The Role of Assessment in a Lean Transformation

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in Partial Fulfillment of the Requirements for the Degrees of

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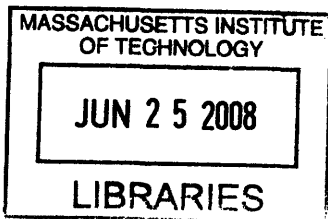& Lean Advancement Initiative

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ABSTRACT

When starting the journey to become a Lean company, companies commonly face the problem of understanding how to manage a Lean transformation. Often times, the first step in managing a Lean transformation is to understand the current state of the organization followed by defining the desired future state of the organization. However, in order to assess the current state, an effective measurement method is necessary. With a good measurement method, a company can not only understand the beginning state, but it can also take periodic measurements to check its progress against its transformation plan.

In this thesis the effectiveness of Dell Business Assessment is analyzed in comparison to other current assessment methods. The Dell Business Assessment is examined in depth, as the thesis describes the development, piloting and recommendations for Dell's assessment tool.

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Thank you,
Ray

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1. Introduction to Continuous Improvement Assessment Methods

In today's business world, continuous improvement initiatives have become mainstream. The advent of quality initiatives brought in from Japan during the 1980's has made businesses significantly more competitive. However, at the same time there are many companies that have tried to establish quality initiatives, but ultimately failed. One of the reasons why this happens is a lack of a way to measure how well a particular initiative is working. A continuous improvement assessment method is an essential tool to get continuous improvement programs to work.

1.1. Continuous Improvement Initiatives Management Methods

There are two commonly used methods to manage continuous improvement methods. The first that is most often used is a direct top-down approach. Often a person at the top of the organization will learn about new quality initiative, and start rolling it out within their organization. This often means that a large percentage of employees are required to learn what this particular initiative is, and have some level they must achieve to meet their yearly performance objective. However, often times the employees at the bottom do not understand the point of the objective, and will take the path of least resistance to meet their performance objective. Similarly, the top down approach can lead to the common problem of "a flavor of the month" where executives roll out too many initiatives simultaneously or back to back, and the employees lose track of what is a priority.

A second commonly found approach is the bottom-up approach. This is seen often in the case of Lean Manufacturing where a plant might be at a point of closing, and are forced to either improve or close. While this may lead to local gains, it can be very difficult to get substantial gains outside the plant where many of the larger scale gains can be had. The top management has often no incentive to actually learn the quality initiative if the people under them take care of it themselves.

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1.2. Necessity for assessment methods

There is an old saying often heard around manufacturing facilities: "You cannot manage what you cannot measure." The idea is that without a solid understanding of how you are performing, it is impossible to improve. Similarly, a quality initiative cannot be properly managed without a measurement tool. There is evidence that successful continuous improvement processes use an effective feedback mechanism (Hallam, 2003). The focus of this thesis is to explore current Lean measurement tools and their role in Lean transformation.

In Chapter 2, current methods of continuous improvement assessment will be discussed from both Industry and Academia. This portion will include the Baldrige National Quality Program, the Lean Enterprise Self-Assessment Tool (LESAT) from MIT, and the Shingo Prize from Utah State. For each of these three methods there will be an overview, some analysis of implementation effectiveness and related implications for management.

Chapter 3 will examine Dell's manufacturing environment in 2007. This overview will include a brief description of Dell's competitive situation, and Dell's culture. These factors are important to understand the setting surrounding Dell's Lean transformation, and the development of Dell's lean assessment tool in the context of Dell's specific needs and constraints.

Chapter 4 will explain how the Dell Business Assessment works. This section will include an overview of how the tool is structured, and how it works, how the process is run, and how to understand the assessment results.

Chapter 5 will explain the pilot results and purposed future improvements within Dell. This section will also look at the correlation between the pilot results with what is both observed and measured in traditional metrics. This section concludes with recommendations for Dell to manage their assessment program in the future.

Finally there will be a conclusion section to summarize findings covered in the rest of the thesis. This section will discuss transferring this knowledge to companies and industries outside of Dell.

2. Common approaches and usages of Assessment in Continuous Improvement

The need for an assessment tool is a well known problem that has spawned many solutions from industry and from academia. This section examines some of these existing solutions their efficacies and implications for management teams.

2.1. Existing Assessment Methods

Currently there are many existing assessment methods to learn from. This section will examine three that are widely used in industry, the Baldrige National Quality Program, the LESAT (MIT) and the Shingo Prize (Utah State). For all three methods, there will be an overview, and a discussion of benefits and drawbacks.

2.1.1. Baldrige National Quality Program

2.1.1.1. Overview on the Baldrige National Quality Program

The Baldrige National Quality Award is largely considered the National Quality Prize of the United States, similar to the Deming Prize in Japan. The Baldrige Award is given by the President of the United States to organizations that apply and are judged to be outstanding in seven areas: leadership; strategic planning; customer and market focus; measurement, analysis, and knowledge management; human resource focus; process management; and results. These businesses range from manufacturing and service, small and large, and to education, health care and nonprofit. (NIST 2007)

When Congress established the award in 1987, many industry and government leaders saw that a renewed emphasis on quality was no longer an option for American companies but a necessity for doing business in an ever expanding, and more demanding, competitive world market. The Baldrige Award was envisioned to raise awareness about the importance of quality and performance excellence as a competitive edge and as a standard of excellence that would help

U.S. organizations achieve world-class quality. The award is not given for specific products or services. Three awards may be given annually in each of these categories: manufacturing, service, small business, education, health care and nonprofit. (NIST 2007)

The Award is named for Malcolm Baldrige, who served as Secretary of Commerce from 1981 until his tragic death in a rodeo accident in 1987. Baldrige was a proponent of quality management as a key to this country's prosperity and long-term strength. He took a personal interest in the quality improvement act that was eventually named after him and helped draft one of the early versions. In recognition of his contributions, Congress named the award in his honor. (NIST 2007) Principal support for the program comes from the Foundation for the Malcolm Baldrige National Quality Award, established in 1988. (NIST 2001)

2.1.1.2. How the Baldrige Program Works

Award Mechanics

Every year, thousands of organizations headquartered in the United States apply for the award In one of the six award categories – manufacturing businesses, service businesses, small businesses, education organizations, health care organizations or nonprofit organizations. After an organization submits an Eligibility Certification Package the Award Application Package is submitted. (NIST, 2007)

Once an application is submitted, there are up to three rounds of review. The first is the Independent and Consensus Review. During this round, and there is an independent review and evaluation by at least six members of the board, followed by a joint review by a team of Examiners, led by a Senior Examiner. The second round consists of a Site Visit Review. Applicants that score well in the Independent and Consensus Review receive a site visit. Finally, a group of judges' review and make recommendations to the Director of NIST. (NIST, 2007)

The Examiners

The board of examiners includes more than 300 experts from industry, educational institutions, governments at all levels, and non-profit organizations. In addition to spending many hours reviewing applications for the award and conducting site visits, these volunteers also provide

each applicant with an extensive feedback report citing strengths and opportunities to improve. The Panel of Judges, part of the Board of Examiners, makes Award recommendations to the Director of NIST. The board consists of leading experts from U.S. businesses and education, health care, and nonprofit organizations. NIST selects members through a competitive application process. For 2008, the board consists of about 570 members. Of these, 12 (who are appointed by the Secretary of Commerce) serve as Judges, and approximately 100 serve as Senior Examiners. The remainders serve as Examiners. (NIST, 2007)

Selection Criteria and Process

The criteria for the Baldrige Award have played a major role in achieving the goals established by Congress. The criteria are designed to help organizations enhance their competitiveness by focusing on two goals: delivering ever improving value to customers and improving overall organizational performance.

The Baldrige Award examiners use seven main award criteria to judge applications. The seven criteria are:

1. Leadership—Examines how senior executives guide the organization and how the organization addresses its responsibilities to the public and practices good citizenship.
2. Strategic planning—Examines how the organization sets strategic directions and how it determines key action plans.
3. Customer and market focus—Examines how the organization determines requirements and expectations of customers and markets; builds relationships with customers; and acquires, satisfies, and retains customers.
4. Measurement, analysis, and knowledge management—Examines the management, effective use, analysis, and improvement of data and information to support key organization processes and the organization's performance management system.
5. Workforce focus—Examines how the organization enables its workforce to develop its full potential and how the workforce is aligned with the organization's objectives.
6. Process management—Examines aspects of how key production/delivery and support processes are designed, managed, and improved.

7. Results—Examines the organization's performance and improvement in its key business areas: customer satisfaction, financial and marketplace performance, human resources, supplier and partner performance, operational performance, and governance and social responsibility. The category also examines how the organization performs relative to competitors.

Examiners look for achievements and improvements in all seven categories. Organizations that pass an initial screening are visited by teams of examiners to verify information in the application and to clarify questions that come up during the review. Each applicant receives a written summary of strengths and areas for improvement in each area addressed by the criteria.

2.1.1.3. Results of the Baldrige Program

There have been many academic studies done over the past twenty years examining the effectiveness of the Baldrige criteria such as Evans & Jack (2003), Flynn (2001), Wisner,(1994) and Dow (1999). Most of these studies have focused on validated Baldrige's seven main criteria. However the overall effect of the program on companies have had mixed results for both entrants and winners. Financial results have been mixed, but the results have tended to depend on the maturity of a company's quality program and their competitive position. Companies who have gained the most out of the Baldrige program tended to do better if they have more mature quality programs and have a better competitive position. Those companies that tended to not get anything out of the program tended to have difficulty fully understanding the Baldrige thought process, or do not have a good competitive position.

Financial Results

The best way to start to look at the results of the Baldrige program is to look at economic results. The most common method that has been used is to compare a hypothetical portfolio made up of MBNQA winning companies ("Baldrige Index") with the S&P 500 stock index. NIST in the past has issued an annual study which began in 1995 and ended in 2004. Prior to 2002, the MBNQA companies have always outperformed the S&P 500 by a ratio of at least 2.4 to 1. However, from 2002 through 2004, the Baldrige Index fell sharply, and by the time the study concluded, the S&P 500 had increased a total of 36%, while the Baldrige Index had decreased a

total of 18%. The Baldrige Program discontinued the study because it felt that the study no longer accurately reflects the results, accomplishments, and diversity of the Baldrige Award recipients and site-visited organizations. Moreover, as there had been an increase in nonprofit or privately owned businesses with the addition of the health care and education eligibility categories only 4 of the 23 Baldrige Award recipients in the last 5 years (2000-2004) were publicly traded, U.S.-owned organizations and could be included in the stock study. (NIST 2005)

Despite these mixed results, Dean and Tomovic (2004) discount this method due to the circular nature of these results. Companies that score well on the Baldrige criteria, by definition, are already doing well on quality management and business results. The cause and effect are confused under the assertion that quality management led to the outstanding results. (Dean 2004)

Quality Program Maturity

The research done by Wilson et al (2003) tells us that award winning companies began their quality programs on average of nearly seven years prior to winning the MBNQA. The time ranges from a minimum of three years to a maximum of 15 years, with a mean of 6.8 years and a median of six years. This amount of time extends far beyond the many managers' time horizons. Companies that succeed need to have patience and commitment throughout the organization to get a quality program to award level. If a company does not reach a certain level of maturity first, it can be very demoralizing (Babicz, 2002).

As Wiggins (1995) describes, quality practices can fail when taken from prepackaged approaches, some quality tactics may be inappropriate for individual organizations. Tailoring quality tactics to the specific needs and goals of one's company may be the hardest job of all. It requires the intelligence, knowledge, and judgment a prepackaged kit does not demand.

Selecting quality tactics appropriate to a company's current level of performance maturity is essential. Those companies attempting to use tactics better suited to another level are wasting money, frustrating both managers and employees, and slowing their own pace. There is no single formula which could work for all levels. (Wiggins, 1995)

Lower performers, just beginning to strive for quality, don't have the knowledge to apply practices seen in their observations of leaders. They should begin with a limited number of highly focused goals. Employee teams within departments can help them discover small problems they can solve, with initial success leading to greater accomplishments later. Many kinds of training are desirable for this level. (Wiggins, 1995)

Medium performers should direct their energies toward activities like simplifying design processes. Their employee training should emphasize problem solving. At this level of performance, companies should select their suppliers carefully. Higher-performing companies can use benchmarking successfully, because they have the sophistication to apply lessons learned in this manner. (Wiggins, 1995)

Thus, leadership is important during all implementation phases of quality programs from the initial implementation to the later stages of implementation. The results of Lee's (2003) research suggest that quality practices require better links between upper management leadership and quality systems, as well between quality information and quality systems. Organizational success depends not only on adopting primary quality programs (strategic planning, customer and market focus), but also on supportive quality programs (human resource and process management). Ultimately, enhanced competitiveness results from better links between leadership and quality systems, and between quality information and quality systems throughout the organization. (Lee, 2003)

Competitive Position

For some organizations, improving quality may offer very little improvement on the bottom line. In a situation where a company is in a poor competitive situation, or are perhaps the last company in the industry to adopt a quality program, it will more likely slow down a decline, rather than turn one around. Incremental improvements from quality programs may be inadequate when more severe changes are needed. (Wiggins, 1995)

2.1.1.4. Additional Benefits and Drawbacks of Baldrige

Despite the mixed financial results by some companies, there are some definite benefits to using the Baldrige Quality program. First of all, it forces a quality program within a company. Second, the process provides excellent feedback on strengths and improvement opportunities for a company.

Quality Program

Once a company decides to go after the Baldrige criteria, it must either start or focus its quality program. As previously stated, from Wilson (2003), award winning companies began their quality programs a mean of nearly seven years prior to winning the MBNQA. Regardless if the company wins a Baldrige award, using the criteria to start or focus a quality program will likely provide positive results.

Garvin's (1991) research finds that once quality programs start, companies start to shift from politely listening to speeches about quality to absorbing them. In his example, Xerox talks to over 100,000 people a year, many of the customers and suppliers. All come seeking information and advice about quality. "We absolutely don't believe this would have happened without the Baldrige Award," said one Baldrige examiner. (Garvin, 1991)

Additionally, the award created a common vocabulary and philosophy bridging companies and industries. Managers view learning across the boundary lines of business as both possible and desirable. The abhorrence for anything "not invented here," once a source of corporate uniqueness and pride is being replaced by an unabashed zeal for borrowing ideas and practices from others. (Garvin, 1991)

Good Feedback

"The application and review process for the Baldrige Award is the best, most cost-effective and comprehensive business health audit you can get," says Arnold Weimerskirch, former chair of the Baldrige Award panel of judges and vice president of quality, Honeywell, Inc. (NIST 2007)

The Feedback Report given by Baldrige judges can provide deep insight on strengths and improvement opportunities for the company. Each report has at least 300 hrs of review by a minimum of 8 business and quality experts. Site visits get more than 1000 hrs of in depth review by judges. Baldrige Judge and vice president of corporate quality at Brooks-PRI Automation Inc. Kay Kendall estimates 70% of information in the feedback report the company already knew. However, the other 30% identifies best practices and vulnerabilities that the company would not have seen otherwise. This is a great deal of information that only an outsider would have spotted. Due to this great deal of feedback, Kendall suggests early stage companies should not apply as the results can be overwhelming. Rather, they should start with the NIST "Getting Started" booklet. (Babicz, 2002)

Potential Drawback

Despite these benefits, before getting too involved with the Baldrige program, the costs are worth noting. For every company that starts a quality program, and decides to apply for the prize, it can take significant time and money. "Both Xerox, a 1989 winner and Corning, a 1989 finalist, admit to having spent, respectively $800,000 and 14,000 labor hours preparing applications and readying employees for site visits by Baldrige examiners."(Garvin, 1991) While this amount will vary in small or large companies, it will not vary as much as the gains. For small companies, winning the prize can cost as much as the benefits. For large companies, this can be small relative to the large gains they get out of it.

Even after winning the Award, companies can be overwhelmed by the resource drain. After being the first to win the small business award in 1988, Globe Metallurgical's Kenneth Leach gave 134 speeches the following year. Motorola, also a 1988 winner, devoted two employees to handling its "Baldrige Desk." (Wiggins, 1995) For a small company, these additional resources can make an enormous difference.

2.1.2. Lean Enterprise Self-Assessment Tool (MIT)

The Lean Enterprise Self Assessment Tool (LESAT) is a tool for self-assessing an enterprise's present state of leanness and its readiness to change. The LESAT was developed by the Lean Advancement Initiative (LAI) at the Massachusetts Institute of Technology (MIT). (LAI - LESAT)

2.1.2.1. Overview of LESAT at MIT

History

As Hallam (2003), recounts, the beginnings of the LESAT tool started in early 2000, when the Executive Board of LAI at MIT chartered a team of representatives from academia, government, and industry to develop a Lean Enterprise Self-Assessment Tool (LESAT). The tool was intended to assess the leanness of the enterprise as well as its readiness for change. LESAT was designed to work LAI's Lean Enterprise Model (LEM) and Transition to Lean (TTL) guide. The LESAT was intended to complete the tool triad by providing a means to measure the state of leanness of the enterprise as a means for informing the transformation process, as depicted in Figure 1: LAI Enterprise Tool Triad .
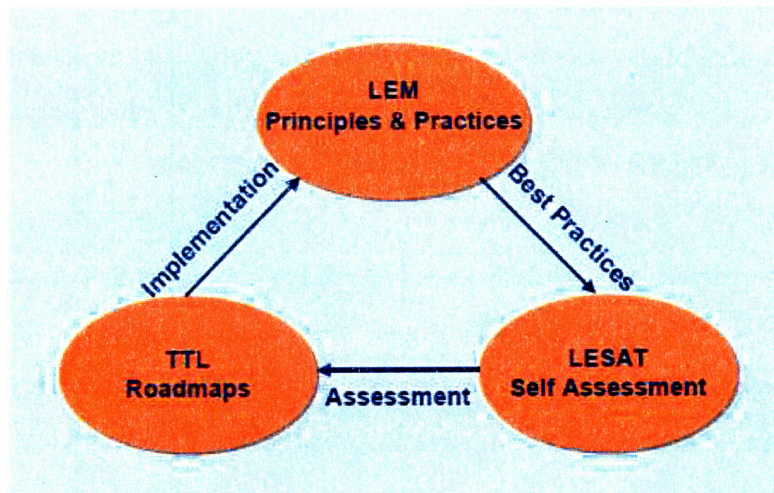
Figure 1: LAI Enterprise Tool Triad (Nightingale, 2001)

2.1.2.2. How LESAT Works

The Lean Enterprise Self-Assessment Tool (LESAT) was developed to help the enterprise leadership team determine the extent to which lean principles, practices, and behavior have become a part of their organization. The LESAT is not intended as a means for comparing companies in an industry, but rather to analyze the current state "As-Is" level of "leanness" of their enterprise and see at "To-Be" Vision of the future state that can potentially be achieved (Nightingale, 2001).

