mediator is potent (Baron & Kenny, 1984). The results suggest a less potent
mediation. The direct effect of LM Preparation Capability on LM Competence (0.53, p<.001) remains significant and meaningful (Meehl, 1990). In addition, the direct effect of LM Preparation Capability on LM Implementation Capability ($R^2 = 65.0\%, 0.81$, p<.001) is also significant and meaningful with the $R^2$ of the relationship, just shy of the substantial threshold (0.67%) established by Vhin (1998). LM Implementation Capability has a significant and meaningful (Meehl, 1990) direct effect on LM Competence (0.36, p<.001), however when we take into account the effect of LM Preparation Capability on LM Implementation Capability, the effect becomes less meaningful. The total effect of LM Preparation Capability on LM Competence is 0.81 (0.53 direct effect and .28 indirect effect); the critical role of LM Preparation Capability is demonstrated.

The post hoc complementary partially mediated model (Zhou, Lynch & Chen, 2010) is a better representation of the relationship between LM Preparation Capability, LM Implementation Capability and their effect on LM Competence than the originally hypothesized moderating relationship. $R^2$ for LM Competence is marginally reduced (0.1%) and remains the same for Lean-Based Benefits. Given this importance of LM Preparation Capability on LM Implementation Capability and LM Competence, my suspicions are that prior research into Lean concepts, tools and practices likely were affected by the organization’s individual and institutional resources. However, these later suspicions were not empirically measured in this study.

### 7.6 Summary

In response to my original research questions, this multi-faceted research thesis addressed each through a rigorous methodological approach that resulted in not only answers to my questions (and their associated hypotheses), but the development of reliable and valid
measurement instruments. As such I have made several contributions to the body of knowledge in operations management, in particular LM. The data demonstrated meaningful and significantly strong relationships between the reflective indicators LM Skills, LM Executive Leadership, LM Supervision, LM Climate and LM Culture and the higher order construct LM Preparation Capability. These latent factors co-align. Higher measures of LM Preparation Capability are meaningfully and significantly associated with higher measures of LM Competence. Higher measures of LM Competence are meaningfully and significantly associated with Lean-Based Benefits. Environmental Uncertainty was not a moderator of the relationship between LM Competence and Lean-Based Benefits. LM Implementation Capability was not a moderator of the relationship between LM Preparation Capability and LM Competence, however in post-hoc analysis it was shown to partially mediate that relationship and LM Preparation Capability had a substantial effect on LM Implementation Capability.

Given my emphasis on framing LM from a value generation perspective, integrating little used R-A theory and resource orchestration (at least in the operations management literature) into my research, and highlighting the greater need for managerial attention and empirical research into the factors that help organizations prepare adequately for the deployment of LM, I consider this thesis research productive, significant and meaningful. From a learning and personal development perspective, I have no doubts that it was successful.

The promise of LM can be achieved through paying greater attention to preparation and the cultivation of requisite capabilities. The same can be said for doctoral studies and academic research.
CHAPTER 8 – CONCLUSION

8.1 Contributions

Successful LM Deployment (and the associated attainment of Lean-Based Benefits) requires a holistic and systematic management orientation focused on the development of a LM Competence. In this thesis, I have attempted to provide meaningful explanatory and prescriptive LM insights through the conceptualization and theorization of a “strategically ready” LM deployment approach. This “strategically ready” LM deployment model highlights the distinctions between the resource cultivation and orchestration of a LM Preparation Capability and LM Implementation Capabilities. The activation and leveraging of these resources and capabilities facilitates the forming of a LM Competence and a comparative resource advantage (framed by R-A Theory). The criticality of LM Preparation Capability (reflected by LM Skills, LM Supervision, LM Executive Leadership, LM Climate and LM Culture) and LM Implementation Capability suggests the importance of a combined socio-technical approach to mindfully and purposefully managing a lean-based program of initiatives. Managerial priorities should focus on value design through the cultivation and orchestration of institutional and individual resources, value delivery through the activation of those resources into a comparative resource advantage, and value capture through the realization of value created through marketplace competitive advantage.

The resource based literature on competition has generally agreed that the primary basis for organizations to compete is through the acquisition or development of unique capabilities (Barney, 1991; Flynn et al., 2010). By offering an integrative theorization on “strategically ready” LM deployment, I contribute to the operations management literature a novel conceptualization and argumentation as to how organizations can increase their ability to
generate orchestrated lean-based resource comparative advantages and marketplace positioning competitive advantages.

In addition to this novel conceptualization and argumentation about LM, through the systematic application of a two stage approach to scale development (Menor & Roth, 2007), I have developed reliable and valid measurement instruments for numerous constructs within my research model. These scales can be used by operations management scholars to further empirical research regarding the deployment of LM resources, capabilities and competency in pursuit of Lean-Based Benefits.

My empirical study of the LM deployment phenomenon in US hospital emergency departments demonstrated the importance of preparation to the overall successful and productive deployment of LM. The LM Preparation and LM Implementation Capabilities enabled advantages, as I have argued, that require the mindful and purposeful management of the organization’s collection of individual and institutional resources. These advantages require management to apply a “strategically ready” approach to resource cultivation and orchestration and thus are not to be expected from the “just do it” approach so often applied to LM deployment. The data supports the hypotheses that LM Preparation Capability is a multi-faceted higher order representation of the co-alignment of five latent factors: LM Skills, LM Executive Leadership, LM Supervision, LM Climate and LM Culture. These factors co-vary and are reflective of a LM Preparation Capability possessed by the organization. The post-hoc mediated model demonstrates empirically that LM Implementation Capability is a complementary partial mediator of the association between LM Preparation Capability and LM Competence. And finally, the possession of a LM Competence positively affects the Lean-Based Benefits that accrue to the organization through the deployment of LM. These relationships are not necessarily
surprising per se, however what I believe to be interesting (Smith, 2003), important and potentially impactful (Cachon, 2012) is the degree of the total effect of LM Preparation Capability in relation to LM Implementation Capability.