The LESAT is composed of 54 practices grouped into three sections (LESAT, 2001):
• Section I - *Lean Transformation and Leadership* - the processes and leadership attributes nurturing the transformation to lean principles and practices (28 practices)
• Section II - *Life-Cycle Processes* - the processes responsible for the product from conception through post delivery support (18 practices)
• Section III - *Enabling Infrastructure* - the processes that provide and manage the resources enabling enterprise operations (8 practices)

The *Lean Transformation and Leadership* section of the LESAT contains those Lean practices pertinent to the Lean transformation process, with emphasis on enterprise leadership and change management. The goal of this section is to develop and deploy lean implementation plans throughout the enterprise leading to (1) long-term sustainability, (2) acquiring competitive advantage and (3) satisfaction of stakeholders (LESAT, 2001).

As Hallam (2003) explains, this section focuses on the lean practices that are developed and maintained by upper-level leadership in the organization to guide enterprise activities. This includes having a clear definition of customer value, establishing the necessary support and incentives to create a lean transformation environment, and includes formal processes for defining, adjusting, improving, and measuring change activities within the organization to support lean operations.

Within Section I, there are 7 subsections and 28 Lean practices:
- I.A Enterprise Strategic Planning (3 Lean practices)
- I.B Adopt Lean Paradigm (4 Lean practices)

- I.C Focus on the Value Stream (4 Lean practices)
- I.D Develop Lean Structure and Behavior (7 Lean practices)
- I.E Create and Refine Transformation Plan (3 Lean practices)
- I.F Implement Lean Initiatives (2 Lean practices)
- I.G Focus on Continuous Improvement (5 Lean practices)

The *Lean Lifecycle Process* section of the LESAT contains those Lean practices pertinent to the "life cycle processes" of an enterprise, i.e., those processes involved in product realization. The goal of this section is to examine Lean practices across life-cycle processes for defining customer requirements, designing products and processes, managing supply chains, producing the product, distributing product and services and providing post delivery support (LESAT, 2001).

As Hallam (2003) explains, execution of *Lifecycle* Processes will form the link in the supply chain between upstream input suppliers and downstream customer demand, with some transformation function adding value between the two. This requires *Enabling Infrastructure* Processes (LESAT Section III) to be architected with an understanding of their contribution to reducing waste and increasing value delivery within the Lifecycle Processes.

Within Section II, there are 6 subsections with 18 Lean practices:
- II.A Business Acquisition and Program Management (4 Lean practices)
- II.B Requirements Definition (2 Lean practices)
- II.C Develop Product and Process (3 Lean practices)
- II.D Manage Supply Chain (3 Lean practices)
- II.E Produce Product (2 Lean practices)
- II.F Distribute and Service Product (4 Lean practices)

The *Enabling Infrastructure* section of the LESAT contains those Lean practices pertinent to the infrastructure support units. The goal of this section is to assess the enterprise infrastructure necessary to support the implementation of Lean principles, practices and behavior.

Hallam (2003) views this execution of this section as supporting the execution of the first two sections. Enabling Infrastructure Processes have two critical purposes. First, they must support the execution of all other processes (Leadership and Life Cycle Processes) and second, they must provide services to internal customers in the organization.

Within Section III, there are 2 subsections with 8 Lean practices:
- III.A Lean Organizational Enablers (5 Lean Practices)
- III.B Lean Process Enablers (3 Lean Practices)

Hallam (2003) presents how these three sections work together to develop a Lean enterprise. The processes in Section I set the organizational culture and structure to allow those in Sections II & III to mature, while those in Section III are also necessary to support those in Section II. These proposed process relationships, as depicted in Figure 2.
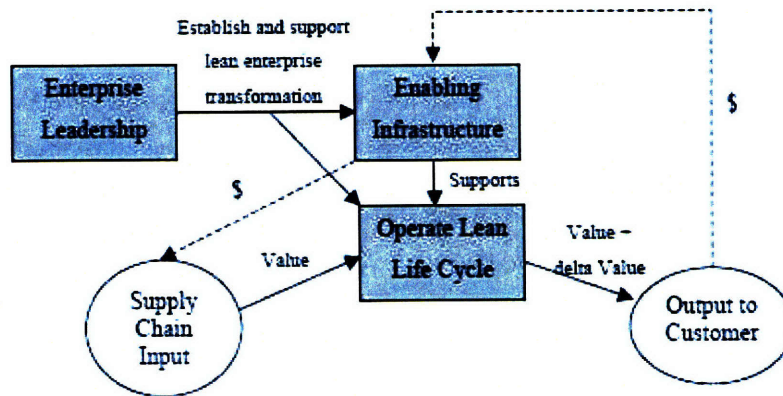
Figure 2: Representation of interdependency of LESAT processes (Hallam 2003)

2.1.2.3. Findings from LESAT

From Hallam's (2003) research, there are three important findings. First, Hallam was able to find strong evidence to support his three main hypotheses. First, enterprises that exhibit a high lean maturity in *Leadership/Transformation* processes will exhibit a greater value of lean *Lifecycle Process* maturity. Second, enterprises that exhibit a high lean maturity in *Leadership/Transformation* processes will exhibit a greater value of lean *Enabling Infrastructure* process maturity. And third, enterprises that exhibit a high lean maturity in *Enabling Infrastructure* processes will exhibit a greater value of lean *Lifecycle Process* maturity. Thus, for enterprise change efforts, there must be mature leadership/transformation processes in order to improve the maturity of lifecycle processes and enabling infrastructure. Maturity in these

processes will lead to improved P&L results and better enterprise stakeholder value delivery. These relationships are displayed in Figure 3.
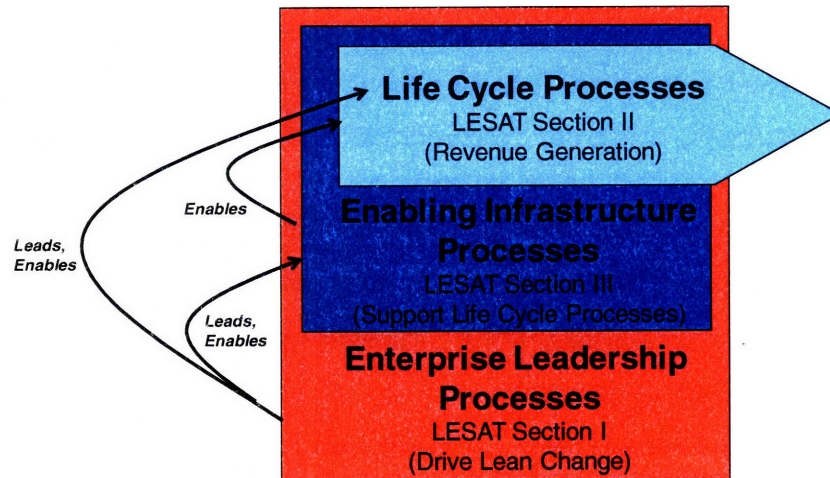
Figure 3: Relationships in enterprise process lean maturity (Hallam, 2003)

A second finding of Hallam reinforces the need for a strong leadership commitment when pursuing a Lean enterprise as an operational strategy. His research indicates that leadership commitment is an essential prerequisite for establishing a lean change environment, which in turn enables detailed lean change activities to occur in practice.

Despite evidence that local lean efforts can improve local performance metrics, Hallam finds no evidence that lean enterprise transformation can occur without leadership support, as the change efforts need to cross functional, process, and corporate management boundaries. From his aerospace industry studies, many local lean changes are "islands of success" as they have minimal impact on overall program costs and schedules. These "islands of success" highlight the fact that a major limiting factor in expanding local lean improvement efforts is the need to go beyond the authority of the local leader.

Hallam has a third finding that demonstrates that a formal management information feedback loop with lean enterprise change activities is necessary for achieving lean enterprise transformation. Furthermore, the structure of this feedback loop may lead to a faster lean enterprise transformation. Hallam has evidence that the highest lean maturity enterprises have

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established formal feedback mechanisms that allow the enterprise to strategically build on existing lean capabilities and prioritize lean improvement activities for the strategic needs of the enterprise.

Hallam categorizes the 30 enterprises from his research based on three observed categories of information feedback loops. These three categories are:

A. *Open Loop Assessment* – These companies invest the time and effort to perform the LESAT but do not utilize the results to influence any sort of improvement action.

B. *Independent Closed-Loop Control* – These enterprises have a desire and the effort to utilize their assessment results to become a leaner enterprise, but did not tie their LESAT-centric improvement plans with other enterprise improvement plans.

C. *Integrated Closed-Loop Control* – These enterprises successfully couple LESAT assessment results with other enterprise strategic issues to develop an integrated and coherent continuous improvement plan.

As shown in Figure 4, those enterprises in Category C, tend to have higher maturity in their *Leadership/Transformational* processes and in their *Lifecycle* processes than those in Category B. Similarly, enterprises in Category B typically show higher maturity than those of Category A.
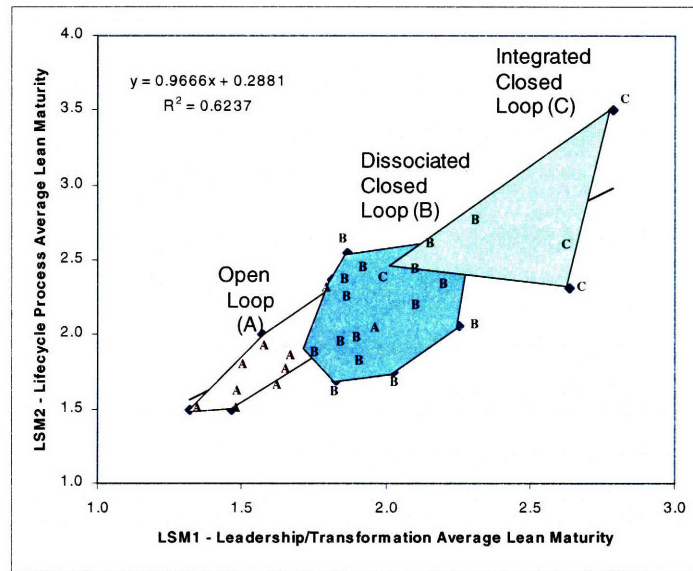
Figure 4: Effectiveness of Feedback Loops (Hallam, 2003)

While this research was found while studying the LESAT, it makes sense that the same will happen with other Lean assessment tools. Using an integrated feedback loop with a Lean assessment tool will help focus improvement actions to best meet strategic needs and thus should help speed up the Leadership and Lifecycle maturity.

2.1.2.4. Benefits and Drawbacks of LESAT

Benefits of LESAT Assessment

From Hallam's research, there are some important benefits of the LESAT that can be extracted. Professor Nightingale (2006) has recounted these benefits:

Assessment process is valuable

From the Hallam's interviews with the participants in the LESAT Beta test, the majority of participants felt that the assessment process itself was as valuable as the results. In many cases, the discussions resulting from the assessment analysis proved more valuable than the exact scores. Thus, going through the assessment process is a valuable method of learning about the current state of affairs and about Lean.

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Increased executive communication

The introduction and report-out sessions were found to increase the amount of lean enterprise communication amongst executives, as they covered many of the cross-functional issues within their enterprises.

Creation of common vocabulary

The assessment participants felt they began to establish a common vocabulary for discussing issues related to creating a lean enterprise, which resulted in fewer interpretation problems as participants discussed post-assessment actions.

Identify and support those who need education

Some executives pursued individual education to become more versed in the tenets of lean as a result of the use of the LESAT.

Clear picture of maturity of enterprise / Open identification of enterprise-level issues

Participants reported that the results of the LESAT assessment provided a clear picture of how their enterprise was performing relative to lean principles and practices.

Next level of maturity obvious

The participants also reported that the tool was able to provide an obvious improvement path as the next levels of maturity were well defined for each of the practices.

LESAT can elevate lean to enterprise level

One additional benefit is the ability of LESAT to help organizations start examine how lean their enterprise is. LESAT will provide a more holistic understanding of the role of leadership processes, life cycle processes, and enabling processes in delivering value. The insights from an enterprise assessment provide opportunities for strategic lean actions. Hallam also found evidence that the multi-stakeholder focus of the lean enterprise, versus a pure customer focus, is a source of improved enterprise value delivery. Without a total enterprise view, many organizations will "plateau". Thus, LESAT is a catalyst to elevate lean to the enterprise level.

Drawbacks to LESAT

Hallam also identified three potential drawbacks to LESAT.

First, while several of the participating companies found that Section I of the LESAT was valuable for understanding the maturity of lean transformation efforts in specific support functions, much of Section 2 and 3 were found not to be applicable as they did not consider their function as delivering a physical product to a customer.

Second, since LESAT is aimed at executive management, there are concerns and difficulties with getting the group together, and having them spend the 4-6 hours necessary to complete the assessment. Logistically, it can be a problem of coordinating multiple schedules from across the enterprise. Additionally, not all executives found the time spent was worthwhile.

Third, since LESAT is a high level assessment, many found that they needed help with the details of implementation. While an improvement path is apparent with the LESAT, the question of "How" to achieve the next level of maturity is not. In some enterprises the question of "Where" to start the improvement efforts also arose.

Additionally, as Lean enterprise in Aerospace is still in its infancy, there is currently no evidence of how LESAT will affect organizational performance. Hallam concludes that LESAT is an important part of the Lean enterprise transformation, and that a Lean enterprise will have increased operational performance. However, it still remains to be seen what amount of resources are necessary to accomplish this Lean enterprise transformation and if this transformation can turn into sustainable financial results.

2.1.3. The Shingo Prize (Utah State)

2.1.3.1. Overview on the Shingo Prize

The Shingo Prize is a widely used manufacturing award program in North America. The vision of the Shingo Prize is to be the "Nobel prize" in business, grounded in lean enterprise management leading to world-class and globally competitive business. The Shingo Prize's

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mission is to build Operational Excellence in organizations through the promotion of "True North" principles of Lean, Lean systems of management and the wise application of Lean tools and techniques across the entire organizational enterprise (The Shingo Prize for Operational Excellence).

The Prize was established in 1988 to promote awareness of Lean manufacturing concepts and recognize companies in the United States, Canada, and Mexico that achieve world-class manufacturing status. The Shingo Prize philosophy is that world-class business performance may be achieved through focused improvements in core manufacturing and business processes. (The Shingo Prize for Operational Excellence). In addition to a national Shingo Prize, there are also statewide and regional Shingo Prizes run by individual state or regional Shingo organizations.

The Shingo Prize awards organizations and research with three types of prizes: The Business Prize, The Research Prize and The Public Sector Prize. The Business Prize promotes use of world-class manufacturing strategies and practices to achieve world-class results. The Research Prize promotes research and writing regarding new knowledge and understanding of manufacturing processes, and the Public Sector Prize promotes use of world-class manufacturing strategies and practices to achieve world-class results in the public sector/government owned facilities (The Shingo Prize for Operational Excellence).

The Shingo Prize is directed by the Board of Governors who is made up of leading representatives of businesses, professional organizations, and academic institutions. A dedicated management team oversees day-to-day operations while promotional support is provided by non-profit sponsors. Individuals who have distinguished themselves in the area of operational excellence are able to serve as promotional ambassadors through the Shingo Prize Academy.

The Prize is named for Japanese industrial engineer Shigeo Shingo who distinguished himself as one of the world's leading experts in improving manufacturing processes. Dr. Shingo has been described as an "engineering genius" who helped create and write about many aspects of the revolutionary manufacturing practices which comprise the renowned Toyota Production System (The Shingo Prize for Operational Excellence).

In 1988, Utah State University recognized Dr. Shingo for his lifetime accomplishments with an Honorary Doctorate in Business. The Shingo Prize Model was developed as a world-class manufacturing model that incorporates many of Dr. Shingo's practices as well as exemplary practices from other sources. (The Shingo Prize for Operational Excellence)

2.1.3.2. How the Shingo Prize Works

Author's note: The Shingo Prize significantly changed its model in February 2008. Since all research on the Shingo model and much of this thesis is based on the pre-2008 Shingo model, the earlier version will be primarily discussed in this thesis. However, section 2.1.3.5 includes a brief description of the changes to 2008.

The Shingo Model

The Shingo Prize Model includes 11 key elements of world-class manufacturing. These elements are grouped into five categories, signifying that it is necessary to integrate them into a complete system to achieve world-class results. Figure 5 shows how these five areas work with one another. The Shingo Prize criteria do not prescribe specific methods, techniques, practices, or processes. Rather, for each element the criteria lists practices and techniques that might be incorporated to achieve world-class level quality, cost, delivery, and business results. (The Shingo Prize 2007)

Enablers

I. Leadership Culture and Infrastructure

A. Leadership
75 pts

B. Empowerment
75 pts

Core Operations

II. Manufacturing Strategies and System Integration

A. Manufacturing Vision and Strategy 50 pts

B. Innovations in Market Service and Product 50 pts

C. Partnering with Suppliers / Customers & Environmental Practices 100 pts

D. World-Class Manufacturing Operations and Processes 250 pts

III. Non-Manufacturing Support Functions 100 pts

Results

IV. Quality, Cost and Delivery

A. Quality and Quality Improvement
75 pts

B. Cost and Productivity Improvement 75 pts

C. Delivery and Service Improvement 75 pts

▼ **Feedback** ▲   ▼ **Feedback** ▲   ▼ **Feedback** ▲

V. Customer Satisfaction and Profitability 75 pts

♦ Customer Satisfaction
♦ Profitability

Total Points: 1000

Business Results

Figure 5: Shingo Prize Model (The Shingo Prize, 2007)

Selection Process

Application process is as follows. First, the company must file the Intent to Apply Form, which includes organizational information to determine eligibility. Second, a profile sheet is submitted, outlining the organization in two-pages. Third, the achievement report is submitted as a written documentation of the company's efforts and achievements in manufacturing excellence conforming to the Shingo criteria.

The examination process has four steps. After achievement Reports are submitted, they are distributed for review by members of the Board of Examiners. High-scoring applicants will then receive site visit examinations. Based on the application review and site visit examination results, the Board of Examiners will recommend Finalists and Recipients to the Shingo Prize Board of Governors. Finally, the Board of Governors reviews the recommendations and may amend or ratify the recommendations. Generally, Finalists score within a range of ten-percent of the score and recommendations for Recipient status. There is not a limit in the number of Finalists or Recipients that may be so designated. (The Shingo Prize 2007)

After each application is reviewed each applicant is given feedback within the scope of the Achievement Report, on possible improvements and suggestions for deployment.

Selection Criteria

The Shingo Prize achievement criteria provide a framework for identifying and evaluating world-class manufacturing and business related competence and performance. The criteria comprise a systems model for manufacturing excellence. Shingo Prize applicants must prepare an Achievement Report that details key activities and results for each section of the Achievement Criteria based on relevant facts and data spanning a period of three years or longer.

The Shingo Prize Examiners review business applications based on two evaluation dimensions: (1) Strategy & Deployment and (2) Results. Each of the Achievement Criteria's subsections require applicants to furnish information relating to one or both of these dimensions. Sections I through III refer primarily to information on Strategy & Deployment. Sections IV and V refer primarily to overall organizational results. However, it is fully appropriate to include "intermediate" results (number of leadership initiatives, number of teams, team participation rates, number of suggestions per year, cycle time reduction in a specific process, etc.) in sections I through III. Outlined below is a description of each section (The Shingo Prize, 2007):

Section I: Leadership Culture & Infrastructure (15%) –

Implementing world-class strategies and practices requires an aligned management infrastructure and organizational culture. This section examines the management systems and organizational culture, the inputs or enablers in a systems model that are necessary to deploy world-class practices and achieve world-class performance.

Section II: Manufacturing Strategies & System Integration (35%) –

This section focuses on the core manufacturing strategy, practices, and organizational techniques deployed to achieve world-class results. It should provide information about the value chain practices and techniques the company uses to achieve world-class results.

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Section III: Non-manufacturing Support Functions (10%) –

This section is designed to evaluate (1) the degree of integration between manufacturing and all non- manufacturing functional units; and (2) the extent to which improvement techniques and strategies have been applied in non-manufacturing functions up and down the value stream.

Section IV: Quality, Cost & Delivery (22.5%) –

This section is designed to evaluate the outputs of the core business systems or the performance of the world-class/lean practices described in sections 2 and 3 of the criteria.

Section V: Business Results (7.5%) –

This section is intended to evaluate the outcomes of quality, cost, and delivery on customer satisfaction and business results. For each measurement presented, three or more years of results should be documented. The overall aim of this section is to document customer satisfaction and to demonstrate the positive financial results derived from a lean transformation.

2.1.3.3. Results of the Shingo Prize

The results from the Shingo Prize are mixed. While many Shingo winners have made dramatic improvements to manufacturing sites, these local gains have not always turned into global gains for the larger enterprise. Also, there has been very little information on how sustainable these local gains have been.

To demonstrate the some of the positive effects Shingo has had on a local level, three Shingo winning sites from three different companies are presented below.

The Boeing Company started implementing Lean in the late 1990's when they realized their performance was declining. The company created the Boeing Production System based on Lean manufacturing techniques. After many years of using this, they have yielded some impressive results. The first site that will be examined is Boeing's Mesa Arizona manufacturing facility where Apache Helicopters are made. This site is a recipient of the Shingo Business Prize in March 2005. (Waurzyniak 2007) Below is a list of the extraordinary accomplishments the site made from 1999 to the time of the assessment in 2005:

- Apache helicopter on-time delivery of 100% for the past five years since 1999.
- Apache helicopter final assembly, integration and test hours per aircraft reduced 85% over the past five years since 1999.
- Overall Apache helicopter production hours per aircraft reduced more than 48% over the past five years since 1999.
- Manufacturing cycle time reduced more than 40% over the past six years since 1998.
- The number of internal defects reduced more than 58% over the past four years since 2000.
- The cost of internal defects (rework, repair, and scrap) reduced more than 61% over the past four years since 2000.
- The lost workday case rate reduced more than 58% over the past four years since 2000.
- The lost workday rate reduced more than 76% over the past four years since 2000.

The second site that will be examined comes from the HON Company of Cedartown, GA. The Hon company makes midmarket office furniture. Hon's Lean effort began with parent company HNI Corp., which created their Rapid Continuous Improvement Program (RCI). Thanks to the help of the RCI program, Hon's Cedartown, GA site won the Shingo Prize in 2003. (Panchak 2005) Some of their achievements include:

- Cost reductions of over $7 million in one year
- Plant profitability increase by 27%
- Warranty cost reduction as percent of sales by nearly 32% over three years

The third site that will be examined is Delphi's Juarez, Mexico facility. Delphi's Lean manufacturing system, Delphi Production System (DPS), has been part of this site since 1998, and has since helped win the Shingo Prize in 2003. (Salaiz 2003) With DPS, this Tier One automotive supplier has made some impressive results, as shown below:

- Rework reduced as percentage of sales by 80%
- Customer Returned products reduced by 81%
- First time quality improved by 53%
- Scrap as percentage of COGS reduced by 65%
- On-time Cost and Delivery improved to 99.6%
- Premium freight costs reduced by 70%
- Lead-time reduced by 30%
- Shipping costs reduced by 10%.

The results these sites have experienced are not unusual for Shingo Prize recipients. However, there is little evidence if these sites were able to sustain these results over long periods of time. For Boeing and Delphi, it appears that at least over the 5-6 years that it took to build the quality

program and win the Shingo prize that there were good results and sustained. But it is unclear what has happened since, and if it will continue to do so.

Also, as a company, Delphi has won 22 Shingo Prizes, but in 2006, Delphi declared bankruptcy. (Baudin 2006) Baudin suggests that Delphi's problems are more related to "decades-old commitments", but the fact still remains is that manufacturing plants can win the Shingo prize when the entire company is not doing well.

Furthermore, in Baudin's (2006) study, there are mixed results when comparing sales growth, profitability or employment growth between Shingo Prize winners and their competitiors. While the timeframe is not clear, in Baudin's study, for Shingo winners, Profitability is 10% higher than competitors, but sales growth is less and jobs growth was negative. As you can see from Table 1, if you take out larger companies (>10B/Yr Sales) the difference gets even worse, and the winners are actually less profitable.

Performance In The Market

	SALES GROWTH (%)	PROFITABILITY (%)	EMPLOYMENT GROWTH (%)
ALL SHINGO PRIZE WINNERS	13.00	6.38	-0.54
ALL COMPETITORS OF WINNERS	14.71	5.80	1.26
SHINGO PRIZE WINNERS <$10B/YR IN SALES	9.14	3.63	-3.64
COMPETITORS OF WINNERS <$10B/YR IN SALES	14.09	6.10	0.84

Table 1: Business Results of Shingo Prize Winner vs Competitors

Of course these numbers are for whole companies, while the Shingo Prize was designed to assess individual plants. Baudin's argument is that measuring manufacturing excellence across this many industries is not straightforward.

2.1.3.4. Benefits and Drawbacks of the Shingo Prize

Despite the mixed results of the Shingo Prize, applying for the Shingo Prize and using the Prize criteria to improve your operations do have some potential benefits. First of all it provides companies new to Lean manufacturing with a structure and an ideal state to think about as they approach their Lean transformation. This is important as Lean implementation can be daunting and confusing. Additionally, this structure and methodologies can be used as a feedback

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mechanism to understand where they are and where they need to be along the way. Lean is difficult to implement even with an explicit structure and a feedback mechanism. As stated earlier in Hallam's (2003) research, companies without a good feedback mechanism will have a more difficult time figuring out how to become Lean.

A second clear benefit to the Shingo Prize is the feedback given to applicants. This feedback, similar to the Baldrige program, will provide the site with an expert and objective analysis of their facility. While this can be overwhelming for some sites, it can provide invaluable feedback on blind spots and help companies understand which areas should be a higher priority to improve.

On the other hand, utilizing the Shingo criteria and applying for a Shingo prize is no guarantee for great results. If the site team does not really understand the theory behind the Shingo method, they could possibly put together a site that appears to be lean but is not in reality. Alternatively, a site that was once Lean can quickly lose its results by becoming complacent or by losing some of its key Lean leaders. As an example, Baudin (2006) describes a Shingo winner he visited which had andon towers with incorrect lights on and operator instructions that were not updated in the past three years. There is clearly little evidence of how the Shingo Prize affects organizational performance. The Shingo prize can help a plant become lean in the short term. However, there has not been much study on how the resources spent in gaining lean transformation knowledge can turn into companywide learning and sustainable results.

2.1.3.5. Changes to the Shingo model in 2008

The changes made to the Shingo model in 2008 are moderate. While there is little published information on why these changes were made, the model is public, so by comparing the previous model and the new model, some educated guesses can be made. The biggest change is a shift in focus to a Lean enterprise, rather than a manufacturing plant. The Shingo model is now more flexible that it can be applied to Individual site/plant, a complete division, or the entire business enterprise.(The Shingo Prize for Operational Excellence, 2008) Figure 6 shows the new model.

While the section titles have changed, Sections 1, 2 and 4 are very similar to the previous version. Section 1 *Cultural Enablers* contains very similar content than the previous *Leadership Culture & Infrastructure*. Section 2, *Continuous Process Improvement* combines the content from the previous Section 2, *Manufacturing Strategies and System Integration,* and Section 3, *Non-Manufacturing Support Functions.* The biggest difference in the new Section 2 is that the Support Functions section is now more detailed and has changed its name to "administration". Section 4, *Business Results* seems to have combined the previous Section 4, *Quality, Cost and Delivery* and Section 5 *Customer Satisfaction and Profitability.* Section 4 also added a *People Development* portion to examine objective metrics related to people development.

Section 3, *Consistent Lean Enterprise Culture*, is the biggest change in the new edition. The goal of this new section is to see how well lean principles are understood and applied in all business processes and at all levels of the organization. There are two subsections in this new section. The first, *Enterprise Thinking*, examines how well Lean and a System perspective is used in five critical areas: Financial and other reporting, Business Development & Organization Design and Development, Information Management and Leadership Development. The second subsection, *Policy Deployment*, examines how well the strategic planning and implementation systems are based on scientific thinking, employee involvement, and respect for the individual. More specifically, this subsection looks for Scientific Thinking as a Philosophy and as a Management Process.
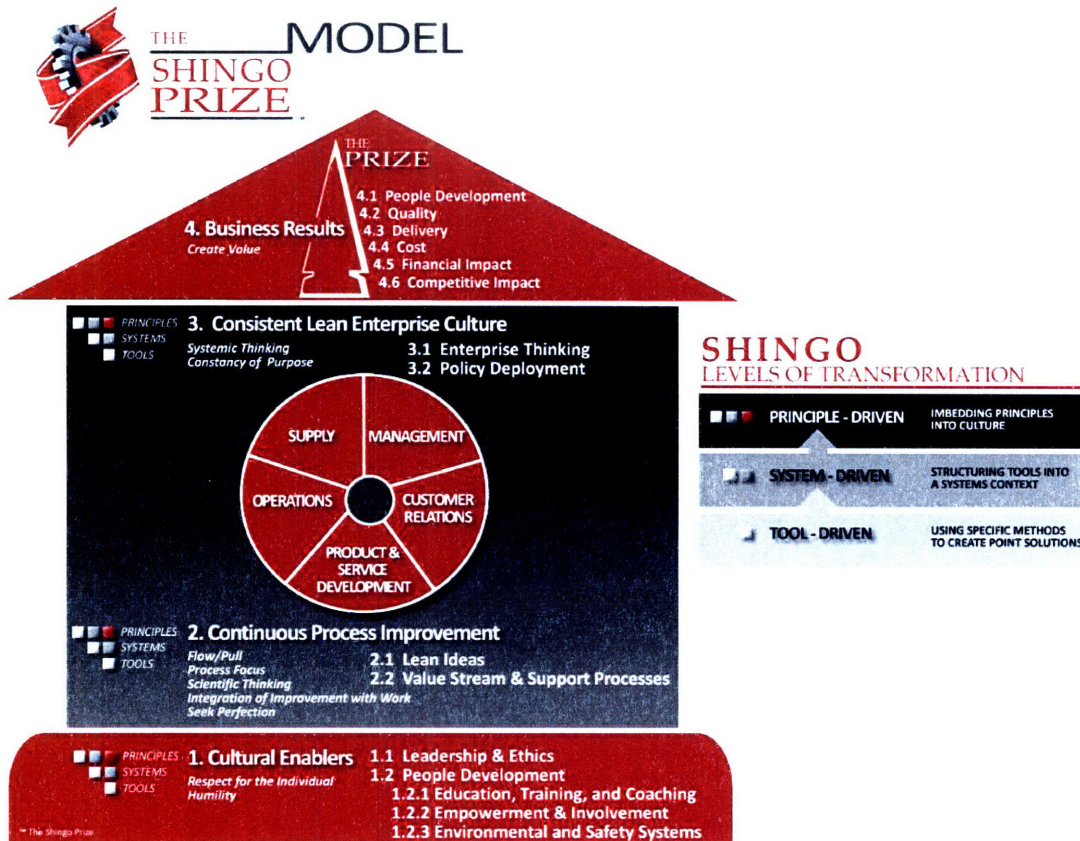
Figure 6: Revised Shingo Model (The Shingo Prize, 2008)

While it is not clear why these changes were made, it is clear these changes provide the Shingo Prize model a more enterprise focus. The author suggests some potential reasoning for this. After 20 years of successfully helping plants become Lean, it was time to evolve the Shingo Prize to the next level – helping enterprises become Lean. Many companies have been able to achieve local gains, but failed to achieve companywide gains. As seen with Delphi, numerous plants winning the Shingo Prize have not helped it avoid bankruptcy. Thus, there is something clearly missing from the formula, and the Shingo Prize model needed to be updated to fix this.

2.1.4. A Comparison of Assessment Methods

In this section, there has been discussion on the Baldrige National Quality Program, the LESAT from MIT, and the Shingo Prize. Each of these has its advantages and disadvantages, and those are summarized here in Table 2.

	Baldrige	LESAT	Shingo 07	Shingo 08
What Assesses	Division / Company	Enterprise	Plant	Enterprise / Division / Plant
Who Assesses	Outside Experts	Internal Executives	Outside Experts	Outside Experts
What Criteria	7 Criteria	3 Sections 15 subsections	5 sections 11 elements	4 sections 12 Elements

Results
 	
from Research
	Financial Results mixed, not sustained over 10 yrs
	Quality Program Maturity
	- Avg 7 years to win
	  - Takes a long time to develop
	  - Helps companies with more developed quality programs
	
	Won't make up for other competitive problems
		Leadership - > Infrastructure
		Leadership - > Lifecycle
		Infrastructure - > Lifecycle
		
		Leadership is Important
		
		Feedback Loop is Necessary
			3 mini cases - good locally but no evidence of sustained results
			Boeing
			HON
			Delphi
			Profits up with big companies, down with small companies
			Sales Growth slightly down with all sizes
			Employement growth down with all sizes
			Delphi Bankrupt with 22 Shingo Winners
				No results data exists on new criteria
				
				More enterprise focus
				New Enterprise section
				Measures communication and effectiveness across boundaries

Benefits	Helps Start new program Provides common vocabulary / philosophy Provides objective feedback - 70% already known - 30% new	Assessment Process is Valuable Increased Executive Communication Creation of Common Vocabulary Identify and Support those who need education Clear picture of enterprise maturity / open identification of enterprise issues Elevate to enterprise level	Provide Structure Feedback to Applicants Assessment Process is Valuable	*Provide Structure* *Feedback to Applicants* *Increased Executive Communication* *Creation of Common Vocabulary* *Clear picture of enterprise maturity / open identification of enterprise issues*
Drawbacks	Resource Heavy	Section II & III not good for support groups Executive resource heavy Not clear on how and where for next maturity level	No Guarantee 3 yrs later (due to not good enterprise)	

Table 2: Comparison of Assessment Methods

There are many conclusions that can be drawn from this comparison. First of all, there is a tradeoff between measuring a plant and measuring an enterprise. As Lean journeys tend to start at the plant level, and there is likely to be a bigger pull for a Plant assessment early in a lean journey. Plants are a good place to start the lean transformation because the waste in manufacturing is often more visible and quantifiable than in other areas. Also, since there is typically more familiarity with Lean amongst manufacturing professionals and a significant body of knowledge exists about lean implementation in plants, starting at the plant level can be easier than the enterprise level, and that helps the company build skill and expertise and gain confidence during the critical early phases of a Lean journey.

However, since enterprise assessments help transform the enterprise to Lean, it can have a larger effect on a company's performance. As Hallam found, having "islands of success" will not

always translate to successful programs or companies. Thus, to makes more sense to use a Lean enterprise assessment to help transform a company into a Lean enterprise rather than a focusing on plants first. But transforming into a lean enterprise without any lean experience is not an easy task. The aerospace industry had significant experience with Lean and other continuous improvement initiatives before they attempted a Lean enterprise. There is little evidence that any company has successfully transformed into a Lean enterprise without any prior Lean experience. While this does not indicate it cannot be done, following the existing path and will likely be more manageable than the non-existent path. Thus, the enterprise assessment should be held back until after the company has developed some proficiency in Lean.

Second of all, there is a tradeoff between having outside experts assess and having an internal team assess. An expert assessment will give a company important objective feedback, and from one account 30% of this feedback was otherwise unforeseeable by the company (Babicz, 2002). On the other hand, getting the feedback too early can be demoralizing (Babicz, 2002). Also, as demonstrated by the LESAT, an internal team assessment can lead to significant learning. In the early stages of a Lean journey, the organization has the most to learn, so the learning gained from self assessment is strongest and most useful during this time. Conversely, as the maturity level increases, this learning will start to diminish and can lead to "blind spots" without some external influence and calibration. Thus when the organization starts to see the learning slow down, it makes sense to use an external assessment to help identify these blind spots.

Third of all, there are desirable outcomes for all assessments. Ideally an assessment is able to:
- Provide a structure to think about a Lean transformation
- Provide an accurate view of the current state
- Provide a common vocabulary for people to discuss lean
- Increase communication between areas
- Provide a clear picture of the future state
- Plan what next steps are necessary to get to the future state

Finally, there are pitfalls to try to avoid in all assessments. Ideally an assessment will avoid:
- Rewarding temporary unsustainable results

- Taking up significant resources
- Assessing a plant when an enterprise is more appropriate and vice versa
- Giving the appropriate amount of feedback

3. Assessment Needs and Development at Dell

This section describes the history and current competitive situation at Dell, Inc, and how and why the Dell Business Assessment was created.

3.1. Introduction to Dell

Dell is a $61 Billion Consumer Electronics and Services Company uniquely enabled by its direct business model. Dell's product range includes desktop personal computers (PC), servers and networking products, storage, mobility products, software and peripherals, and services. Dell is headquartered in Round Rock, Texas. Dell, Inc. was started in 1984 by Michael Dell while a student at the University of Texas.

3.1.1. Dell in 2007

By 2007, Dell was in the middle of a highly competitive landscape. The computer industry continuously evolved, and competitors had found ways to compete with the keys to Dell's success in the 1990's. By October of 2006, Dell had lost its position as the top PC maker worldwide to Hewlett Packard. Soon after, Michael Dell reclaimed his position as CEO, and started Dell down a new path - Dell 2.0. The purpose of Dell 2.0 is to build on the Dell's past successes by creating a strong customer focus. As an example of customer focus, in late 2007 Dell began selling computers and peripherals in the retail space. By getting their products into brick and mortar stores such as Staples, Wal-Mart and Best Buy, Dell can better reach new customers and current customers by giving them a new channel to see new products and purchase them immediately if desired.

3.1.2. A brief description of Dell's Culture

The culture within Dell is well explained in Blaine Paxton's 2004 LFM Thesis "*The Dell Operating Model*". In this Thesis, Mr. Paxton provides a detailed look of Dell's culture while

thoroughly explaining Dell's operation model. He has summed up his cultural findings with four major elements (Paxton, 2004).