The validation of LM Preparation Capability as a higher order construct and the covariance of the dimensions under study provide compelling evidence for the requisite or systematic management of the organization’s resource cultivation process. These results reinforce the importance of the social component of the integrated socio-technical system described by Ohno (1988) and support the premise that only those organizations characterized by a significant use of human resource practices enjoy the full complementary effects of Lean concepts, tools and practices on operational performance (Furlan, Vinelli & Pont, 2011).

While this research makes several contributions from a scholarly perspective, it is my hope that practitioners will take note and make more mindful and purposeful decisions when deploying LM within their organizations. A refocusing of administrators’ LM investments on more preparation based resources and capabilities cultivation and orchestration, and subsequent leveraging decisions, would enhance the probability of developing a LM Competence within their organizations. The result would be more “strategically ready” and less “just do it” LM deployment efforts.

8.2 Limitations

While this thesis makes a number of valuable contributions to the understanding of the deployment of LM, there are several limitations that are worth noting.

The sample size (N=201) used for the survey data was adequate (Barclay, Higgins & Thompson, 1995) for the descriptive research model and the use of PLS-SEM, yet inadequate if I was to have used CB-SEM (Hair et al., 2014). “Sample size is a major determinant of statistical
power and therefore influences the quality of inference statistics obtained” (Henseler et al., 2014: 198). While a larger sample would increase the confidence that the sample was representative of the population, the descriptive statistics showed that respondents were primarily more senior and experienced in the institution and with LM (and thus informed). Additionally, the findings were consistent with my theorization and thus a likely representative of the population. In regards to future research, I would still strive to utilize a larger sample size.

There has been considerable debate of late as to the appropriateness of PLS-SEM as an analysis tool (McIntosh, Edwards & Antonakis, 2014). Ronkko (2014) suggests that PLS “capitalizes on chance correlations” (pg. 166) and that the impact is an amplification of effect sizes. Ronkko & Evermann (2013) state that “parameter estimates are both inconsistent and biased” (pg. 425) providing erroneous estimates and “that the idea that PLS results can be used to validate a measurement model is a myth” (pg. 438). Opposing this view is Henseler et al. (2014) who refute Ronkko & Evermann’s points. Henseler et al. (2014) reinforce the predictive purposes of PLS-SEM themselves and quote its designer Wold in regard to its intended use for exploratory purposes. PLS may in fact possess a bias to have higher estimates for loadings and lower structural path estimates, but as sample size increases and the number of indicators per construct increases, the values approach “true” parameter valuations (Chin, 2010). The size of my sample and the meaningfulness of my parameter estimates does not lead me to believe that my findings are in any way materially incorrect.

An unequal number of indicators on the research model’s lower order constructs hampers estimation of the higher order construct (Chin, 2010) when using the repeated indicator approach leading to bias towards constructs with greater number of indicators (Becker, Klein & Wetzels, 2012). In the development of my higher order LM Preparation Capability construct, the five
lower constructs did not have equal number of indicators (ranging from four to eight), but the numbers were somewhat comparable (Hair et al., 2014). Given the exploratory nature of this study and this being the initial creation of operational definitions and measurement instruments for these five constructs, I chose to not eliminate items just to have comparable numbers between the lower order constructs. In this instance I prioritized content validity over the consistency in item numbers. In future research, the scales could be adapted by either reducing or increasing the number of items in these five scales to better balance the consistency between lower order constructs.

While the use of Qualtrics Inc as a survey distributor was invaluable, the proprietary nature of their method and confidentiality of their panel partners does not allow for the assurance of randomness in sampling. Being somewhat disconnected from who exactly they are contacting to recruit as key respondents is problematic. Additionally, online surveys can potentially suffer from bias by excluding people without Internet access (Ding et al., 2009). I would not do anything differently, and I completely trusted my contacts and their methodology at Qualtrics, however the lack of transparency is a limitation.

I used a single respondent for my survey data collection (with the exception of the control variable Size). As discussed in section 6.2.4, the necessary use of single respondents was explained for logistical reasons. I used post-hoc statistical procedures to address common method bias. In particular, the Environmental Uncertainty construct proved problematic and in retrospect I should have asked a more senior executive in the organization to answer survey question regarding that construct. A next phase of my research will be to augment the survey data with publically available data on LM Competence and Lean-Based Benefits in an effort to mitigate the common method bias issue; obtaining measures of the predictor and dependent
variables from different sources can help reduce the plausibility of method biases (Podsakoff, MacKenzie, Lee & Podsakoff, 2003).

This research employed cross-sectional data; hence this research focuses on a single point in time or a “snap shot” view of the LM deployment phenomenon. Not taken into account are the drivers of LM Competence over time, rather the emphasis is on the possession of capabilities and the resources associated with them. As discussed in the following section, future research should attempt to take a more longitudinal approach to the study of the phenomenon considering the long-term focus on the lean journey by successful practitioners (Liker & Convis, 2012).

One department, in one industry, in one country was selected as a sampling frame to minimize the potential effects of confounding variables. However, the trade-off is in the generalizability of the findings. This limitation was deliberately assumed with the hope that if the results proved promising, that further research in other industries and cultures will follow as part of a greater research stream of study post-thesis. In the future, this broader scope will permit enhanced analytical generalization to other areas of LM adoption.

8.3 Future Research

The relevance of my “strategically ready” LM deployment specification and the findings from this research should be act as a guide to interested scholars’ future research endeavors to further examine the ever present challenges managers face in developing a LM Competence within their organizations and deploying LM across the operational efforts and flows of the organization. Examining this phenomenon in different industries would test the generalizability of my findings. Extending this type of research from cross-sectional to longitudinal would be a wonderful extension of my work and take into account the evolution of the department through their LM journey. Increasing the sample size and transitioning from an exploratory PLS-SEM
analysis to a CB-SEM one, would advance the research model to its next logical phase. The introduction of additional control variables (e.g., the presence of nursing unions) as potential influences on LM Competence could enhance understanding of the phenomenon.

In the end, it is my hope that this “interesting research piques your curiosity, it induces a pause for contemplation, and most importantly it contradicts how you think of the world” (Cachon, 2012: 166). While this research thesis may not contradict scholarly and practitioner thinking, it should awaken their minds to the importance of preparation to the successful deployment of LM. My hope is that this thesis invokes a ‘that’s interesting’ response and that it is just the initial foray into understanding and explaining the organizational and operational capabilities that enable the development of a “strategically ready” LM deployment effort.
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Appendices

APPENDIX A: CASE STUDY BACKGROUND MATERIALS

RESEARCHER BIO

David Barrett – Bio

David is a PhD student at the Richard Ivey School of Business at the University of Western Ontario. His specialty area is Operations Management with a research interest in the deployment of lean management initiatives within the North American hospital industry.

David is a Certified Management Accountant. He has a MBA from the Richard Ivey School of Business at the University of Western Ontario, a Bachelor of Commerce (Major in Accounting) from Mount Allison University and a Graduate Certificate in Business Valuation from the Kelley School of Business at Indiana University.

Prior to his PhD studies, David worked as a management consultant for seven years spanning retail, consumer packaged goods, wireless telecommunications, pharmaceutical and medical devices industries. He led large scale engagements, managed key C-suite relationships and led business development efforts. His consulting work focused on organizational development, team building and leadership, strategic development, activity based cost analysis, supply chain optimization, inventory management and operational process effectiveness. His consulting and project management experience spans Canada, Mexico, England, Ireland, Germany and the United States.

Prior to his MBA, David spent ten years as an elite level ice hockey coach and general manager.

When not on campus in London, ON, David resides in Boston.
LETTER OF INFORMATION

Dear Key Informant,

My name is David Barrett and I am a doctoral student at the Richard Ivey Business School at the University of Western Ontario and the information I am collecting will be used to help frame and development my eventual thesis work.

You are being invited to take part in a research study looking at the deployment of Lean Management (LM) at XXX. The researchers are advancing the descriptive/contextual understanding of the LM implementation phenomenon in a hospital setting. Information collected will develop a more rigorous understanding of the managerial issues and challenges faced during the LM deployment journey within a hospital context. The field work data collected will be used to generate a research case study to further motivate and develop theory/understanding associated with the researchers’ subsequent work in this area. The purpose of this letter is to provide you with the information you require to make an informed decision on participating in this research.

Your consent will permit researchers to observe your work in LM meetings and initiatives and potentially require a one-on-one interview of approximately one hour in length. There are no known risks to this study. All informants will be referred to by position only (e.g. Nurse A, Nurse B, Human Resources Director, etc.). Your participation is voluntary and you may withdraw your consent at any time during the study. Should the results of the study be published, your name will not be used.

Data will be initially collected in this study by field notes and individuals will be identified by hospital informant position only (generic labeling such as “Nurse A” or “Triage Staff A” etc.). Data will be subsequently recorded electronically and stored on a password protected account associated with the Richard Ivey School of Business PhD server. A separate file with informant position, initials and name will be stored on personal hard drive without data. Field notes will be secured in locked office until backed up electronically. Data collected will be treated confidentially unless permission is granted by hospital key informants to utilize undisguised data in the case research writing. Any risk of informant identification not treated by generic labeling (E.G. Chief Executive Officer A) will be reviewed with the informant in question and approved by the informant before any publication of the study. Data will be stored on a password protected account associated with the Richard Ivey School of Business PhD server.
through the PhD thesis stages of the student’s studies and erased upon completion of the student’s dissertation. Data will only be used for analysis and reporting purposes by the student collecting the data.

Should you have any questions or concerns about this study, feel free to contact me or Professor Larry Menor who will be supervising this research study. If you have any questions about the conduct of this study or your rights as a research participant, you may contact the Office of Research Ethics, the University of Western Ontario.

Please indicate your consent to participate by signing and dating this document below. We look forward to your contributions, and wish to thank you again for your consideration.

Yours sincerely,

David Barrett
Ph.D. Student, Operations Management
Richard Ivey School of Business
University of Western Ontario
LETTER OF CONSENT

Consent Form

Project Title: Lean Management Deployment Case Study

Project Location: XXX

Project Researchers: Student Researcher - David Barrett
Principal Investigator - Professor Larry Menor

I have read the letter of information, have had the nature if the study explained to me and I agree to participate. All questions have been answered to my satisfaction.

Name (please print) ____________________________

Signature ________________________________

Date ______________________________

Person Obtaining Consent _______________________

Signature ________________________________

Date ______________________________

Please return your signed consent form to David Barrett.
APPENDIX B: PRETEST ITEM-SORTING INSTRUMENT

APPENDIX B
PRE-TEST ITEM SORTING INSTRUMENT
FOR THE STUDY OF LEAN MANAGEMENT DEPLOYMENT

Instructions: Descriptions of each of the eight lean management dimensions are found on the 'Definitions' worksheet of this workbook. On the 'Item Sorting Instrument' worksheet, measurement items for your evaluation are listed in Column B and a drop-down menu is provided in Column C with the eight dimensions: (LC – Lean Competence, S – Lean Skills, EL – Lean Executive Leadership, SU – Lean Supervision, CU – Lean Culture, CL – Lean Climate, IC – Implementation Capability, EU – Environmental Uncertainty). Please indicate in the grey shaded spaces provided on the 'Item Sorting Instrument' worksheet, the lean management deployment dimension which you feel most closely relates to each measurement item. When you have completed the item sorting exercise, please email the completed document to dbarrett@ivey.ca.