1. Obsessed with Results - This element encompasses three separate points. First, there is a focus by employees on quick and measurable results. Second, employees tend to focus on the future rather than dwell on who or what caused problems on the past. Third, Dell employees hold a high level of personal accountability. Together, these three points create a culture obsessed with results.

2. Flexibility in Everything We Do - This element requires that all employees are flexible and responsive to changes in the market. This element, combined with the fast moving nature of the business, means many aspects of Dell's Operations are always in a state of flux. Therefore Dell's employees can quickly pull together teams and react to problems as they arise. Due to this flexible nature, this also means that processes and standards can quickly change when something new arrives.

3. Value of Personal Relationships – The third element revolves around social networks at Dell. These social networks appear to be the foundation of the speed, flexibility and responsiveness of Dell's operations. People within the organization have developed networks over their careers and use them as ways to quickly share knowledge and form teams.

4. Leadership at all Levels – The last element revolves around empowering employees at all levels to lead efforts. Employees are typically given goals for a project and have freedom to find and develop solutions on their own.

3.2. Push for Lean Manufacturing

The push for Lean Manufacturing started within the Dell Americas Operations (DAO) organization. DAO owns the assembly and fulfillment facilities throughout the Americas. Lean has been with DAO at varying degrees and levels of success starting from the late 1990's (Paxton, 2004). By 2004, a full DAO wide Lean effort was underway. In early 2006, the vice president of DAO moved on to a different organization within Dell to help spread Lean. A new

vice president was hired to further improve Dell's operations and to continue to push the transformation for a Lean organization. Prior to Dell, the new vice president worked in the auto industry where she had prior experience leading a lean transformation in a large company.

3.2.1. Lean Consultant Team

Starting in 2004, the Lean Consultant team is tasked to help teach Dell America's Operations about Lean manufacturing, and facilitate the Lean transformation at Dell. The team is made up of eight consultants spread out at each of Dell's facilities. Their primary responsibilities include training facilities in Lean methods, planning kaizen events in alignment with facility plans and ensuring kaizen events have sufficient resources to be effective. At the beginning of each fiscal year, Lean consultants also help with strategic planning at each site, setting annual goals in alignment with the DAO Hoshin plan and with improving the usage of Lean methods.

Additionally, as a group, Lean consultants support the entire lean transformation of the company. This responsibility includes a very important role of developing standard methods to teach and implement Lean Manufacturing within Dell, and quarterly Lean training sessions for DAO executives.

The Lean Consultant team is made up of individuals who have been part of Lean transformations in other companies and other industries. Most members of Dell's Lean team only have a few years experience at Dell, but have significant experience working with Lean in other companies and industries. This brings in a tremendous amount of experience to the team, and provides unbiased "fresh eyes" to the business. However, this also means there are multiple disparate views on which is the best way to approach lean and which methods should be standardized.

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4. Dell Business Assessment Tool

4.1. Assessment Development Process

By 2006, there was a clear need identified to measure the progress of the Lean transformation. Since some members of Lean Consultant Team were experienced Shingo prize examiners, they wanted to bring a similar approach internally to Dell. Thus, in early 2006, the Lean Consultant Team developed the first version of the Dell Business Assessment (DBA) tool. However, since Dell and DAO were still in its early stages of learning Lean manufacturing, it was decided by the executive team to place the assessment on a bookshelf, and revisit it in a year. Since not enough of the executive team understood Lean enough to use the tool, this delay gave the company some time to better understand Lean concepts and methods without the pressure to produce immediate results. Had the company started to use an assessment without fully understanding Lean, it could prove to be disastrous. Without a solid understanding of lean, actions made to improve the assessment score would likely gain only temporary results, and Lean would quickly lose all credibility.

By June of 2007, the company was further along with its understanding of Lean, and an LFM intern was brought in to further refine the Assessment Tool and to pilot it at various Dell sites. The LFM intern spent time researching existing Lean Assessment models, most notably the Shingo Prize, and MIT LESAT from academia, and the General Motors 33 Elements and UTC ACE program from industry. After months of absorbing Dell's culture, learning about Lean manufacturing, and analyzing various Assessment models, the Dell Business Assessment was refined and reborn.

By the fall of 2007, the Dell sites were much further along in the Lean journey, and started to ask or "pull" for an assessment tool to help them further understand their journey. This worked out nicely as it was the time the Lean Consultant team started to travel around to sites and pilot the assessment.

4.1.1. Assessment Role in Lean Transformation

In developing the Dell Business Assessment, it is of course important to first understand its role within the greater Dell lean transformation. The DBA functions as part of a strategic learning cycle. It is the "Check" in the commonly used Shewhart/Deming *Plan-Do-Check-Act* (PDCA) cycle. The DBA provides Dell with a method to measure how Lean a facility is. Without this *Check*, there would be no way of knowing how well different continuous improvement actions are actually improving Lean maturity. Figure 7 illustrates this learning cycle below.
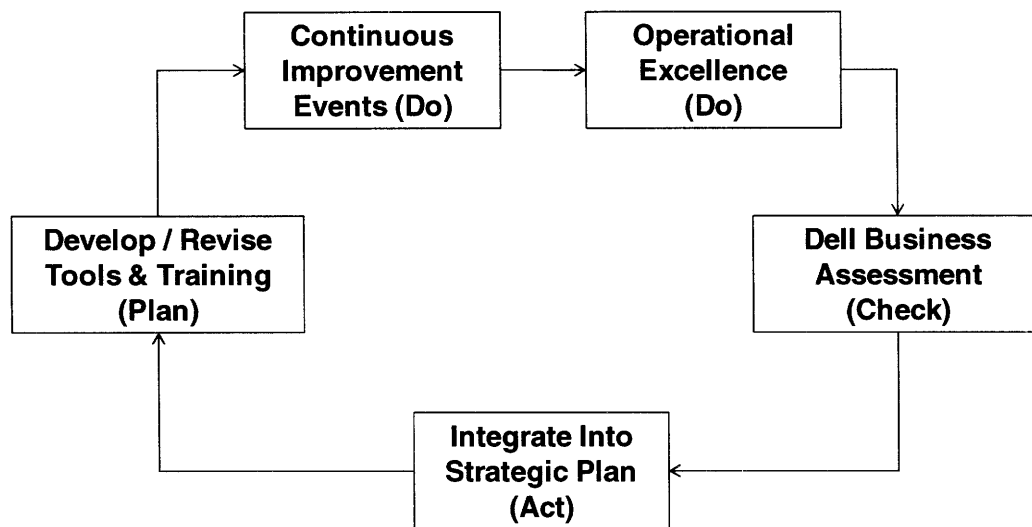
Figure 7: Dell's Strategic Lean Learning Cycle

In this PDCA cycle, the *Plan* phase happens when Lean tools and Lean training plans are developed and revised. The *Do* phase happens through continuous improvement events which improve daily operational excellence. The DBA will provide the *Check* phase and see if these continuous improvement events have improved as designed, and finally, any countermeasures that need to be made will be integrated into the Strategic Plan, or the *Act* phase.

Since the Lean transformation and the DBA are still new to Dell, this cycle has not been used fully yet. Prior to the DBA, a similar PDCA cycle was used to manage the strategic plan. However, rather than use the DBA, the *Check* process was performed by using a mixture of using traditional manufacturing metrics such as cost and productivity and subjective impressions of Lean Cultural improvement. While the objective data drove actions and improvements, not

having an effective method to measure subjective cultural improvements, resulted in little attention paid to these goals, and an open loop process. With the DBA, the hope is to better close this loop on lean maturity and drive improvements.

4.1.2. Assessment Purpose

To fulfill its role in the learning cycle, the DBA tool needs to serve three important purposes. First, this tool needs to be able to quantitatively measure the maturity of a business unit's Lean cultural transformation. At the end of each assessment, there needs to be a score that can be used to measure the effectiveness of changes in a facility's activities. This is the important *Check* phase of the learning cycle as it helps the team understand the progress a facility makes with its improvements.

Secondly, the DBA needs to help prioritize improvement activities. Time and personnel resources are always limited, so it is important to understand which improvement actions are important to do first. Therefore, the tool will ideally sort through assessment results and suggest which areas need improvement first. This will help define what changes need to be made in strategic plan, or the *Act* phase. In this regard the DBA also needs to define what is "Good". Without a clear vision of what good looks like at each stage of the Lean maturation process, it will be very difficult for areas to improve. Thus showing a roadmap to Lean within the assessment is key.

Third, the DBA needs to be able to identify best practices and companywide deficiencies. This is important because each facility is likely to have an area where it is particularly proficient. By identifying these strong points, and capturing their best practices, facilities can improve faster by sharing and learning from each other. This also serves the purpose of presenting a "How" for the strategic planning or *Act* phase. The "How" will come either from a best practice from a different site or in the case of a companywide deficiency, these needs will be identified and developed in the Develop Training or *Plan* phase.

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4.1.3. Focus on Learning

As discussed in section 3.1.2, Dell has a fast moving and results obsessed culture. Thus facility management teams will automatically want to see great results whenever a new measurement method is established. At the same time, the executive team has historically further fueled a competitive fire by judging each site against each other based on common measurement methods. While this competitiveness has historically helped Dell gain an edge in the past, it can be detrimental as the company tries to shift to Lean methodologies. By not taking the time to properly understand Lean and build a solid foundation, the Lean effort will easily fail. An example of this common misconception is as one manager said "Lean Transformations typically take 5 to 10 years. We don't have that kind of time, so we'll get it done in half that time".

So to be effective within Dell's culture, the Lean Consultant team heavily emphasized that the DBA is a learning tool, and not a competitive measure. The assessment is designed to identify strengths for sharing and opportunities for improvement. Without this emphasis on learning, there will not be a willingness to share best practices, and little incentive to grow their Lean understanding together with other sites.

To help facilitate this, the Lean team encouraged facilities to keep their results confidential until they felt comfortable sharing results with other sites. Concurrently, it was important for the executive team to not judge the sites based solely on their lean assessment score. Since it was a learning tool, it is important for the executives to understand the current status of each site, but more importantly, they need to ensure actions plans are properly in place to improve lean maturity and best practices are identified to help other sites improve. A hard push for just score increases will likely force undesired behaviors in trying to game the system. This could lead to reinterpretations of the assessment wordings, or implementing a Lean tool such as 5S, but not properly supporting the tool usage.

4.1.4. Design Scope

Prior to starting development of the Dell Business Assessment, the scope was well defined. First, Dell wanted the Dell Business Assessment to be *sized for a Business Unit*, but also be

scalable. For Dell's Americas Operation, a Business Unit is a facility such as an assembly factory or fulfillment center. Outside of Dell's Americas Operation, this could mean a call center or a sales center, or other similarly scaled functions. Being scalable meant in an ideal situation, the Dell Business Assessment could be used in some form to assess a factory cell, or it could be used at a higher level to assess the enterprise.

In addition to being scalable, the DBA must also be *Comprehensive*. In a factory setting this means the assessment looks not only at the "shop floor", but also at how the different departments work with each other within the factory, and how the departments work with their internal Dell suppliers and their external suppliers.

The third scope assumption is that the Assessment would be *Universal*. This means the assessment usage would start off in DAO facilities, but the intent would be to use this throughout the company and throughout business units.

Finally, this would assessment should be *Global*, and be easily used at any Dell facility or business unit worldwide world and not just in the Americas.

4.1.5. Design Assumptions

The assessment process was designed around certain design guidelines. First, and foremost, the Dell Business Assessment is to be used as a *learning tool*, not a judgment tool. While this has been discussed above, it is a key factor in the assessment design.

Second, the assessment should be *self-assessed*, performed by an internal team, and not by an auditor coming in from outside the facility. Having an internal team perform an assessment is important because it combines the group who performs the assessment and with the group that implements improvement actions. This way, the operational team will own the processes, own the assessment results and own the plans to improve them. This helps the team focus on learning from their own assessment rather than trying to decipher a report that someone unfamiliar with the facility created on a short visit. While this may prevent the team from getting feedback from an objective source, it will help focus the team's efforts at this early stage. When the company is

ready for external feedback, an external source can easily asked to come in and assess the facility.

Third, the assessment needed to be *consistent with continuous improvement* projects and systems currently going on at Dell. It must be clear that this is in no way replacing the six sigma tools, kaizen events or any other Dell program. This assessment will work with these systems and help prioritize which projects to address first.

Fourth, the assessment needed to be *consistent with external sources*. To get a feel for how well they are doing, Dell wanted an assessment that could be compared to non-Dell facilities. This would act as an external calibration. In this respect, Dell chose to calibrate the tool with the Shingo model to it is widely used throughout multiple industries.

Fifth, since this assessment would be internally performed, there needed to be some way to *calibrate internally* to ensure internal consistency between facilities. Thus there needed to be some sort of internal calibration. To do this, the Lean Consultant would be necessary to travel between sites and help facilitate assessments of each other's sites. With enough cross facilitation and group training, this would ensure consistent measurements.

Lastly, the assessment is an important tool for the *long term*. This was not to be a one or two time thing. This assessment should to be an important part of the long journey to Lean, and is designed to be closely aligned with the long term DAO Hoshin plan.

4.1.6.   Choosing Shingo

To best meet the design scope and design assumptions, the team chose to use the Shingo Prize as the model on which to base the Dell Business Assessment tool. By examining the Shingo model, Dell's experience with the Shingo model, and stipulating some implementation parameters, the Shingo model looks to be a good fit for Dell.

The Shingo model inherently matches the design scope requirements of *Sized for a Business Unit, Comprehensive* and *scalable*. Since the Shingo Prize is designed for assessing

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manufacturing sites, it is properly *sized for a Dell Business Unit*, as a Dell manufacturing facility is considered a business unit. The Shingo Prize also takes a comprehensive look at a facility, including the leadership team, the supply chain interactions and the shop floor manufacturing processes. Thus it meets the *Comprehensive* requirement. And third, while not optimized for *scalability*, each section can be used to assess specific areas within a facility, and as a whole, the tool could be used as a way to start thinking about measuring the enterprise. The Shingo model also inherently meets the design assumption of *Consistent with External Sources*, as the Shingo model and Shingo prize are widely recognized and used throughout multiple industries.

With respect to Dell, the Shingo Model works especially well because of the existing experience the Lean Consultant team has with the Shingo model. There is one Lean Consultant trained as a Shingo Assessor, and a few others that have worked with extensively with the Shingo model in the past. This familiarity and expertise with the Shingo model allows Dell to execute an assessment tool much faster and more effectively than other tools. This experience gives Dell the ability to *Self-Assess*, as the assessment expertise already exists within the group and can be quickly disseminated with those less familiar with the Shingo model. By teaching each other, and discussing the Shingo model often, the Lean Consultant team will also become *Internally Calibrated*.

The remaining design scope parameters can be satisfied in the implementation of the Shingo model. As Shingo is designed to be adaptable to measure different industries, it can thus be adapted for both *Global* and *Universal* applications. Thus, with some tailoring, Dell will be able to use the Shingo model throughout their worldwide operations and throughout different business units.

The remaining design assumptions can be satisfied by having an effective leadership team implement the Shingo model. The Dell version of the Shingo model can be used as a *Learning Tool*, can be used for the *long term*, and can be tailored to *work with existing continuous improvement tools*. But, all three of these assumptions are dependant on how the leadership presents and manages the implementation of the DBA. Without a firm stance on learning, a

commitment to the long term and a clear vision of interoperability of the assessment tool, these assumptions and the tool will unlikely succeed.

4.1.7. Other Sources of Influence

In addition to the Shingo model, there were a multitude of other models and experts that influenced the Dell Business Assessment. From academia, the Lean Enterprise Self-Assessment Test from MIT's LAI provided an enterprise perspective. The LESAT influenced areas that related to strategic planning and cross enterprise communication. From industry, the General Motors 33 Elements provided a different perspective from another manufacturing industry. Since GM's tool is more mature but scoped similarly, it provided many ideas on how to reword many questions. Finally, discussions with the Lean Consultant Team and other Dell operational leaders have influenced the Dell Business Assessment by providing a better understanding of Dell and its value chain.

4.2. Assessment Structure

The Dell Business Assessment is based on the five sections from the Shingo Prize. There is a slight change made based on proposed changes to the 2008 Shingo Prize that were never implemented. The main difference for Dell is that the Shingo Section 3 (Non-manufacturing Support Functions) is now a subsection of Section 2 (Operations Strategy & Systems Integration). The resulting four sections are - 1. Leadership Culture & Infrastructure, 2. Operations Strategy & Systems Integrations, 3. Quality, Cost & Delivery, and 4. Business Results.

4.2.1. Structure Overview

Each of the four sections measures a different but important area of a facility. Within each of the DBA four sections, there are up to five sub-sections. Within each of these sub-sections, there are anywhere from four to twenty-three questions used to rate the lean maturity of these sub-sections. When combined, the total ratings of each sub-section will determine the sub-section score, and the combined ratings of the sub-sections will determine the section score.

As illustrated in Figure 8, there are 100 questions overall spread out through the four sections and thirteen subsections. Since each question is weighted the same, the number of questions in each subsection determines the weighting of each subsection. As an example, subsection 2D, the Manufacturing Operations section, has the most value in the assessment as it has 23 questions.

Enablers	Core Operations	Results
I. Leadership Culture and Infrastructure	**II. Manufacturing Strategies and System Integration**	**III. Quality, Cost and Delivery**
A. Leadership (8 questions)	A. Manufacturing Vision and Strategy (5 questions)	A. Quality (5 questions)
B. Empowerment (8 questions)	B. Innovations in Market Service and Product (5 questions)	B. Cost and Productivity (8 questions)
C. Environmental, Health & Safety (5 questions)	C. Partnering with Suppliers /Customers (10 questions)	C. Delivery (5 questions)
	D. World-Class Manufacturing Operations and Processes (23 questions)	
	E. Support Functions (8 questions)	
21 questions	**51 questions**	**18 questions**

Feedback   Feedback

IV. Business Results

A. Customer Satisfaction (5 questions)   **10 questions**

B. Profitability (5 questions)

Figure 8: Dell Businesss Assessment Structure

The flow of the DBA is also very similar to the flow of the Shingo Prize. Section I, *Enablers*, represents a starting point, making it possible to create a world class and Lean facility. Without performing well with Enablers, the other sections are not likely to do as well. With *Enablers* in place, a facility can focus on getting its *Core Operations* in order. Section II, the *Core Operations* of the facility looks at key operational elements of a facility. Since these elements include methods and tools critical to day-to-day operations of a world class facility, a facility performing well in this section will score high on the DBA. Once the *Enablers* and *Core Operations* are performing well, good *Results* should follow. Thus, Section III, the *Results*,

examines the facility ability to perform its main task of delivering high quality, low cost products on schedule.

Another important part of running a world class operation is gathering Feedback from customers and investors. Thus in Section IV, *Feedback*, Customer Satisfaction and Profitability are assessed. A well run facility that is not profitable or not satisfying customers is not a world class operation.