Note: If you would prefer to complete the exercise by hand, please print the 'Item Sorting Instrument', use the abbreviations provided for the dimensions and email a scanned copy to dbarrett@ivey.ca.

Illustrative Example:
A respondent believing that the following item relates to the EL – Lean Executive Leadership dimension would indicate his/her belief as follows:

Our employees trust our Chief Executive Officer

[EL - Lean Executive Leadership]
Definitions

**LC – Lean Competence** - the proficiency of the organization to deploy a systematic, relentless, problem-focused, facts-driven, and team-based panning of waste (and its sources) from operational systems in order to (1) improve throughput-focused work flows and (2) increase the productivity and value-add ratio of all work efforts on an ongoing basis.

**S – Lean Skills** - the project management, problem solving, communication and teamwork abilities that employees could utilize during lean-based initiatives.

**EL – Lean Executive Leadership** - the efforts of the organization’s sensor leadership to explicitly communicate the purpose and objectives of lean-based initiatives, engender commitment from direct reporting personnel, provide oversight, and engage personnel involved in those initiatives in a visible, persistent and authentic manner.

**SU – Lean Supervision** - the efforts of front-line managers to consistently coach, support, motivate, and empower their personnel to work collaboratively and productively on lean-based initiatives.

**CU – Lean Culture** - the collective views and beliefs held within the organization that reflect the norms, values and assumptions that exist with regards to the importance and functioning of lean-based initiatives.

**CL – Lean Climate** - the operational environment that exists in which policies, practices and procedures exist to facilitate the undertaking of collaborative and productive lean-based initiatives.

**IC – Implementation Capability** - the organization’s proficiency in consistently deploying a standard approach when undertaking lean-based work efforts and work flows improvements.

**EU – Environmental Uncertainty** - the degree of dynamism, complexity and malleability in the organization’s operating surroundings.

The term “customer” when used in a measurement item refers to the downstream (external or internal to the organization) user of the product or service produced by the respondent’s department.
<table>
<thead>
<tr>
<th>ITEM DESCRIPTION</th>
<th>DIMENSION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. A high level of importance is placed on developing a proficiency in communication.</td>
<td></td>
</tr>
<tr>
<td>2. Consumer needs and preferences for products and services offered by our organization are changing.</td>
<td></td>
</tr>
<tr>
<td>3. Employees that are involved in the implementing of lean-based initiatives were also involved in the development of the solution.</td>
<td></td>
</tr>
<tr>
<td>4. Our organization forms cross-functional teams to solve problems.</td>
<td></td>
</tr>
<tr>
<td>5. The process variability in our organization has decreased over the past 3 years.</td>
<td></td>
</tr>
<tr>
<td>6. Our organization places its customers’ needs above all others.</td>
<td></td>
</tr>
<tr>
<td>7. Stories are told within the organization about lean-based improvement accomplishments of past employees.</td>
<td></td>
</tr>
<tr>
<td>8. The organization’s goals, objectives and strategies are communicated to me by senior leaders.</td>
<td></td>
</tr>
<tr>
<td>9. Government regulations controlling our industry are unstable.</td>
<td></td>
</tr>
<tr>
<td>10. In our organization we seek perfection through the removal of all waste instead of simply being 'just as good' as established by benchmarking.</td>
<td></td>
</tr>
<tr>
<td>11. All lean-based improvement projects are reviewed regularly during the process against stated objectives.</td>
<td></td>
</tr>
<tr>
<td>12. All lean-based project team members are committed to the same project goals.</td>
<td></td>
</tr>
<tr>
<td>No.</td>
<td>Statement</td>
</tr>
<tr>
<td>-----</td>
<td>---------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>13</td>
<td>Our organization continually seeks to improve all aspects of work flows and work efforts on an ongoing basis.</td>
</tr>
<tr>
<td>14</td>
<td>Our organization is process driven and not expert driven.</td>
</tr>
<tr>
<td>15</td>
<td>Our organization continues to search for additional learning and further improvement after installation of new processes.</td>
</tr>
<tr>
<td>16</td>
<td>Facts drive the development of lean-based improvements in the organization.</td>
</tr>
<tr>
<td>17</td>
<td>The organization’s senior leaders assume responsibility for lean-based performance improvements.</td>
</tr>
<tr>
<td>18</td>
<td>Sayings that embody organizational wisdom about process improvement are often told within the department.</td>
</tr>
<tr>
<td>19</td>
<td>Our senior leaders encourage employee involvement in the lean-based improvement program.</td>
</tr>
<tr>
<td>20</td>
<td>Leadership has put in place a process for obtaining frontline input to develop a portfolio of waste reduction projects.</td>
</tr>
<tr>
<td>21</td>
<td>The organization’s senior leaders are committed to employee lean-based improvement training.</td>
</tr>
<tr>
<td>22</td>
<td>The overall demand levels for our organization’s products and services are unknown.</td>
</tr>
<tr>
<td>23</td>
<td>Frontline employees believe that the organization’s senior leaders accept accountability for our lean-based improvement program’s success.</td>
</tr>
<tr>
<td>24</td>
<td>Frontline employees trust their supervisors and feel safe discussing any work-related issues.</td>
</tr>
<tr>
<td>25</td>
<td>Our organization believes that employee learning is an investment, not an expense.</td>
</tr>
</tbody>
</table>
26 The amount of competition for our organization's customers is constantly changing.

27 The quality of our organization's products and services has been improved over the past 3 years.

28 We have recently discussed what we did right or wrong on a particular lean-based project.

29 Employees are encouraged to quickly try new ideas or models of new ideas and learn through experimentation.

30 Our organization is totally unaware of the potential competitive threats to our business.

31 Front-line employees believe there is a strong commitment to continuous improvement at all levels of this organization.