4.2.1.1. *Rating System*

Each of the 100 questions are rated on a 0 – 5 scale based on the lean maturity of the facility. A rating of zero indicates there is no evidence of the particular method or behavior found within the facility. A rating of 1 would indicate there is some evidence showing a low level of maturity with the particular question. A rating of 3 would indicate a medium level of lean maturity and a rating of 5 would indicate a high level of lean maturity. A rating of 2 is reserved when it is clear that a facility has done more than the low level of maturity, but not quite as much as the medium level. Similarly, a rating of 4 is reserved when it is clear that a facility has done more than the medium level of maturity, but not as much as the high level of maturity.

4.2.2. Dual Assessment Method

To accomplish the three primary goals of the DBA with the 100 questions, the Dual Assessment Method was created. As shown in Figure 9, the Dual Assessment Method has two Systems: The Point System and The Level System. The purpose of the Point System is to measure the overall Lean maturity of a facility, and to identify best practices within a facility. The point structure is derived from the Shingo Prize point structure. By emulating the Shingo Prize, the secondary goal of external calibration is met.

The Level System was created to address the second goal of prioritizing actions. This parallel system groups lean concepts based on how foundational they were to a lean transformation. The more foundational a concept or method is, the lower the level is. So a Level 1 concept is core to Lean and should be mastered well before a Level 4 concept. Since foundational concepts and methods should be addressed first, a simple method for prioritization is established.

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┌─────────────────────────────────────────────────────────────┐
│ Dell Business Assessment                                     │
│                                                              │
│  ▪  Leadership Culture & Infrastructure        21  questions │
│  ▪  Operations Strategy & Systems Integrations 51  questions │
│  ▪  Quality, Cost & Delivery                   18  questions │
│  ▪  Business Results                           10  questions │
│  ─────────────────────────────────────────────────────────  │
│  Total                                         100 questions │
└─────────────────────────────────────────────────────────────┘
```

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┌──────────────────────────────────┐  ┌──────────────────────────────────┐
│         Point System             │  │         Level System             │
│ Measures Overall Facility Maturity│  │ Prioritizes Improvement Actions  │
│                                  │  │                                  │
│ • 1000 point total (10 points/ques)│ │ • Similar to Bronze / Silver /Gold│
│                                  │  │                                  │
│ • Give Credit for Lean Activities│  │ • Each question given a level rating│
│ throughout facility              │  │                                  │
│                                  │  │ • Priority based on building     │
│ • Externally calibrated with Shingo│ │ fundamentals of lean concepts    │
└──────────────────────────────────┘  └──────────────────────────────────┘
```

Figure 9: Dual Assessment Approach

4.2.2.1. Point System

The point system is used to determine an overall facility maturity score. This will give credit for all lean activities throughout the facility regardless of when or how they were implemented. This information is useful to understand the current status of a facility from a high level.

As it has been previously stated, each of the 100 questions are rated on a 0-5 scale. By assigning a simple multiplier of 2 points/rating, each question can reach total of 10 points. 100 questions, weighted at 10 points each, gives a total of 1000 points. In doing this, the point system becomes consistent with the Shingo model. Table 1 illustrates the point breakdown between each section .

I. Leadership Culture & Infrastructure	21 ques x 10 points/ques = **210 points**
II. Operations Strategy & SystemsIntegrations	51 ques x 10 points/ques = **510 points**
III. Quality, Cost & Delivery	18 ques x 10 points/ques = **180 points**
IV. Business Results	10 ques x 10 points/ques = **100 points**
Total Maximum Score =	100 ques x 10 points/ques = **1000 points**

Table 3: Point System Breakdown

After an assessment is completed, the assessment results can be easily read in the Scorecard. As shown in the Sample Point System Scorecard below (Table 4), each subsection has a score which is further aggregated into a total section score. The four sections are further combined to create the total facility score.

Leadership Culture & Infrastructure	Score
A. Leadership	22 / 80
B. Empowerment	32 / 80
C. Enviromental Health & Safety	14 / 50
Section 1 Total:	**68** / 210

Operations Strategy & Systems Integrations	
A. Operations Vision & Strategy	26 / 50
B. Innovations in Market Service & Product	16 / 50
C. Partnering With Suppliers/Customers	50 / 100
D. World Class Operations & Processes	84 / 230
E. Indirect Support Functions	42 / 80
Section 2 Total:	**218** / 510

Quality, Cost & Delivery	
A. Quality	28 / 50
B. Cost & Productivity	34 / 80
C. Delivery	22 / 50
Section 3 Total:	**84** / 180

Business Results	
A. Customer Satisfaction	16 / 50
B. Profitability	14 / 50
Section 4 Total:	**30** / 100

TOTAL POINTS	**400** / 1000

Table 4: Example Point System Scorecard

While not obvious from the Scorecard, best practices can be identified by reviewing the assessment in detail and looking for those areas where the facility was rated a 4 or a 5. There will be more detail on this topic in section 0.

4.2.2.2. Level System

To help each facility understand priority and where their next action steps should be, the team designed the Level System. Without a prioritization method each facility would know where they were lacking, but would have to guess on which areas should be addressed first. Thus, this system is designed to guide each site in the order they should learn and implement Lean.

To determine this order, the team took two steps. First, the team agreed that the order would be based on first focusing on building a strong foundation in Lean, and then followed by adding increasingly more advanced concepts as the Lean maturity increases. Advanced Lean concepts will only be prioritized when there is a solid foundation below it. Second, based on the collective experience and knowledge of the development team, each of the 100 assessment questions was assigned to one of four Maturity Levels.

As shown in Figure 10, there are currently five Maturity Levels defined for Dell's Lean journey. Here is a quick summary of what each Maturity Level represents:
- Maturity Level 1 focuses primarily on leadership, lean education and strategy.
- Maturity Level 2 focuses primarily on the factory floor and partnering within the four walls of the facility.
- Maturity Level 3 focuses primarily on partnering outside the four walls, and looking at the Quality, Cost and Delivery.
- Maturity Level 4 examines how well the business is actually functioning.
- Maturity Level 5 and above are reserved for reviewing sustainment and continuous improvement of current Lean methods.

Each element in each of the four Sections of the Dell Business Assessment feeds into one of the first four Maturity Levels. Since Section I, Leadership Culture & Infrastructure includes a lot of leadership and education elements, it feeds mostly into Maturity Level 1. However, since some

of the leadership concepts are more advanced, it partly feeds into Maturity Level 2. Section II, the Operations Strategy & Systems Integrations section includes some important foundational strategy elements that are categorized into Maturity Level 1. Since a large portion of Section II is focused around internal partnering and the factory floor, it is mostly assigned to Maturity Level 2. However, similar to section 1, since there are some more advanced factory floor elements and some extended partnering elements, it is partially categorized into Maturity Level 3. Section III, Quality, Cost and Delivery is entirely categorized into Maturity Level 3, and Section 4, Business Results are entirely categorized into Maturity Level 4.
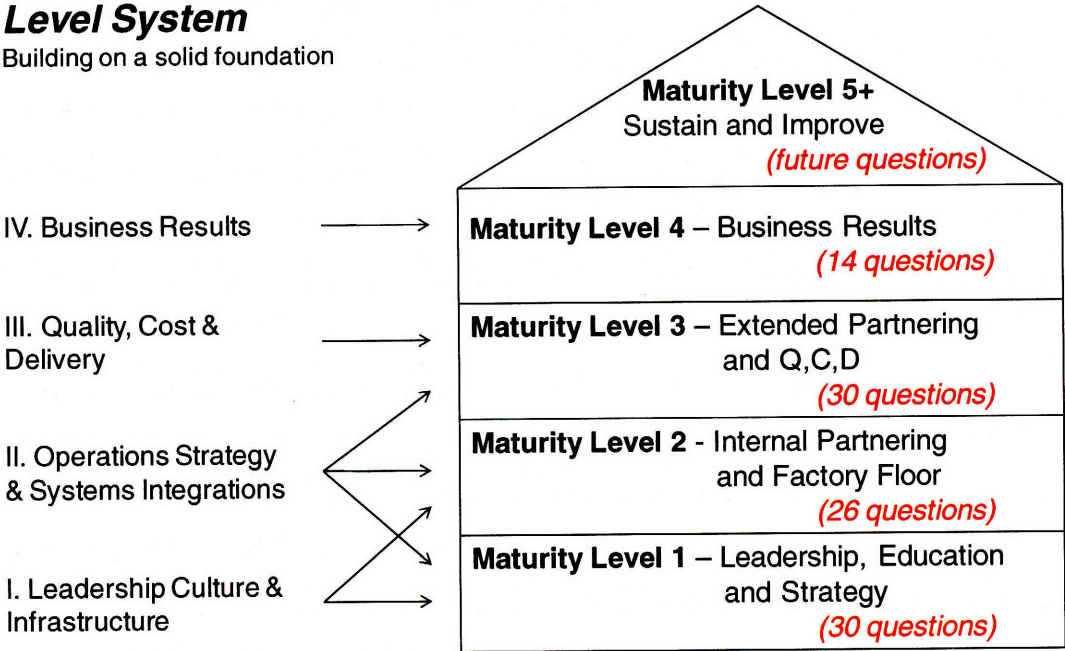
Figure 10: Dell Business Assessment Level System

While there is currently no element assigned to Maturity Level 5 or above for Dell, there is an expectation that the future will hold higher levels. Lean is about pursuing perfection, so as the company becomes proficient and reaches high maturity levels, there will be more difficult versions of questions which will start at a higher level. Right now a strategy question might be a Maturity Level 1 question. Once a facility is rated a 5 in that question, then a more difficult version will be needed, and that might start at a Maturity Level 4.

To further refine prioritization within the Level System, a new measurement call "Current Level" was created. The purpose of Current Level is to further prioritize which element to focus on within the same Maturity Level and between Maturity Levels. As an example, which of these two elements should a site focus on first ? A Maturity Level 1 element with a rating of 3 or a Maturity Level 2 question with a rating of 0 ?

Current Level is determined by two factors, the Maturity Level and the question rating. A higher Maturity Level and a higher rating will lead to a higher Current Level. Thus, questions that are of the lowest Current Level should be prioritized and addressed first. The worst case and thus highest priority is an element of Current Level zero (CL0), because it indicates the question is foundational and the facility has rated it 0.

To determine what Current Level an element is, a simple table was devised, and is shown below in Table 5: Current Level Table. In the case above, the first element is a Current Level 2, and the rating of the second element is Current Level 1, so the second element should be addressed first. Alternatively, the algorithm is also easy to understand. Starting with a Maturity Level 1 and a Rating of 0, when a rating is increased to 1, 3 or 5, the current level increases. Alternatively, when the Maturity Level increases by one, the current level also increases.

Current Level Table						
	Question Rating					
	R=0	R=1	R=2	R=3	R=4	R=5
ML1	CL0	CL1	CL1	CL2	CL2	CL3
ML2	CL1	CL2	CL2	CL3	CL3	CL4
ML3	CL2	CL3	CL3	CL4	CL4	CL5
ML4	CL3	CL4	CL4	CL5	CL5	CL6
ML5	CL4	CL5	CL5	CL6	CL6	CL7

Table 5: Current Level Table

The usage of this prioritization is further described in section 4.3.5.

4.2.3. Assessing Each Question

The process of assessing each question involves four main steps which are outlined below. The example rating in Figure 11: Example Rating is provided as an example.

1. Carefully read the definitions – The definitions are intended to properly capture the essence of zero, low, medium and high demonstrations of maturity for each particular question. (as described in section 4.2.1.1)

2. Capture evidence – To best understand which rating should be attributed to the site, it is important to understand what is currently going on, and capture it in the evidence section of each question.

3. Determine Rating – Once the evidence has been captured, the team can determine which rating is appropriate , as described in section 4.2.1.1. An important guideline to remember is that in order to qualify for a rating, all areas of the plant must achieve the definition as described, and the definitions below it.

4. Identify improvement opportunities – The final step is to capture what improvement opportunities are available. Typically this exercise is done by examining the current state and indentifying what needs to be done to get to the next state.
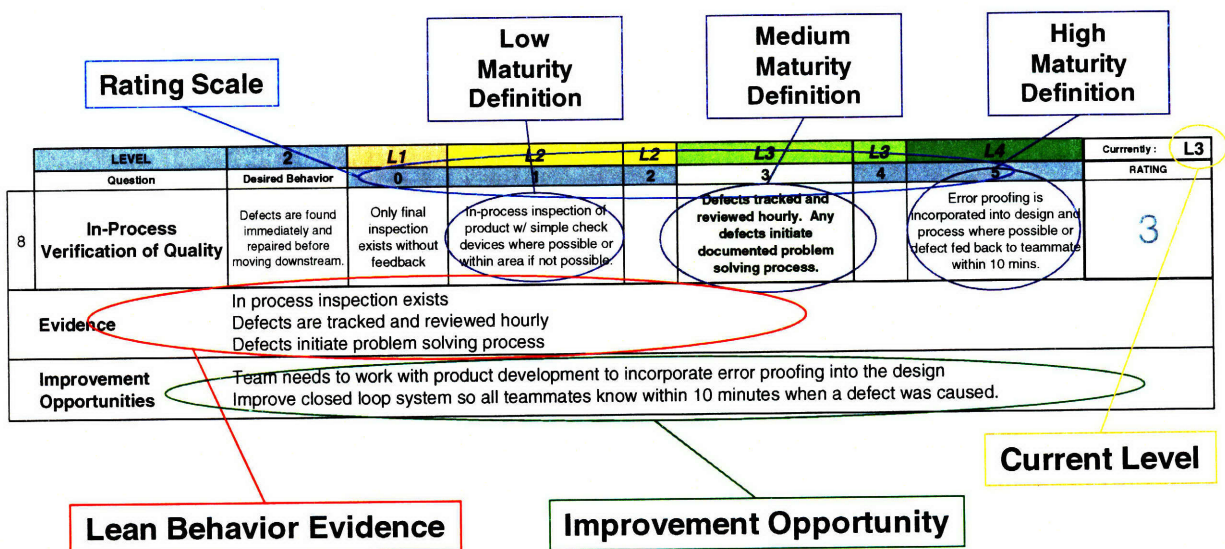
Figure 11: Example Rating

4.2.4. The Four Sections in Detail

The four sections of the Dell Business Assessment are modeled after the Shingo Prize. Each section is meant to assess a different portion of a facility.

4.2.4.1. Leadership Culture and Infrastructure

The first portion, *Leadership Culture and Infrastructure* covers three areas: The leadership team, empowerment of the workforce, and the environmental, health and safety aspects of the facility. The *Leadership* subsection evaluates how well the leadership at all levels uses core business practices, sets the organization's direction in alignment with the company's goals and creates the organizational culture and infrastructure to achieve world class results.

The *Empowerment* subsection evaluates employee involvement and how well the environment develops and utilizes each person's abilities. A good facility will have a leadership team committed to its employees and will have a safe, happy and productive team achieving the organization's objectives.

The last subsection under leadership focuses on the *Environmental, Health and Safety* initiatives and results of the facility.

4.2.4.2. Operations Strategy and Systems Integration

The *Operations Strategy and Systems Integration* section is the largest section. It covers five areas – *Operations Vision and Strategy, Innovations in Market Service & Product, Partnering with Suppliers/Customers and World Class Operations & Processes.*

The *Operations Vision & Strategy* subsection focuses on the operations strategy as it relates to the selection and use of the methods, systems and processes detailed in following three subsections. A good facility will have a clear vision aligned with the corporate vision and clear strategy aligned with the corporate strategy.

The second subsection is the *Innovations in Market Service & Product*. This subsection evaluates an organization's approach and success in product and market innovations. These product and market innovations often lead to reducing cost and improving value to the customer or in new product design & development.

The third subsection is *Partnering with Suppliers/Customers*. This subsection evaluates how well the company integrates suppliers and customers into the value-creation process. The assessment examines both supplier and customer relationships within the facility and external to the facility.

The fourth subsection is *World Class Operations & Processes*. This subsection is the largest and focuses on use of lean manufacturing practices. This subsection examines how well many traditional lean tools are used in the core operations (i.e. factory floor) of the facility.

The final subsection is the *Indirect Support Functions*. This subsection evaluates the degree of integration between the business unit and support functions and the extent to which improvement techniques and strategies have been applied in non-manufacturing functions up and down the value stream.

4.2.4.3. Quality Cost and Delivery

The *Quality, Cost and Delivery* section covers how well the facility performs in their key operational measures. A well run facility with poor Quality, Cost and Delivery is not an effective facility. This section is split up into three obvious subsections – *Quality, Cost/Productivity* and *Delivery*.

In the *Quality* subsection, the focus is to ensure no human or machine errors get into customers' hands and in-process defects are continually reduced. The goal is zero defects, and the questions are defined to examine quality at different areas of the facility.

In the *Cost & Productivity* subsection, the goal is to assess the improvement trend and level of cost and productivity with the aim to continually improve both.

Finally, in the *Delivery* subsection, the assessment is designed to identify whether or not the customer is getting what they need in the time and quantity desired. Over or under delivering in either time or quantity is undesirable.

4.2.4.4. Business Results

The last section is the *Business Results* section. This section is important because a facility needs to have good business results in order to be useful for the company. A facility that has great business process but does not make good economic sense will not help out the company. In this section, there are two sub sections – *Customer Satisfaction* and *Profitability*.

The *Customer Satisfaction* subsection looks for evidence of customer satisfaction data that is reported and clearly defined, and used to improve the customer experience.

The *Profitability* subsection looks to make sure the level and trends of profitability are defined and tracked and relevant to the business.

4.3. Assessment Process

4.3.1. Assessment Frequency

The Assessment is designed to be performed every six months, with monthly status checks. This time frame was chosen to not become burdensome to the facility leadership team. However, it is short enough to keep an accurate view of how each facility is doing in a fast changing environment. As the assessment tool and usage evolves, this frequency might need to change. However, in most cases since there is likely travel required for some facilitators, it might make sense to hold have an internal facility personnel only assessment at the six month point and a full external facilitator assessment only once a year.

To ensure progress is being made, monthly status checks are recommended. Every site has some sort of governance meeting where an agenda topic covering improvement action status should be checked on a monthly basis.

4.3.2. Assessment Timeline

Assessments typically are scheduled for two days. The entire process is split-up into seven separate sections. These seven sections are outlined here in sequence:

1. **Pre-work:** Prior to the beginning of the two days, there is a *pre-work* section. This covers commonly found metrics in the Quality, Cost, Delivery section and the Business Results section. Since these metrics should already be measured within the company, this should not take very much time to track down. Also, since there should be no interpretation required for these metrics, a small team can track down this data in an efficient manner.

2. **Training:** At the beginning of the two day assessment, the facilitators spend time *Training* any new assessors and refreshing experienced assessors on any changes or particular tricky points. This should take less than two hours.

3. **Assess Section 1:** After the team is trained, the assessment begins. The first section is the Leadership Culture and Infrastructure section. This should take roughly four hours.

4. **Assess Section 2:** The second part of the assessment is the Manufacturing Strategies and System Integration section. Similar to the first section, this should also take roughly four hours.

5. **Assess and Review Sections 3&4:** The last part of the assessment is to assess any remainder questions from sections 3&4 and review Pre-work results from those sections with the larger team.

6. **Action Planning:** Since sections 3 and 4 are completed in the Pre-work phase, the assessment should be complete after section 2 is completed. At this point, all the data should be compiled and the preliminary results should be created. From this, the assessment team can create an improvement action plans to address improvement opportunities. This section should take roughly 2 hours.

7. **Feedback:** The final step is for the facilitators to gather feedback on the assessment tool for future assessments. For more information on this section, refer to section 4.3.6. This section could take up to an hour if needed.

4.3.3. Assessment Team

The recommended assessment team should be approximately six to eight people in size, with a Lean Consultant from another facility as a facilitator. The facility Lean Consultant should be a secondary facilitator, but it is important to have an external facilitator to ensure a fair and corporately consistent assessment. A second external Lean Consultant will further help with consistency, but is not absolutely necessary.

The rest of the team should be formed with the facility director or plant manager, and a collection of senior managers, regular managers, and supervisors. Ideally the mix has some good shop floor knowledge of how the operations are actually carried out, and some knowledge about how higher level strategic decisions are made and executed within the site.

4.3.4. Assessment Ownership

Since this is a self-assessment for the purpose of learning, the assessments are meant to be owned by the facility. The expectation is for the facilities to run their assessment regularly following DAO's guidelines, and for there to be some external facilitation to ensure a consistent and calibrated assessment. The results are to be shared however the facility feels is necessary.

The assessment tool however will be owned by the Lean Consultant team. This cross facility team will ensure all suggestions are feedback into the tool, and make sure the tool is continually improved so it will keep up with changes in Dell.

4.3.5. The Action Planning Process

After an assessment is complete and compiled, prioritization of actions need to be done. To do this, within the Microsoft Excel file, there is a tab labeled "Action Plan". This tab sorts all 100 questions based on the Current Level of each question. Since the lowest Current Level questions

should be addressed first, they are on top, and the highest current level questions are at the bottom.

Within each current level, the questions are sorted by where they are in the assessment. So a question that is in category 1B will be sorted higher then category 2A. This is a suggested order of improvement based on a making foundational categories a higher priority. The actual order of how improvements will be made will be up to the facility leadership team. This team knows the facility and the current strategy the best, and can thus best decide on what areas make the most sense to address first.

After the top actions have been identified, it is important to integrate them into the existing strategic plan or yearly objectives of the facility. Without documenting the action plans, and tracking it into the facility governance meeting, they will easily fall by the wayside. This is a crucial step, as it is undesirable to encourage work that is not on the 1 year or 3 year strategic plan.

4.3.6. Built-in Continuous Improvement Process

Since this assessment tool is based around the fundamentals of Lean manufacturing, it is important that Lean methodologies are used in designing and implementing the tool. Thus, the team built continuous improvement into the assessment process. Despite how much time the team spends designing the tool, there will always be room from improvement. Also, as Dell matures in Lean, the facilitators and assessors will evolve in their understanding of Lean and the assessment will also need to evolve with them. Hence, when the assessment is scheduled, there is an expectation to schedule time at the end of the assessment to provide feedback to the facilitators, as described in step 7 of section 4.3.2. By scheduling this feedback time in advance, it ensures there is time to reflect and continuously improve the tool in the pursuit of perfection.

In the first few iterations of using the tool, this feedback will likely take longer and be more process focused with discussions on timing, personnel and large adjustments to questions. As the assessment becomes better understood and improves in quality and in execution, later

iterations will likely be shorter and finer level in detail, and looking to change the nuances of certain definitions.

As a final point, this feedback is important in that it allows the facilities a way to have their voice heard in the process. Since they are the customers of the tool, they are going to be more likely to use and support the tool if they feel like they are a part of its evolution. The more involved they feel, the more seriously they will take the assessment and the results.

4.4. Understanding Assessment Results

4.4.1. Assessment Scorecard and Level Report

The first method to understand the assessment results is to examine the scorecard and level report. As shown earlier in Table 4, the scorecard is a summation of all the ratings and gives you a score for each section and a total score. This is important to see how each section is doing, and to see how the site is doing as a whole. Since this is an aggregation, there is not much detail on what specific areas need improvement, however this will give you a high level overview of how each area doing, and with several sets of data, one can see trends in the lean transformation of the site.

The level report in contrast shows the reader how mature the site is for each section. Similar to the Scorecard, this gives more detail on what level each section is on, and where resources should be roughly focused.

Improve the L0's First

Leadership Culture & Infrastructure	L0	L1	L2	L3	L4	L5
A. Leadership	1	6	1	0	0	0
B. Empowerment	2	2	4	0	0	0
C. Enviromental Health & Safety	0	3	1	1	0	0
Leadership Total	3	11	6	1	0	0

Operations Strategy & Systems Integrations	L0	L1	L2	L3	L4	L5
A. Operations Vision & Strategy	0	1	2	2	0	0
B. Innovations in Market Service & Produ	0	1	0	3	1	0
C. Partnering With Suppliers/Customers	0	0	3	4	3	0
D. World Class Operations & Processes	0	7	8	4	4	0
E. Indirect Support Functions	0	1	1	4	2	0
Operations Total	0	10	14	17	10	0

Quality, Cost & Delivery	L0	L1	L2	L3	L4	L5
A. Quality	0	0	1	2	1	1
B. Cost & Productivity	0	0	0	3	4	1
C. Delivery	0	0	0	1	3	1
Q,C,D Total	0	0	1	6	8	3

Business Results	L0	L1	L2	L3	L4	L5
A. Customer Satisfaction	0	0	0	1	4	0
B. Profitability	0	0	0	1	4	0
Business Results Total	0	0	0	2	8	0

TOTAL POINTS	3	21	21	26	26	3

Figure 12: Sample Level Report

As you can see from the example in Figure 12, the gray areas indicate which areas the site needs to address first, as those areas are only at Current Level 0. Similar to the colors in Table 5, each of the colors represent different Current Levels. Orange = Current Level 1, Yellow = Current Level 2, Light Green = Current Level 3, Dark Green = Current Level 4, and Blue = Current Level 5.

4.4.2. Prioritized Improvement Opportunities

The second method to understand the assessment is by reviewing the list of prioritized opportunities. This is the list generated by using the method described in section 4.3.5. As mentioned earlier, high priority opportunities are those which have lower current scores. In the fictitious example in Table 6, the Leader Standard Work was high on the list because its current level is a Level 0, as it scored low on a low level question. Since this is a foundational question,

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the site should prioritize this area to be one of the first to improve as other more advanced Lean concepts will build upon this solid foundation.

Index	Category	Sub Category	Sub Index	Question	Level	Current Score	Current Level	Evidence	Improvement Opportunities
7	1. Leadership	A. Leadership	7	Leaders Standard Work	1	0	L0	(Sample evidence)	(Sample Improvement Opportunity)
9	1. Leadership	B. Empowerment	1	Qualified People	1	0	L0	(Sample evidence)	(Sample Improvement Opportunity)
10	1. Leadership	B. Empowerment	2	Incentive alignment	1	0	L0	(Sample evidence)	(Sample Improvement Opportunity)
1	1. Leadership	A. Leadership	1	Corporate World Class Vision	1	1	L1	(Sample evidence)	(Sample Improvement Opportunity)
2	1. Leadership	A. Leadership	2	Facility Mission Statement	1	1	L1	(Sample evidence)	(Sample Improvement Opportunity)
3	1. Leadership	A. Leadership	3	Lean learning by Leadership	1	1	L1	(Sample evidence)	(Sample Improvement Opportunity)
8	1. Leadership	A. Leadership	8	Leadership Involved in Safety	1	1	L1	(Sample evidence)	(Sample Improvement Opportunity)
13	1. Leadership	B. Empowerment	5	Continuous Improvement Training (annual days / employee)	1	1	L1	(sample evidence)	(Sample Improvement Opportunity)
23	2. Ops	A. Ops Strategy	2	1 Year Strategic Plan	1	1	L1	(Sample evidence)	(Sample Improvement Opportunity)
44	2. Ops	D. Processes	3	Continuous Improvement Project Selection	1	1	L1	(Sample evidence)	(Sample Improvement Opportunity)
45	2. Ops	D. Processes	4	Standard Methods	1	1	L1	(Sample evidence)	(Sample Improvement Opportunity)

Table 6: Sample Prioritized Opportunities List

4.4.3. Identified Best Practices

The third area of focus for the assessment is to identify best practices. The assessment is useful in this regard because it is able to identify strengths of each site. This is important for two reasons. First, this allows the sites to recognize and celebrate their accomplishments, and second this allows DAO to highlight best practices so other sites can learn and improve.

This process works by resorting the Action Plan list. The Best Practices will be those that are rated a level 5. In Table 7 a fictitious Best Practice list is shown. In this case, these four questions this sample site has done well in, and are possibly areas which other facilities need help.

Index	Category	Sub Category	Sub Index	Question	Level	Current Score	Current Level	Evidence	Improvement Opportunities
65	2. Ops	E. Support	1	Support Leadership & Participation	1	5	L3	(Sample evidence)	(Sample Improvement Opportunity)
34	2. Ops	C. Suppliers	3	Integration of upstream internal suppliers	2	5	L4	(Sample evidence)	(Sample Improvement Opportunity)
38	2. Ops	C. Suppliers	7	Integration of downstream internal customer	2	5	L4	(Sample evidence)	(Sample Improvement Opportunity)
66	2. Ops	E. Support	2	Lean Learning by support functions of organization	2	5	L4	(Sample evidence)	(Sample Improvement Opportunity)

Table 7: Sample Best Practices

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5. Piloting the Dell Business Assessment

5.1. Pilot Overview and Objectives

In the fall of 2007, a pilot program was run at five DAO facilities. There were three main goals of this pilot program. The first goal was training. The team needed to introduce the Dell Business Assessment to these sites, train the facilitators, and train the personnel on how to use the DBA and interpret the results. The sites were all new to this assessment tool, so it was important to properly introduce and train them before the tool was officially implemented. Also, since this tool was developed mostly by two members of the Lean Consultant team, this pilot process was a way for the remaining Lean Consultants to gain a deeper understanding of how the tool works. This also provided a chance for the Lean Consultants and facility teams to give feedback, as they will be responsible for the future use of the tool.

The second goal was to test the tool out and gather feedback on the questions, the process and the effectiveness. By actually trying it out, the team acquired a better understanding of what works and what does not. This valuable feedback provided a better understanding of how to run an assessment, and what makes sense and doesn't make sense within the content.

Third, the pilot was important to get a first set of preliminary baseline data on the sites. This is useful so the Lean Consultant team has a better understanding of where each site is relative to one another, and where the team can focus their energy. This also helped document the current situation of these facilities as there is significant amounts of informal knowledge about the sites, but very little of this knowledge is documented.

The first pilot site was the Winston-Salem, North Carolina facility. This was essentially an alpha test. The team immediately gathered large amounts of feedback. With this feedback, the team spent many weeks revising the process, the content and the training of the DBA.

The second step was to pilot at two sites in Nashville, Tennessee. Both of these assessments went smoother, and once again valuable feedback was gained on the process and content. Finally, after another week of revisions, the last two sites in Austin, Texas were piloted. This gave the team two final data baseline points and additional feedback on the tool.

At the end of the pilot program, the team had trained all five sites in the usage and interpretation of the DBA, significant feedback was gathered, and five baseline data points were established.

5.2. Pilot Training and Pilot Process

5.2.1. Pilot Training Sessions

All five sites were trained. Due to some scheduling and communication problems, some sites had better attendance than other. All the site leadership teams have at least been briefed on what the assessment is, how it works, and how it will be used. However, as the assessment plays a larger role in the lean transformation, it will become important to train more people in understanding and participating in the assessment.

5.2.2. Pilot Assessment Execution

The assessment pilots were executed with very small teams. Since this was a pilot, the focus was put on learning how the tool will be used, and how the well the questions are understood and rated. Because of this, the teams were kept small in order to receive candid feedback and to not waste the time of a large team when discussing fine details.

To help facilitate the pilot process, at the beginning of each pilot session, ground rules were set. The first was that the team was not there to re-write the tool, but to do the best job they could to answer the questions as is. This was important because one of the objectives of this pilot was to have a consistent baseline of each site. Thus, only small clerical and typographical clarifications were made between sites. However, every time there was a misunderstanding or feedback about the rating system, there notes were taken to ensure this feedback was not lost.

Since some of these sites have multiple lines of business, a second ground rule was set to use the lowest score within the site for each rating. To give the higher performing lines of business credit, the differences were noted in the comment section as to document the differences.

5.3. Pilot Assessment Results Interpretation

5.3.1. Scorecard comparison

To help understand the current situation of Dell's sites, a comparison of the three Desktop Manufacturing sites is presented in Table 8. For confidentiality purposes, the points for each section have been normalized to Site A representing 100%. This comparison shows that the overall score ranged a total of only 13%. This is a tight distribution, however there was some significant variation in how the scores added up. In this example, Site A was better in Quality, Cost and Delivery score as compared to Site C, but Site C is doing a much better job with their Leadership team.

Point Breakdown	Site A	Site B	Site C
Total Initial Score	100%	108%	95%
- Leadership Score	100%	117%	117%
- Operations Score	100%	110%	96%
- Q,C,D Score	100%	87%	73%
- Business Score	100%	127%	73%

Table 8: Pilot Scorecard Comparison

5.3.2. Best Practices / Common Deficiencies Identified

In the pilot, there were important differences discovered between sites. Each site has its own strengths and its own weaknesses. This is important as each site's strengths can be documented as a best practice and shared with sites weaker in those areas. Similarly, a site which has identified a particular deficiency area should seek the advice and knowledge sharing of another

site which is good that area. The fabricated data in Table 9 demonstrates this effect. The assessment has shown Site A is proficient at Value Stream Mapping, while Site B is identified as needing help in this area. Similarly, Site B has identified Standard Methods as a strength, and has an opportunity to help Site A which has Standard Methods as an important area to improve.

Table 9: Comparison of Best Practices

Another important benefit from this assessment comparison is the ability to isolate areas which all sites are deficient in. This is important because it identifies areas which might be systematic problems within the company. These are areas where a high level resource will need to investigate. As another fictitious example, Table 10 shows the top three improvement opportunities that a company might see.

Table 10: Identifying Common Deficiencies

The solve the problem, a central resource might need to create new training, hire new expertise or create a new organizational structures to ensure this company wide problem is addressed.

5.4. Lessons Learned from Pilot

There were many lessons learned from the pilot. First, the questions and ratings were tested, and many questions were either deemed "too difficult", "too easy", "off-scope" or confusing. This feedback is incredibly valuable and after documenting these comments, the assessment tool will be updated for the next round of assessments.

Second, it was important to understand the assessment execution timing. This was difficult to estimate beforehand, and only after performing a few assessments did this become clear. On average, each question took about four minutes to reach a team consensus rating. This will likely shorten as the teams become more familiar with the questions and the teams become more efficient on how determine a team consensus rating.

Understanding the timing also helped set expectations for the sites, so the right people knew when they needed to be there, and when they could focus on their other tasks. This also helped the team plan out when breaks should be taken to minimize disruption.

Third, the assessment validated that the tool is useful and can provide useful information. While the data was taken with a small team and the tool still needs revisions, it was clear that the results came in very similar to what was generally understood with each site. Virtually everything that came out of the assessment results was what the leadership team already knew. However, it was now documented in a standard way and visible to the teams. By reviewing the sites together, best practices became obvious, as were deficiencies and more importantly common deficiencies.

Lastly, there was variation in how ratings were assessed. Despite attempts to keep the training and facilitation consistent, assessment teams had some authority to make their own assessments. This is mostly due to fact that the assessment teams had differing levels of expertise from site to site. Those with more expertise in an area tended to score that area higher. However, the total amount of expertise in each assessment team tended to be similar so despite score differences in each section, there were similarities in the aggregate score.

5.5. Results Validation

Since this assessment will be used for the purpose of improving the business, it is important to know how assessment results will affect the business and the bottom line. Despite the immense effort in making the DBA about measuring how good the business processes are, and how lean the facility is, there is a possibility that these efforts will not return a measureable result. This section focuses on how well the pilot results correlated with Dell's commonly used metrics, and how well the results correlate with subjective observations.

5.5.1. Correlation with Business Metrics

Dell uses a set of metrics to examine its productivity and costs across its facilities. To take an initial look at correlations, the entire set of metrics were correlated with the results of the assessment pilot. A recent 6 month time frame was used to be reflective of current conditions and to lessen any short term effects that might exist. Also, due to product differences between the facilities, only the three most similar sites were chosen for the correlation study, as facility cost and productivity vary tremendously based on the product line and mix.

The results of the correlation study indicate there is little correlation between the pilot results and the set of cost and productivity metrics. As an example, for productivity, the correlation between the DBA result and a key productivity metric only showed a R^2 value was 0.1211. For a key cost metric, the correlation only had an R^2 value of 0.0025.

Having no clear correlation after the Pilot phase , is not entirely unexpected. There were only three data points from the pilot, and there was variation in size of the pilot assessment teams, the expertise of these teams, and the manner in which these teams went through the assessment process.

Also, the DBA is not expected to 100% correlate with these traditional cost and productivity metrics. Having a Lean facility should decrease the cost and productivity of a site, but it will also make improvements in other factors such as flexibility or employee satisfaction that might not make noticeable effects in the facility cost and productivity metrics. The DBA is designed to

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measure all these factors that should increase the overall competitiveness of the facility, whereas these commonly used cost and productivity metrics only measure the competitiveness of cost and productivity. After all, if they did include everything necessary to improve the facility, there would be no need for a Lean transformation or the DBA.

However, the author does expect the correlation to improve over time and eventually reach a moderate level. The tool and the process are still undergoing improvements. As the tool is used more times, familiarity will build, the assessment team within each site will become more consistent, and the facilitators between sites will become more consistent. All of these combined will lead to more consistent results and thus better understanding of how the assessment results relate to Dell's commonly used metrics. Based on observed Lean learning rates at Dell, and the amount of interest this tool is receiving, the author feels that moving up this learning curve will likely take 3 or 4 iterations.

5.5.2. Subjective Correlation

An alternative method of validation is to check to see if subjective observations and impressions match the assessment scores. While there was no subjective data taken, there are significant observations and impressions from the Author's visits to each of the five facilities. Impressions stem from interviews with site leaders and team members, Gemba walks around each site, and from facilitating DBA training and assessments.

In general, the observed average and standard deviation of Lean maturity is consistent with the pilot results. Some are better than others, but the range is less than a hundred points. The main difference is the order in which the scores came out. From the subjective observations, some of the lower sites should have scored better, and some of the better sites should have scored worse. The reasoning behind this is not clear. Some of the reasons above in section 5.5.1 still apply, the pilot assessments were inconsistent and the observations might not be indicative of what is really happening. Similarly, the author predicts the subjective impressions will continue to improve in a similar fashion to increases in assessment scores.