32 Our organization’s members are continually willing to challenge each other’s thinking about these processes.

33 The diversity and technical intricacy of our product and services is always changing.

34 The organization’s supervisors encourage the employees who work for them to function as a team.

35 We provide ongoing training for our departmental employees on problem solving techniques.

36 The lean-based efforts in the organization are relentless.

37 We provide lean-based improvement training to managers and supervisors throughout the organization on an ongoing basis.

38 The lean-based initiatives in the organization have been effective at enhancing the proportion of value-adding activities of work efforts.

Ivey PhD
David Barrett
Ph.D. Candidate

Pre-Test Item Sorting Instrument

39. Our organization keeps records about how each lean-based improvement project is conducted.

40. Lean-based initiatives in the organization are problem-focused.

41. Our organization diffuses ideas across department lines so as to spread lean-based improvement learning.

42. We have enough lean-based training to do our jobs well on lean-based initiatives within the department.

43. Our organization rewards group sharing and team performance as opposed to individual performance.

44. We use charts to determine whether the implementations of our processes are in control.

45. We provide training in the basic statistical techniques (such as histograms and control charts) on an ongoing basis.

46. Frontline employees respect their direct supervisor(s) in this organization.

47. Our organization’s senior leaders understand the needs of front-line employees and customers.

48. We provide lean-based improvement training to hourly employees throughout the organization on an ongoing basis.

49. The organization’s supervisors frequently hold group meetings where the people who work for them can really discuss things together.

50. The organization’s senior leaders have demonstrated the ability to set and communicate organizational goals for lean-based programs.

51. Employees are not laid-off, right-sized or fired as a result of lean-based initiatives in our organization.

IVY PhD
Pre-Test Item Sorting Instrument

52. Our front-line supervisors are more likely to tell us something face-to-face than to send a memo.

53. We see our organization’s senior leaders at the front line of service delivery on a regular basis.

54. Our organization always uses a similar problem solving structured methodology on lean-based initiatives.

55. Employee teams are encouraged to try and solve their own problems through their own innovations improvements as much as possible.

56. Our direct supervisor(s) empower as opposed to direct us on lean-based activities.

57. Our direct supervisor(s) gives fair evaluations of our work.

58. The amount of instability or turbulence in the industry is high.

59. Quality of participation in lean-based initiatives is a significant part of managerial performance evaluation.

60. Our organization’s existing incentive and reward systems are appropriate for employee involvement and development in lean-based initiatives.

61. The long-run competitive strategy of my organization has been communicated to me by senior leaders.

62. We effectively utilize cross-functional teams as a method to approach lean-based initiatives.

63. Our organization conducts a thorough review of all potential alternatives to solving a problem before selecting a solution to execute.

64. When problems surface, our organization uses root cause analysis to seek process improvement instead of blaming people.
Our organization always solicits opinion leaders to act as a project leader or to champion the cause of lean-based improvement initiatives.

Our department’s care givers function as a team.

A team-based approach is taken to the lean-based efforts in the organization.

The speed of our product and service delivery has increased over the past 3 years.

The lean-based initiatives in the organization have been effective at enhancing productive work flows.

We can do almost anything we want without consulting our direct supervisor(s).

In our organization, frontline workers freely challenge the ideas of more senior employees.

Our organization’s senior leaders create and communicate a vision focused on lean-based improvement.

Our organization’s senior leaders inspire employees to contribute to lean-based initiatives.

Employees in the organization continually analyze their work processes to look for ways of doing a better job.

The organization’s senior leaders visibly demonstrate personal commitment to lean-based improvement on a consistent basis.

During problem solving sessions, the organization makes an effort to get all team members’ opinions and ideas before making a decision.

The organization’s supervisors encourage people who work for them to exchange opinions and ideas.
78 Continuous improvement is stressed in all work processes throughout the organization.

79 Our organization always commits appropriate resources for the execution of lean-based projects.

80 In our organization, members of a lean-based improvement team have their roles and responsibilities specifically identified and documented.

81 Our direct supervisor(s) listens to our problems and concerns.

82 A systematic approach to lean-based efforts in the organization is used.

83 Detailed execution plans are created for each designed lean-based solution.

84 Employees are cross-trained in this department so that they can fill in for others if necessary.

85 When we are on a difficult lean-based assignment, we can usually count on getting assistance from our boss and coworkers.

86 We provide ongoing training on project management tools and techniques to our departmental employees.

87 Our organization’s supervisors are incented and rewarded for lean-based improvement.

88 The organization’s front-line supervisors regularly provide lean-based coaching.

89 The public’s political views and attitudes towards our industry is in flux.

90 The competition for our organization’s supply of skilled resources is unknown.
Ongoing training in conflict resolution is given to managers and supervisors throughout the organization.

Thank You For Taking The Time and Making The Effort To Help With This Critical Stage of My Thesis Work
APPENDIX C: SURVEY INSTRUMENT

Lean Deployment in US Hospital Emergency Departments

Project Title: Lean Management Deployment In US Hospital Emergency Departments

Principal Investigator: Larry Menor, Ivey Business School, Western University (Canada)

Letter of Information

1. Invitation to Participate

You are being invited to participate in a research study to better understand the institutional and individual capabilities that underpin the productive deployment of Lean Management in US Hospital Emergency Departments. As you are a panel member of Qualtrics who is a nurse in an emergency department at a US hospital who has participated in a Lean Management initiative you are qualified to participate.

2. Purpose of the Letter

The purpose of this letter is to provide you with information required for you to make an informed decision regarding participation in this research.

3. Purpose of this Survey

The purpose of the survey is to better understand the institutional and individual capabilities that underpin the productive deployment of Lean Management through the collection of perspectives from informed respondents.

4. Inclusion Criteria

You can participate in the study if you have participated in a Lean Management initiative in an emergency department at a US hospital.