5.6. Recommended Next Steps for Dell

5.6.1. Improvement Suggestions for the Dell Business Assessment

There are five improvement recommendations for the Dell Business Assessment tool. First, it is important to incorporate the DBA tool usage feedback from the pilot and subsequent assessments. The tool is not perfectly written and needs the continuous improvement to improve the quality of its results. This is also vital to gain confidence from the facilities that the assessment reflects practical operations reality and not ivory tower theory. The more the facilities feel that their input is being incorporated, the more ownership they will take in the assessment and execution.

Second, the process of executing the assessment has room for improvement. As the definitions become clearer through rewording questions and through familiarity, the assessment should move faster. However, there are still many variables that can be optimized to ensure a quick and effective assessment. There is an optimal value to each of these variables such as the order questions should be answered, the time when breaks should be taken, and the list of which team members are best suited and necessary to answer each question. The one method to find these optimal values would be to use the PDCA cycle.

Third, once the team feels the sites have a firm understanding of the basic concepts of lean, the tool should start to be realigned with the new Shingo Model. As Hallam concluded, the lean enterprise will give a greater competitive advantage than just a series of lean plants. But there are two reasons why this should not be done immediately. First, since the current model just rolled out, a large immediate change would be very disruptive and this instability will make both Lean and the DBA lose credibility. This instability will also make it more difficult to make improvements and validate the entire model. Second, since Dell is still early in its Lean transformation, there is still a lot to be learned on the plant level. Starting to look at an enterprise level too early will divert the team's focus. However, after some stability has been established and the teams are more comfortable with the DBA, there an alignment with the new Shingo criteria will help Dell and the sites to start thinking about the lean enterprise, and it will re-achieve an external calibration, as originally desired.

Fourth, when sites are comfortable, they should apply for an external assessment. This could be from Shingo, Baldrige, or some other method. The purpose of this is to learn and gaining valuable feedback on areas where the site or company maybe blind to. As mentioned in the Baldrige section, one Baldrige judge estimates that 30% of the feedback included information on best practices and vulnerabilities that the company would not have seen otherwise.

This does not necessarily need to happen soon and it does not necessarily need to be for an award. But the knowledge gained from objective fresh-eyes will be valuable and otherwise not observable by insiders. An intermediate form of this might be an audit from experts within Dell that are not knowledgeable with a particular site.

Finally, as Dell continues to increase its business outside of the Americas, it is important to work with worldwide team to create a universal Dell Business Assessment. The DBA was designed to be global, but it was designed in the U.S., and so far has only been piloted in the U.S. As seen in recent financial reports, worldwide sales are on a growth path. Thus using the same universal assessment tool will enable greater consistency throughout Dell's global operations, and make identification and sharing of best practices easier. This will lead to faster dispersion of process innovations and will increase the competitiveness of the company.

5.6.2. Usage of Assessment within DAO

Within DAO, it is important to continue to use and improve the DBA. As with the original plan, DAO should continue to make assessments of each of its facilities every six months. Having a Check every six months will provide a good balance of enough time to implement new processes and continuous improvement events, but not too much time so that there are too many changes made that each effect cannot be isolated and understood. Also, if this assessment happens any quicker, it will start to take up too much time from the leadership team, and that can be counterproductive.

However, in order to make sure assessments are done regularly, a key enabler is getting the act of using the Dell Business Assessment incorporated into the facility Hoshin plan, as the Hoshin plan is the key strategic plan for the facility. This is consistent with Hallam's findings that

integrated feedback mechanisms lead to more maturity than disassociated feedback mechanisms. Without the assessment as a key part of the facility improvement strategy, it will become an ad hoc plan and might not be utilized. Since the assessment helps focus the priorities and resources of the facility, it is important the assessment is on the plan, integrated with the other critical activities for the next 1-3 years. With assessments as part of the facility Hoshin plan, assessment time should be scheduled at the beginning of each fiscal year to ensure attendance and consistency.

Additionally, it is important that any action plans that come out of assessments are also tracked either in the Hoshin plan or in some other commonly used tracking matrix. Again, this is consistent with Hallam's findings on integrated feedback mechanisms. Without the action plans as a key part of the facility improvement strategy, they will have to compete with those actions on the Hoshin plan, and might not be utilized. By integrating these actions with existing planning tools, it will create an integrated closed-loop feedback mechanism, and will help increase maturity faster.

5.6.3. DAO as a whole

For the facilities within Dell America's Operations to succeed, it is important that the DAO executive team demonstrate its leadership commitment to Lean as it is necessary for success. There is a strong correlation between leadership commitment and the effectiveness of Lean tools such as TQM, JIT and TPM (Cua, 2001). Thus, the DAO leadership needs to get involved and help facilitate the Lean learning cycle and the use of the DBA. A top-down approach concurrent with the bottom-up approach will complement existing efforts and help further increase lean maturity. Commitment and facilitation from DAO executives is important to ensure that the tool is used and that follow-up actions take place. Facilitation can be demonstrated in a few different ways. First, it is important to include DAO assessment objectives into the DAO Hoshin plan. This might include number of assessments, level certifications (ie all sites have no Current Level 0 areas by end of FY08) or percentage improvement targets. By documenting this into the Hoshin, it will be on everyone's objectives.

Second, the DAO leadership needs to help create and facilitate a learning organization. Creating a learning organization is the key to getting the most out of benchmarking activities (Voss, 1997), and a necessary component to have Lean manufacturing work (Flinchbaugh, 2004). DAO can help facilitate learning by monitor assessment, and make sure facilities are following through the PDCA cycle with improvement suggestions. While it is not necessary to closely monitor every action taken, it is important to encourage and help facilities to take improvement actions. Since Lean is still relatively new to most parties, assisting facilities will help everyone further their Lean proficiency. One way DAO could support the facilities, is by helping document and share best practices. While this might be best suited for facility personnel, it might be difficult for facilities to allocate sufficient resources to meet the desired rate of improvement. Thus, having a centralized role could be the most effective method to help all the sites improve.

Third, DAO needs to address any company wide deficiencies identified. From the assessment pilot, there are certain areas that all sites have struggled with. For those areas, it would be useful for a centralized DAO representative to spend some time trying to develop a solution. This representative maybe best suited to sit on a particular site to develop a solution, but the centralized role is important because there is likely a systemic issue within the organization that someone without a centralized view will have a difficult time solving.

5.6.4. Dell as an Enterprise

As an entire Enterprise, Dell can still make many improvements with the use of this assessment. While it is clear that Desktop sales are slowing and there is facility consolidation in the Americas, there are still many opportunities to implement Lean and the Dell Business Assessment both inside and outside of the Americas. Within the Americas, there has been some work done in the fulfillment centers and returns and refurbishment centers, but further work can be done in the sales operations and call centers. This will advance Dell's knowledge on how to implement lean, and it will also provide the beginnings of an enterprise perspective.

Additionally, there has been some work done with Dell Asia Pacific and Dell Europe. As these areas will continue to grow, becoming Lean will have a larger effect. In these areas, Dell needs

to make sure there are good open and clear lines of communication between the different operations teams. A consistent standard for Lean with significant best practice sharing will help prepare Dell to become more competitive. Developing a worldwide standard will not be easy, but consistency will be vital in helping out all parties become Leaner.

Once the company has a solid foundation in understanding Lean and the DBA within its operations, Dell should start assessing itself at an enterprise level. This will help identify more, larger scale opportunities for Dell to become Lean throughout the company. While this might be done with the LESAT, the new Shingo Prize model or some other method, a lean enterprise perspective will help Dell obtain more effective and sustainable results than just a lean manufacturing facility strategy.

6. Conclusion

There is currently inconclusive evidence that using a Lean assessment tool will turn into positive sustainable financial results. The Malcolm Baldrige National Quality award has had mixed results in its financial studies. Hallam's (2003) research on LESAT gave many interesting correlations related to lean enterprises, but not much information on sustained financial results. The Shingo results at first appear to be significant for winning plants, but as Baudin (2006) describes, in the case of Delphi do not take into account deeper troubles with the company.

Despite these inconclusive financial results, there are other important benefits that come with assessment tools. Beyond the actual assessment results, the process itself can provide tremendous learning, as seen with the LESAT. The creation of a common vocabulary is useful and has the added effect of increasing communications between groups and individuals (Hallam, 2003). On the other hand, when an assessment is external, the feedback given can provide valuable new information that the applicants would not have otherwise found on their own, as seen with Baldrige applicants (Babicz, 2002).

How a Lean transformation and Lean assessment are implemented is vital. Without a Leadership commitment, a learning culture and a feedback mechanism, Lean transformation and assessment will not be as effective. As Cua et al. (2001) found, a strong leadership commitment is highly correlated to the effective use of Lean tools. Similarly, Hallam (2003) found, a strong leadership commitment is necessary when pursuing a Lean enterprise.

Developing a learning culture is also important when implementing a Lean transformation and Lean assessment. A learning culture will better internalize the results from assessment and can use that to improve the company. As Voss et al. (1997) found, assessment and benchmarking is a vital part of a learning companies toolset, as it helps identify strengths and weaknesses, which in turn will benefit performance. Similarly, Flinchbaugh (2004) has found a strong relationship between success in Lean Manufacturing and a learning culture. Rather than focusing only on

implementing lean tools, learning cultures will focus on lean concepts and thus will have more success implementing Lean tools.

Having an effective feedback mechanism can further help implement Lean. As Hallam (2003) concluded, enterprises with an integrated closed loop feedback mechanism, tend to have higher maturity in their *Leadership/Transformational* processes and in their *Lifecycle* processes than those with conflicting closed loop processes or open loop processes. In this thesis the Dell learning cycle is shown as another example of this integrated feedback loop.

Also, having an enterprise focus can help the effectiveness of the assessment tool. As Hallam noted, many plant level lean changes are "islands of success" as they have minimal impact on overall program costs and schedules. Transforming lean manufacturing sites are a good starting point for beginning the Lean journey, as it is an easier method to learn and build expertise. However, it will not be able to have the large scale effects that a Lean enterprise focus can provide. So, once a company has a solid foundation in understanding Lean and the DBA within its operations, it should start assessing itself at an enterprise level. This will help identify more, larger scale opportunities for companies to become Lean throughout the company.

While it is still too early to see how the assessment tool will affect Dell's bottom line, carefully executing the DBA can provide feedback during Dell's Lean transformation. With strong leadership team, a learning culture, an integrated closed loop process and an enterprise focus, Dell can increase its understanding of Lean, and can continue to improve the company.

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Appendix: The Dell Business Assessment Tool

DELL Business Assessment Tool

Facility: Sample Site
Visit Date: December 14, 2007

I. Leadership Culture & Infrastructure

A. Leadership - This subsection evaluates how well the leadership team sets the organization's direction in alignment with the company's goals and creates the organizational culture and infrastructure to achieve world class results.

LEVEL	1	L0	L1	L1	L2	L2	L3	Currently :	L2
Question	Desired Behavior	0	1	2	3	4	5	RATING	
1 Corporate World Class Vision	Enterprise has defined where it wants to be in the future; long range goals.	No evidence	A vision statement for the business exists.	in between	Vision statement is visible and communicated to team	in between	Leadership team champions vision and policies and practices are consistent with vision	3	
Evidence	Evidence								
Improvement Opportunities	Improvement Opportunities								

LEVEL	1	L0	L1	L1	L2	L2	L3	Currently :	L2
Question	Desired Behavior	0	1	2	3	4	5	RATING	
2 Facility Mission Statement	Facility has defined its fundamental purpose within the company	No Evidence	A mission statement is developed and championed by facility leadership and is visible and communicated to the team	in between	Facility mission is aligned with enterprise vision.	in between	A process is in place to periodically evaluate the mission statement	3	
Evidence	Evidence								
Improvement Opportunities	Improvement Opportunities								

LEVEL	1	L0	L1	L1	L2	L2	L3	Currently :	L2
Question	Desired Behavior	0	1	2	3	4	5	RATING	
3 Lean learning by Leadership	Leadership team actively is continually learning by teaching and practicing lean principles	No Evidence	Leaders participate in annual lean compliance training	in between	Leaders participate (1/qtr) in continuous improvement events and meet monthly with a Lean Consultant	in between	Leaders lead continuous improvement events and participate in benchmarking activities with other companies	3	
Evidence	Evidence								
Improvement Opportunities	Improvement Opportunities								

LEVEL	1	L0	L1	L1	L2	L2	L3	Currently :	L2
Question	Desired Behavior	0	1	2	3	4	5	RATING	
4 Lean Accountability	Leadership team is held accountable for delivering lean behaviors	No Evidence	Some team performance plans include Lean deliverables.	in between	All leadership (people managers) have performance plans with lean deliverables.	in between	All employees have performance plans with lean deliverables.	3	
Evidence	Evidence								
Improvement Opportunities	Improvement Opportunities								

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LEVEL		1	L0	L1	L1	L2	L2	L3	Currrently :	L2
	Question	Desired Behavior	0	1	2	3	4	5	RATING	
5	**Commit resources for lean improvements**	There are sufficient resources allocated for lean improvements - Lean Consultants and Lean Change Agents	No full time resources committed to supporting continuous improvement	One full time resource committed to supporting site and lean change agents <1% population	in between	**Full time resources allocated at a ratio of 1:500 employees to support site and lean change agents 1%-3% population**	in between	Full time resources allocated at a ratio of 1:200 employees and lean change agents >3% population	3	
	Evidence (prework)	Evidence -								
	Improvement Opportunities	Improvement Opportunities								

LEVEL		1	L0	L1	L1	L2	L2	L3	Currrently :	L2
	Question	Desired Behavior	0	1	2	3	4	5	RATING	
6	**Project Governance Process**	A cross-functional governance process exists in alignment with the Hoshin plan;	No project reviews	Each project has a review for each separate function	in between	**Cross-functional governance process to check progress of projects against plan, and to help adjust as necessary**	in between	Upon completion of project, best practices are shared with all factories, and results are monitored for a full year to ensure sustained results	3	
	Evidence	Evidence								
	Improvement Opportunities	Improvement Opportunities								

LEVEL		1	L0	L1	L1	L2	L2	L3	Currrently :	L2
	Question	Desired Behavior	0	1	2	3	4	5	RATING	
7	**Leaders Standard Work**	Leaders within the facility have standard work aligned with their roles and responsibilities	Leader Standard Work is not defined	Operations Leader Standard Work is established for all levels of the organization within facility	in between	**Leader Standard Work is established for non-operational functions within facility**	in between	Facility Leader Standard Work is regularly reviewed for continuous improvement and is aligned with Executive Standard Work.	3	
	Evidence	Evidence								
	Improvement Opportunities	Improvement Opportunities								

LEVEL		1	L0	L1	L1	L2	L2	L3	Currrently :	L2
	Question	Desired Behavior	0	1	2	3	4	5	RATING	
8	**Leadership Involved in Safety**	The facility leadership team is actively helping improve employee safety and working conditions.	Leadership occasionally reviews safety reports	Leadership participates in reoccurring safety observation tours	in between	**Cross-functional Plant Safety Review Board meets regularly and uses a closed looped process to implement and sustain safety measures with improved results.**	in between	Communications of best practices, performance, objectives within facility and between facilities	3	
	Evidence	Evidence								
	Improvement Opportunities	Improvement Opportunities								

Leadership Total		**L2 = 8**

Examiners: Person A, Person B, Person C, Person D, Person E

B. Empowerment - This subsection evaluates employee involvement and how well the environment develops and utilizes each person's abilities. A leadership team committed to its employees will have a safe, happy and productive team achieving the organization's objectives.

LEVEL	1	L0	L1	L1	L2	L2	L3	Currrently :	L2
Question	Desired Behavior	0	1	2	3	4	5	RATING	
1 Qualified People	Team members are qualified to perform their job and are being developed for advancement.	Hirings and Promotions are not based on necessary skill set.	Required competencies are defined, communicated and understood for each level of the organization	in between	Hiring/promotion selection process is in place based on identified competencies	in between	A development process is in place that helps individuals acquire new competencies	3	
Evidence	Evidence								
Improvement Opportunities	Improvement Opportunities								

LEVEL	1	L0	L1	L1	L2	L2	L3	Currrently :	L2
Question	Desired Behavior	0	1	2	3	4	5	RATING	
2 Incentive alignment	Incentives and rewards aligned with lean behaviors	Incentives are based on productivity	Incentives are based on individual performance metrics (Q, C, D, S)	in between	Incentives are based on team/department performance metrics WITHOUT direct alignment to Hoshin	in between	Incentives are based on team/department performance metrics WITH clear alignment to Hoshin	3	
Evidence	Evidence								
Improvement Opportunities	Improvement Opportunities								

LEVEL	1	L0	L1	L1	L2	L2	L3	Currrently :	L2
Question	Desired Behavior	0	1	2	3	4	5	RATING	
3 Open Communication Channels	Vertical & horizontal communication channels exist and formal / informal communications occur frequently.	No Evidence	Regularly scheduled meetings to discuss team issues, company performance and open issues	in between	Leadership demonstrates open communications skills (accessibility, active listening, floor presence)	in between	Leaders open forum discussion (round tables/town hall) with follow-up actions promptly addressed	3	
Evidence	Evidence								
Improvement Opportunities	Improvement Opportunities								

LEVEL	1	L0	L1	L1	L2	L2	L3	Currrently :	L2
Question	Desired Behavior	0	1	2	3	4	5	RATING	
4 Information Passdown	Important information and business results are passdown from top to bottom quickly and consistently	No evidence of standard communications	Structured process in place to quickly disseminate information (newsletters, TV monitors, Andon boards, emails...)	in between	Leaders communicate business results to all employees quarterly	in between	There is a process to check passdown effectiveness and to improve information passdown	3	
Evidence	Evidence								
Improvement Opportunities	Improvement Opportunities								

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LEVEL	1	L0	L1	L1	L2	L2	L3	Currrently: L2
Question	Desired Behavior	0	1	2	3	4	5	RATING
5 Continuous Improvement Training (annual hours / employee)	Employees trained in continuous improvement and development activities, and sufficient resources support training	Training plans do not exist for all team members	0 - 16 hours / employee / year	17-24 hrs / emp / yr	25-40 hours / employee / year	40 - 79 hrs / emp / yr	>80 hours / employee / year	3

Evidence (prework)	Evidence -

Improvement Opportunities	Improvement Opportunities

LEVEL	1	L0	L1	L1	L2	L2	L3	Currrently: L2
Question	Desired Behavior	0	1	2	3	4	5	RATING
6 Simple Continuous Improvement	Employees throughout the organization are empowered to make simple continuous improvement suggestions	No way for employees to implement ideas	There is a process for teammate to make improvement suggestions, and are rewarded for them.	in between	Suggestion approvals are decided within 1 week, and pilots are started within 2 weeks.	in between	Teammates conduct daily kaizen with work teams	3