5. Survey Procedures

The online survey will ask you to evaluate aspects of institutional and individual dimensions of the hospital. The online survey will take around 20 minutes to complete. The types of questions will primarily ask for your degree of agreement with statements like:

“Lean-based initiatives in our department focus on the most critical problems”, or

“The organization’s senior leaders assume responsibility for lean-based performance improvements”.

You will be asked to provide the name of your hospital and its location. This information will be used to cross reference with Center for Medicare and Medicaid Services data on hospital performance, but no individual information will be collected.
6. Possible Risks and Harms

There are no known or anticipated risks or discomforts associated with participating in this study. Your identity is not provided to researchers with your responses and thus your identity is anonymous.

7. Possible Benefits

You may not directly benefit from participating in this study. However, information gathered may provide a better theoretical understanding and improve managerial deployment of Lean Management.

8. Compensation

For your participation, you will be paid in accordance with your agreement with Qualtrics. It is estimated at $20-$50 depending on length of survey and qualifying rates.

9. Voluntary Participation

Participation in this study is voluntary. You may refuse to participate, refuse to answer any questions or withdraw from the study at any time. If you withdraw from the study after commencing it, all data collected from your responses will be disposed of by Qualtrics and will not be forwarded to the researchers.

10. Confidentiality

All of the data is collected and analyzed in a completely anonymous form. Any information that could identify you will be removed from your questionnaire, and you will not be asked to include your name or other identifying information on your survey other than the US hospital where you experienced a Lean Management initiative and some basic demographic information. The records will be stored securely in a locked office at Western University for five years. The final research report will only discuss summaries of the responses to the questionnaires. You will not be identified in anyway in the report.

11. Contacts for Further Information

If you have any questions about your rights as a research participant or the conduct of this study, you may contact The Office of Research Ethics. Should you have any questions or concerns regarding this survey, please contact the researchers, Larry Menor or David Barrett.

12. Publication

If the results of the study are published, your name will not be used. If you would like to receive a copy of any potential study results, please contact David Barrett.

13. Consent

Completion of the online survey is indication of your consent to participate in this research study. Information collected from this survey will not be used for purposes other than the study of Lean Management in US hospitals.
Please indicate the extent to which you agree or disagree with the following statements as they pertain to your hospital emergency department’s lean management initiatives.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly Disagree</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Employees are provided with ongoing training on problem solving techniques</td>
<td>☐</td>
<td>☐</td>
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<td>☐</td>
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</tr>
<tr>
<td>We provide training in the basic statistical techniques (such as histograms and control charts) on an ongoing basis</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>We provide ongoing training on project management tools and techniques to employees</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
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</tr>
<tr>
<td>We have enough lean-based training to do our jobs well on lean-based initiatives</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Ongoing training in conflict resolution is given to managers and supervisors</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
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</tr>
<tr>
<td>Employees are cross-trained in this department so that they can fill in for others if necessary</td>
<td>☐</td>
<td>☐</td>
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<td>☐</td>
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<tbody>
<tr>
<td>The organization’s senior leaders have demonstrated the ability to set and communicate organizational goals for lean-based programs</td>
<td>○</td>
<td>○</td>
<td>○</td>
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<tr>
<td>The organization’s senior leaders assume responsibility for lean-based performance improvements</td>
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</tr>
<tr>
<td>The organization’s senior leaders visibly demonstrate personal commitment to lean-based improvement on a consistent basis</td>
<td>○</td>
<td>○</td>
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</tr>
<tr>
<td>Our organization’s senior leaders do not inspire employees to contribute to lean-based initiatives</td>
<td>○</td>
<td>○</td>
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</tr>
<tr>
<td>Our organization’s senior leaders create and communicate a vision focused on lean-based improvement</td>
<td>○</td>
<td>○</td>
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</tr>
<tr>
<td>The organization’s goals, objectives and strategies are communicated to me by senior leaders</td>
<td>○</td>
<td>○</td>
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</tr>
<tr>
<td>The long-run competitive strategy of my organization has been communicated to me by senior leaders</td>
<td>○</td>
<td>○</td>
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</tr>
<tr>
<td>We see our organization’s senior leaders at the front-line of service delivery on a regular basis</td>
<td>○</td>
<td>○</td>
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</tr>
<tr>
<td>The organization’s senior leaders are committed to employee lean-based improvement training</td>
<td>○</td>
<td>○</td>
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<tbody>
<tr>
<td>Our direct supervisor(s) empower as opposed to direct us on lean-based activities</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
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<tr>
<td>Our direct supervisor(s) listens to our problems and concerns</td>
<td>○</td>
<td>○</td>
<td>○</td>
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<tr>
<td>Our direct supervisor(s) gives fair evaluations of our work</td>
<td>○</td>
<td>○</td>
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</tr>
<tr>
<td>The organization’s supervisors encourage people who work for them to exchange opinions and ideas</td>
<td>○</td>
<td>○</td>
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<tr>
<td>The public’s political views and attitudes towards our industry is in flux</td>
<td>○</td>
<td>○</td>
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</tr>
<tr>
<td>The organization’s front-line supervisors regularly provide lean-based coaching</td>
<td>○</td>
<td>○</td>
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<tr>
<td>The organization’s supervisors frequently hold group meetings where the people who work for them can really discuss things together</td>
<td>○</td>
<td>○</td>
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</tr>
<tr>
<td>Our front-line supervisors are more likely to tell us something face-to-face than to send a memo</td>
<td>○</td>
<td>○</td>
<td>○</td>
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<tr>
<td>Front-line supervisors create a safe environment for discussing any work related issues</td>
<td>○</td>
<td>○</td>
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<tbody>
<tr>
<td>Our department rewards group sharing and team performance as opposed to individual performance</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Our department’s incentive systems reward employee involvement and development in lean-based initiatives</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Employees are not laid-off, right-sized or fired as a result of lean-based initiatives in our department</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
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</tr>
<tr>
<td>Continuous improvement is stressed in all work processes throughout our department</td>
<td>○</td>
<td>○</td>
<td>○</td>
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</tr>
<tr>
<td>Our department’s members are willing to challenge each other’s thinking about their processes</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Our department’s supervisors are incented and rewarded for lean-based improvement</td>
<td>○</td>
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<tbody>
<tr>
<td>Our organization believes that employee learning is an investment, not an expense</td>
<td>⬜</td>
<td>⬜</td>
<td>⬜</td>
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</tr>
<tr>
<td>Stories about lean-based improvement accomplishments of past employees are often told within the organization</td>
<td>⬜</td>
<td>⬜</td>
<td>⬜</td>
<td>⬜</td>
<td>⬜</td>
</tr>
<tr>
<td>Front-line employees do not believe there is a strong commitment to continuous improvement at all levels of this organization</td>
<td>⬜</td>
<td>⬜</td>
<td>⬜</td>
<td>⬜</td>
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</tr>
<tr>
<td>Sayings that embody organizational wisdom about process improvement are often told within the organization</td>
<td>⬜</td>
<td>⬜</td>
<td>⬜</td>
<td>⬜</td>
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</tr>
<tr>
<td>Our organization values its customers' needs above all others</td>
<td>⬜</td>
<td>⬜</td>
<td>⬜</td>
<td>⬜</td>
<td>⬜</td>
</tr>
<tr>
<td>Our organizations believes that employee teams should try and solve their own problems through their own improvement efforts</td>
<td>⬜</td>
<td>⬜</td>
<td>⬜</td>
<td>⬜</td>
<td>⬜</td>
</tr>
<tr>
<td>In our organization it is understood that we can do almost anything we want without consulting our direct supervisor(s)</td>
<td>⬜</td>
<td>⬜</td>
<td>⬜</td>
<td>⬜</td>
<td>⬜</td>
</tr>
<tr>
<td>Our organization believes in continuing the search for additional learning and further improvements even after the installation of new process</td>
<td>⬜</td>
<td>⬜</td>
<td>⬜</td>
<td>⬜</td>
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</tr>
<tr>
<td>Our organization is driven by a belief in the processes and not by a belief in the experts</td>
<td>⬜</td>
<td>⬜</td>
<td>⬜</td>
<td>⬜</td>
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<tr>
<td>Detailed execution plans are created for each designed lean-based solution</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Lean-base project teams review all potential alternatives to solving a problem before selecting a solution to execute</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
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</tr>
<tr>
<td>Our organization always uses the same problem solving structured methodology as a consistent framework for lean-based projects</td>
<td>○</td>
<td>○</td>
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</tr>
<tr>
<td>Commitment to project objectives is obtained from every member of a lean-based project team to ensure that goal alignment occurs</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
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</tr>
<tr>
<td>We use charts to determine whether the implementations of the processes of our lean-based initiatives are in control</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
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</tr>
<tr>
<td>Our organization commits appropriate resources for the execution of lean-based projects</td>
<td>○</td>
<td>○</td>
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</thead>
<tbody>
<tr>
<td>The deployment of lean-based initiatives has reduced process variability in our department over the past 3 years</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>The lean-based initiatives in our department have been effective at enhancing the proportion of value-adding activities of work efforts</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
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</tr>
<tr>
<td>The lean-based initiatives in our department have been effective at enhancing the productivity of work flows</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>The deployment of lean-based initiatives has improved the quality of our department’s products and services over the past 3 years</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>The relentless lean-based efforts in our department deliver value for customers (internal and/or external) and the firm</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Lean-based initiatives in our department focus on the most critical problems</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Facts are an influential component in the development of lean-based improvements in our department</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Our department’s diffusion of lean-based learnings to other departments has resulted in accelerated learning within the organization</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
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</tr>
<tr>
<td>The deployment of lean-based initiatives has increased the speed of our department’s product and service delivery over the past 3 years</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
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<tbody>
<tr>
<td>The overall demand levels for our organization’s products and services are unknown</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>The competition for our organization’s supply of skilled resources is unknown</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>The amount of competition for our organization’s customers is constantly changing</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Government regulations controlling our industry are unstable</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>The diversity and technical intricacy of our product and services is always changing</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>The organization’s senior leaders assume responsibility for lean-based performance improvements</td>
<td>○</td>
<td>○</td>
<td>○</td>
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<td>○</td>
</tr>
<tr>
<td>The amount of instability or turbulence in the industry is high</td>
<td>○</td>
<td>○</td>
<td>○</td>
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</tr>
<tr>
<td>Consumer needs and preferences for products and services offered by our organization are changing</td>
<td>○</td>
<td>○</td>
<td>○</td>
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<tr>
<td>Our lean-based initiatives have resulted in greater overall customer satisfaction with our products and services</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>Our lean-based initiatives have resulted in more fulfilling experiences for our customers</td>
<td>•</td>
<td>•</td>
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</tr>
<tr>
<td>Our customers seem happier with our responsiveness to their problems as a result of our lean-based initiatives</td>
<td>•</td>
<td>•</td>
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<td>•</td>
</tr>
<tr>
<td>Our lean-based initiatives have resulted in improved access to our products and services for our customers</td>
<td>•</td>
<td>•</td>
<td>•</td>
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<td>•</td>
</tr>
<tr>
<td>Our lean-based initiatives have resulted in improvements in quality outcomes for our customers</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>Our lean-based initiatives have resulted in lower overall costs for our customers</td>
<td>•</td>
<td>•</td>
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</tr>
<tr>
<td>Employee morale has improved as a result of the lean-based initiatives in the organization</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>Our lean-based initiatives have enhanced the long-run level of profitability of our organization</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>Our lean-based initiatives have enhanced the competitiveness of our organization</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
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Please answer the following questions in regard to your hospital emergency department and your personal professional background and experience.

The emergency department's level of technical sophistication is:

- Well Below Average
- Below Average
- Average
- Above Average
- Well Above Average

Lean-based initiatives have been in place in my department for:

- less than one year
- more than one year but less than two years
- more than two years but less than three years
- more than three years but less than four years
- more than four years

I have been a professional nurse for:

- less than three years
- more than three years but less than six years
- more than six years but less than ten years
- more than ten years but less than fifteen years
- more than fifteen years

I have worked in this organization for:

- less than one year
- more than one year but less than three years
- more than three years but less than six years
- more than six years but less than ten years
- more than ten years

My age is:

- younger than 25
- 25 to 34
- 35 to 44
- 45 to 54
- 55 or older
CURRICULUM VITAE

David Barrett

<table>
<thead>
<tr>
<th>Education</th>
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<tbody>
<tr>
<td><strong>Ph.D. Operations Management Candidate</strong></td>
<td>(expected) 2014</td>
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</tbody>
</table>
| Ivey Business School, Western University  
(formerly the University of Western Ontario)  
Advisor: Larry J. Menor | |
| **Graduate Certificate of Business Valuation** | 2007 |
| Kelley School of Business, University of Indiana | |
| **Master of Business Administration** | 2004 |
| Ivey Business School, Western University | |
| **Bachelor of Commerce (Major in Accounting)** | 2001 |
| Mount Allison University | |
| Supplemental Education | |
| **Inter-university Consortium for Political and Social Research (ICPSR)** at University of Michigan – SEM with Professor Ken Bollen | 2011 |
| **Western Summer School in Longitudinal Data Analysis** | 2011 |
| University of Western Ontario | |
| **Certified Management Accountant (CMA)** | 2004 |
| Canadian Society of Management Accountants (CMA Canada)  
Chartered Professional Accountants of Canada (CPA Canada) | |
| **Canadian Securities Course (CSC)** | 2003 |
| Canadian Securities Institute | |

<table>
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<tr>
<th>Research Interests</th>
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<tbody>
<tr>
<td>Healthcare Lean Management Deployment</td>
<td></td>
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<tr>
<td>Process Improvement in Service Operations</td>
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Recent Academic Scholarships, Acknowledgments, & Awards

**Bill Brock PhD Scholarship**  
*2010 - 2014*
*Ivey Business School, Western University*

**Plan for Excellence Doctoral Fellowship**  
*2010 - 2014*
*Ivey Business School, Western University*

**Pfizer Consumer Group MBA Marketing Scholarship**  
*2003*
*Ivey Business School, Western University*

**Schneiderman MBA Award in Operations Management**  
*2003*
*Ivey Business School, Western University*

**MBA Dean's List**  
*2002 - 2004*
*Ivey Business School, Western University*

**Dean's List**  
*2000 - 2001*
*Mount Allison University*

Publications

**Manuscripts in Process**
*David Barrett & Larry Menor, “Just Do It, Just Fail: The Influence of Preparation and Implementation Capabilities on Lean Management Competence” (conceptual manuscript under review at the Journal of Operations Management)*

**Case Studies**
*Murray Bryant, David Barrett (2014 in progress); “Product and Customer Profitability – Lesson on Strategic Decision Making From the Farm”*

*Allen Morrison, David Barrett (2004), “Bombardier Transportation and the Adtranz Acquisition” (9B04M023), Ivey Publishing*

*Jeffrey Gandz, Allen Morrison, David Barrett (2004), "HSBC – The Bital Acquisition" (9B04N012), Ivey Publishing*

**Conference Posters and Presentations**
*David Barrett, “Lean Value Generation: A Case Study of North American Hospital Capabilities” INFORMS Annual Meeting (October, 2013)*

*David Barrett, “Medicare Medical Tourism: An Economic &Political Perspective - Determining the Levels of Cost Savings and Political Support Necessary to Affect a Change in Procurement Policy of Non-Urgent Procedures”, Academy of Management Annual Meeting (August, 2013)*


Teaching & Instructional Experience
Western University
Lecturer - Operations Management, Ivey School of Business 2015

Lecturer – Managerial Cost Accounting, The DAN Management
And Organizational Studies Program 2014

Lecturer - Operations Management, The DAN Management
And Organizational Studies Program 2014

Co-Coach – Women’s Varsity Hockey Team 2014 - 2015

Graduate Assistant - MBA Accounting and Control for Managers
Professor Vaughan Radcliffe 2012

Graduate Assistant - HBA Performance Measurement
Professor Murray Bryant 2011

Truro Bearcats Junior A Hockey Team, Truro, NS 2001 - 2002
Head Coach

Mount Allison University, Sackville NB 1996 - 1998
Men’s Varsity Hockey Coach

General Manager and Head Coach

Relevant Professional Background
Creative Business Consulting Group, Boston, MA 2009 - 2014
Managing Partner – International Strategic Retail Consultancy

Axia Consulting, Boston, MA 2006 - 2008
Senior Manager – Global Supply Chain Process Improvement

Adventis Consulting, Boston, MA, 2004 - 2006
Consultant – International Telecommunication Strategy

Mount Allison University, Sackville NB 1998 - 2000
Director of Conferences

Academic Service
Reviewer, Academy of Management Conference 2013
Operations Management and Health Care Management Groups
<table>
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<th>Professional Affiliations</th>
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<tr>
<td><em>Decision Sciences Institute</em></td>
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<td><em>INFORMS</em></td>
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<tr>
<td><em>Academy of Management</em></td>
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<td><em>Production and Operations Management Society</em></td>
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<th>Personal Information</th>
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<tbody>
<tr>
<td><em>United States Permanent Resident Card Holder</em></td>
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<tr>
<td><em>Canadian and United Kingdom Dual Citizenship</em></td>
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