Evidence	Evidence

Improvement Opportunities	Improvement Opportunities

LEVEL	1	L0	L1	L1	L2	L2	L3	Currrently: L2
Question	Desired Behavior	0	1	2	3	4	5	RATING
7 Continuous Improvement Events	Continuous improvement projects (kaizen, BPI, GDI) occur often enough to meet business improvement goals.	No schedule of CI activity	1 event / month for every 500 employees	1 / mth / 400 empls	1 event / month for every 300 employees	1 / mth / 200 empls	1 event / month for every 100 employees	3

Evidence (prework)	Evidence						#DIV/0!	employee-months / event

Improvement Opportunities	Improvement Opportunities

LEVEL	1	L0	L1	L1	L2	L2	L3	Currrently: L2
Question	Desired Behavior	0	1	2	3	4	5	RATING
8 Continuous Improvement Participation	All employees participate in continuous improvement activities such as Lean, BPI, SIG or other.	No goal for employee participation	< 20% participation	20% - 40% participation	40% - 60% participation	60% - 80% participation	> 80% participation	3

Evidence (prework)	Evidence

Improvement Opportunities	Improvement Opportunities

Empower Total		L2 = 8

98

C. Environmental Health & Safety

LEVEL	1	L0	L1	L1	L2	L2	L3	Currrently :	L2
Question	Desired Behavior	0	1	2	3	4	5	RATING	
1 Proactive Safety	Safety and Ergonomics are actively examined and improved prior to any incidents.	No Evidence of a proactive safety program	BBS / First aid / OSHA / near misses collected, documented and tracked. New Employee, Contractor and Visitor Orientation		Process for team members to raise concerns, and process to address all concerns with root cause / 5 why analysis		Safety concerns are raised and addressed during process design. Evidence of safety improvements.	3	
Evidence	Evidence								
Improvement Opportunities	Improvement Opportunities								

LEVEL	2	L1	L2	L2	L3	L3	L4	Currrently :	L3
Question	Desired Behavior	0	1	2	3	4	5	RATING	
2 Ergonomics	Teammates can complete their work in an ergonomically sound manner	No evidence	Ergonomics training for everyone.		Process to raise, address, correct and sustain ergonomic concerns		Processes designed with ergonomics in mind. Noise levels are controlled and continually reduced	3	
Evidence	Evidence								
Improvement Opportunities	Improvement Opportunities								

LEVEL	2	L1	L2	L2	L3	L3	L4	Currrently :	L3
Question	Desired Behavior	0	1	2	3	4	5	RATING	
3 Plant Safety Results (OSHA Recordable Rate)	The facility is a safe and hazard free work environment	>2.4	1.7 - 2.4	1.3 - 1.7	0.9 - 1.3	0.5 - 0.9	<0.5	3	
Evidence (prework)	Evidence								
Improvement Opportunities	Improvement Opportunities								

LEVEL	2	L1	L2	L2	L3	L3	L4	Currrently :	L3
Question	Desired Behavior	0	1	2	3	4	5	RATING	
4 Environmental initiatives	Environmental Initiatives such as ISO 14001 exist.	No environmental initiatives	ISO14001 certified; Frequent findings & non-conformances during audits;		ISO14001 certified; Evidence of projects to reduce waste and waste streams, recycling and emissions;		ISO14001 certified; Support of community environmental initiatives and projects that impact the local area	3	
Evidence	Evidence								
Improvement Opportunities	Improvement Opportunities								

LEVEL	2	L1	L2	L2	L3	L3	L4	Currrently :	L3
Question	Desired Behavior	0	1	2	3	4	5	RATING	
5 Community initiatives	Team is involved in local community	No evidence	Company donates money to local charities		>50% Participation in community, social services, educational activities.		>75% Participation in community, social services, educational activity.	3	
Evidence (prework)	Evidence								
Improvement Opportunities	Improvement Opportunities								

EHS Total		L2 = 1	L3 = 4

Examiners: Person A, Person B, Person C, Person D, Person E, Person F

II Operations Strategy & Systems Integrations - This section focuses on core operations strategy, practices and organizational techniques, including the total value chain.

A. Operation Strategy - This subsection requires an outline of the operations strategy as it relates to the selection and use of the methods, systems and processes detailed in sections B, C and D.

LEVEL	1	L0	L1	L1	L2	L2	L3	Currrently :	L2
Question	Desired Behavior	0	1	2	3	4	5	RATING	
1 **3 Year Strategic Plan**	Facility develops a 3 Year Strategic Plan with the PDCA approach, and reviews it often.	No Evidence	Facility has a 3 year plan aligned with DAO 3-year plan		**Facility uses an x-matrix to determine one year plan**		Facility uses PDCA approach to review adjust 3 year plan once every 6 months	3	
Evidence	Evidence								
Improvement Opportunities	Improvement Opportunity								

LEVEL	1	L0	L1	L1	L2	L2	L3	Currrently :	L2
Question	Desired Behavior	0	1	2	3	4	5	RATING	
2 **1 Year Strategic Plan**	Facility develops a 1 Year Strategic Plan with the PDCA approach, and reviews it often	No Evidence	Facility has a 1 year strategic plan aligned with 3-yr plan and progress is checked quarterly		**Department and team annual plans are aligned throughout organization and posted in a visible location.**		Each plan is developed with team and supplier involvement and resources are sufficient to execute.	3	
Evidence	Evidence								
Improvement Opportunities	Improvement Opportunity								

LEVEL	1	L0	L1	L1	L2	L2	L3	Currrently :	L2
Question	Desired Behavior	0	1	2	3	4	5	RATING	
3 **Value Stream Mapping**	Value streams are visible and consistently refined to accommodate a changing environment.	No evidence	Current & future state map exists for the business unit.		**Action plans in progress and checked via goverence process**		Current & future state maps exist for all product families and action plans in progress and checked regularly	3	
Evidence	Evidence								
Improvement Opportunities	Improvement Opportunity								

LEVEL	2	L1	L2	L2	L3	L3	L4	Currrently :	L3
Question	Desired Behavior	0	1	2	3	4	5	RATING	
4 **Use of Assessment Tool**	A Facility uses this assessment tool often and regularly to track Lean transformation progress.	Internal Assessment < 1/yr	Internal Assessment (only people from within facility) 1/yr		**External Assessment (outside facility, within Dell) 1/yr**		External Assessment (outside facility, within Dell) every 6 months	3	
Evidence	Evidence								
Improvement Opportunities	Improvement Opportunity								

LEVEL	3	L2	L3	L3	L4	L4	L5	Currrently :	L4
Question	Desired Behavior	0	1	2	3	4	5	RATING	
5 **Organization by Value Stream**	Cross-functional teams are organized by value stream across the extended business	The enterprise operates as functional silos.	Value Streams are identified and action plans to put into place to reorganize		**Cross-functional teams organized by value stream exist in business unit**		Cross-functional teams organized by value stream extend throughout enterprise	3	
Evidence	Evidence								
Improvement Opportunities	Improvement Opportunity								

Strategy Total		**L2 = 3**	**L3 = 1**	**L4 = 1**

B. Innovations in Market Service & Product - This subsection evaluates an organization's approach and success in product and market innovation -in reducing cost and improving value to the customer or in new product design & development.

LEVEL	1	L0	L1	L1	L2	L2	L3	Currrently :	L2
Question	Desired Behavior	0	1	2	3	4	5	RATING	
1 Quality Standards	Quality Standards exist for manufacturing and engineering to meet customer expectations.	No evidence	A forum exists for engineering, manufacturing and support teams to discuss and make decisions on quality standards		There is a process to develop and revise quality standards to satisfy customer, engineering and manufacturing		Quality standards are incorporated into standard work, achievable within facility, and not tighter than upstream process	3	
Evidence	Evidence								
Improvement Opportunities	Improvement Opportunity								

LEVEL	3	L2	L3	L3	L4	L4	L5	Currrently :	L4
Question	Desired Behavior	0	1	2	3	4	5	RATING	
2 Improving Value on New Products	Enterprise value stream works together so every new product introduction improves on customer value and customer service	New products are launched at facilities without increasing customer value	Product Engineering and Manufacturing work separately to increase customer value on new products.		There is a forum for Engineering and Manufacturing to discuss and make decision on increasing customer value on new products.		There is a forum for everyone in the enterprise value stream to discuss and make decisions to increase total value on new products.	3	
Evidence	Evidence								
Improvement Opportunities	Improvement Opportunity								

LEVEL	3	L2	L3	L3	L4	L4	L5	Currrently :	L4
Question	Desired Behavior	0	1	2	3	4	5	RATING	
3 Product Design Integration (DFM / DFA)	Engineering and Manufacturing teams work together to ensure manufacturability is accounted for in the design.	No evidence	Product engineering works from an established set of criteria to ensure design for assembly/ manufacturing.		Cross-functional platform teams use DFM / DFA tools.		Feedback from manufacturing pilots and previous launches incorporated in the product design.	3	
Evidence	Evidence								
Improvement Opportunities	Improvement Opportunity								

LEVEL	3	L2	L3	L3	L4	L4	L5	Currrently :	L4
Question	Desired Behavior	0	1	2	3	4	5	RATING	
4 Manufacturing Process Validation	Product and process development is integrated with upstream and downstream stakeholders.	Development is performed in functional organizations.	Processes, equipment, gauges are validated relative to Man, Machine, Material and Method prior to use		Risk analysis methods (FMEA) are used in the development of processes, and error proofing is incorporated into product and process design		Manufacturing validation is run under production conditions and process controls are implemented to comply with engineering requirements.	3	
Evidence	Evidence								
Improvement Opportunities	Improvement Opportunity								

LEVEL	3	L2	L3	L3	L4	L4	L5	Currrently :	L4
Question	Desired Behavior	0	1	2	3	4	5	RATING	
5 Benchmarking	Competitors are benchmarked and results drive changes in process or product	No evidence	Competitors are benchmarked on an ad hoc basis by engineering and manufacturing		There are regular standardized benchmarking events with results shared with team		Benchmark results drive improvement actions and actions are tracked by team	3	
Evidence	Evidence								
Improvement Opportunities	Improvement Opportunity								

Innovations Total		L2 = 1		L4 = 4	

Examiners: Person A, Person B, Person C, Person D, Person E, Person F

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C. **Partnering With Suppliers/Customers & Environmental Practices** - this subsection evaluates how well the company integrates suppliers and customers into the value-creation process.

LEVEL	2	L1	L2	L2	L3	L3	L4	Currrently :	L3
Question	Desired Behavior	0	1	2	3	4	5	RATING	
1 Supplier performance measures	Supplier performance is measured to understand capabilities and drive improvements	No evidence	Every part has a Q,C,D requirement		Supplier performance measures (Q, C, D) are reviewed regularly, and a non-conformance process exists		Supply Chain Decisions are made by examining Q,C,D in all areas including materials, manufacturing, transport, duty, storage, inventory and handling	3	

Evidence	Evidence
Improvement Opportunities	Improvement Opportunity

LEVEL	2	L1	L2	L2	L3	L3	L4	Currrently :	L3
Question	Desired Behavior	0	1	2	3	4	5	RATING	
2 Information Flow to and from external suppliers	Information flows easily to and from suppliers (orders, forecasts, inventory, quality)	No evidence	Information to and from suppliers is ad hoc and available upon request		Information flow is standardized and reoccurring		Information flow is continuously improved to make sure everyone has the information they need	3	

Evidence	Evidence
Improvement Opportunities	Improvement Opportunity

LEVEL	2	L1	L2	L2	L3	L3	L4	Currrently :	L3
Question	Desired Behavior	0	1	2	3	4	5	RATING	
3 Integration of upstream internal suppliers	Upstream suppliers are involved and optimized in the continuous improvement and value creation process	No evidence	Teammates can identify their upstream supplier and defects and problem resolutions are fedback / fedforward to/from upstream supplier.		Information flow to/from supplier (form, content, timing) is standardized.		Upstream Suppliers are directly involved in the continuous improvement process	3	

Evidence	Evidence
Improvement Opportunities	Improvement Opportunity

LEVEL	2	L1	L2	L2	L3	L3	L4	Currrently :	L3
Question	Desired Behavior	0	1	2	3	4	5	RATING	
4 Integration of external suppliers	External suppliers are involved and optimized in the continuous improvement and value creation process	No evidence	External suppliers are known and there is a process to feedback / feedforward defect information to/from external supplier.		Information flow to supplier (form, content, timing) is standardized.		External Suppliers are directly involved in the continuous improvement process	3	

Evidence	Evidence
Improvement Opportunities	Improvement Opportunity

LEVEL	4	L3	L4	L4	L5	L5	L6	Currrently :	L5
Question	Desired Behavior	0	1	2	3	4	5	RATING	
5 Foster innovation and knowledge-sharing throughout the supplier network	Suppliers are encouraged to be innovative and share best practices with each other	Primary focus on internal capabilities, with little knowledge across suppliers.	Suppliers have partial ownership over continuous improvement metrics (Q,C,D)		A supplier forum exists to share information, encourage common thinking, and deepen partnership and co-operation.		Technology roadmaps are jointly created with suppliers thru on-going communication of vision, strategy, metrics and implementation	3	

Evidence	Evidence
Improvement Opportunities	Improvement Opportunity

Currently: L4

LEVEL	3	L2	L3	L3	L4	L4	L5	RATING
Question	Desired Behavior	0	1	2	3	4	5	
6 Information flow to and from external customers	Information flows easily to and from customers (orders, forecasts, inventory, quality)	No evidence	Information to and from customers exists and is available upon request		**Information flow on Quality and Delivery is standardized, reoccurring and often.**		Information flow is continuously improved to make sure everyone has the information they need	3
Evidence	Evidence							
Improvement Opportunities	Improvement Opportunity							

Currently: L3

LEVEL	2	L1	L2	L2	L3	L3	L4	RATING
Question	Desired Behavior	0	1	2	3	4	5	
7 Integration of downstream internal customer	Customers are involved and optimized in the continuous improvement and value creation process	No evidence	Teammates can identify their downstream customer. Info feed forward if escaped defect, backup tool in use, problem resolution, changes in process/product		**Information flow to customer (form, content, timing) is standardized.**		Downstream customers are directly involved in the continuous improvement process	3
Evidence	Evidence							
Improvement Opportunities	Improvement Opportunity							

Currently: L3

LEVEL	2	L1	L2	L2	L3	L3	L4	RATING
Question	Desired Behavior	0	1	2	3	4	5	
8 Integration of end customer	End customers are involved in the continuous improvement and value creation process	No evidence	Teammates can identify their end customer. Info feed forward if escaped defect, or changes in product or delivery process		**Information flow to customer (form, content, timing) is standardized.**		End Customers are directly involved in the continuous improvement process	3
Evidence	Evidence							
Improvement Opportunities	Improvement Opportunity							

Currently: L3

LEVEL	2	L1	L2	L2	L3	L3	L4	RATING
Question	Desired Behavior	0	1	2	3	4	5	
9 Parts Ordering and Delivery Process	Parts are ordered on a fixed period basis, and execptions follow an established process.	Parts are ordered and delivered on an ad hoc basis	Parts are ordered with an agreed upon lead time to ensure consistent on-time delivery		**Parts are ordered and delivered on a fixed schedule**		Exception process exists for emergencies	3
Evidence	Evidence							
Improvement Opportunities	Improvement Opportunity							

Currently: L4

LEVEL	3	L2	L3	L3	L4	L4	L5	RATING
Question	Desired Behavior	0	1	2	3	4	5	
10 Part Packaging	Incoming Raw Materials arrive in efficient and easy-to-use packaging.	No evidence	For every part number, there is one standard packaging configuration, an approved label and a container removal process		**A container selection process is used based on efficiency and safety/ergonomics for picking, prep, presentation and removal**		Container size is optimized for team member available space and reach, and containers are either returnable or recycled	3
Evidence	Evidence							
Improvement Opportunities	Improvement Opportunity							

Partners Total		L3 = 7	L4 = 2	L5 = 1

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D. World Class Operations & Processes - This subsection focuses on use of lean manufacturing practices.

LEVEL	2	L1	L2	L2	L3	L3	L4	Currrently :	L3
Question	Desired Behavior	0	1	2	3	4	5	RATING	
1. Layered Audit Process	There is a layered audit process to help leaders verify and escalate any issues arising from the standard work below them	No layered audit process exists	The a defined layered audit process is established and used to manage the facility operations		**The layered audit process is used to manage the areas outside the facility operations**		The layered audit process is regularly reviewed and extends beyond facility	3	

Evidence	Evidence
Improvement Opportunities	Improvement Opportunity

LEVEL	1	L0	L1	L1	L2	L2	L3	Currrently :	L2
Question	Desired Behavior	0	1	2	3	4	5	RATING	
2. Identification & elimination of Waste	Waste is systematically identified and eliminated	No evidence or awareness	All current teammates are trained in the 7 wastes, and 7 wastes training required for new hires.		**Team focuses of ID & elimination of waste in Kaizen events and improvement projects.**		Strategic focus on identifying and eliminating waste throughout value stream.	3	

Evidence	Evidence
Improvement Opportunities	Improvement Opportunity

LEVEL	1	L0	L1	L1	L2	L2	L3	Currrently :	L2
Question	Desired Behavior	0	1	2	3	4	5	RATING	
3. Continuous Improvement Project Selection	A cross-functional project selection process exists in alignment with the Hoshin plan;	Projects are chosen at whim	Continuous Improvement projects are selected based on functional objectives		**Continuous Improvement projects are selected in alignment with other projects and facility plan**		Continuous Improvement projects are selected based on value stream objectives	3	

Evidence	Evidence
Improvement Opportunities	Improvement Opportunity

LEVEL	1	L0	L1	L1	L2	L2	L3	Currrently :	L2
Question	Desired Behavior	0	1	2	3	4	5	RATING	
4. Standard Methods	Teammate Work is standardized to reduce variation and ambiguity	No evidence	Work Instructions including job elements, work sequence, cycle time, safety & ergo points, quality standards & checks are visible in cell.		**Work Instructions are agreed to by all shifts, and include value add time, takt time and calculated workloads representative of option content**		Regular audits for process compliance exists to continually improve and address non-compliance	3	

Evidence	Evidence
Improvement Opportunities	Improvement Opportunity

LEVEL	1	L0	L1	L1	L2	L2	L3	Currrently :	L2
Question	Desired Behavior	0	1	2	3	4	5	RATING	
5. Workplace organization (5S+1)	The workplace is clean and organized. Missing objects are obvious	No evidence	Team trained in 5S, process and assessment owners are identified across shifts		**Workplace Organization standards are agreed upon and displayed across all shifts with regular reviews and closed loop non-conform review process**		5S principles applied to non-production areas	3	

Evidence	Evidence
Improvement Opportunities	Improvement Opportunity

LEVEL	2	L1	L2	L2	L3	L3	L4	Currrently :	L3
Question	Desired Behavior	0	1	2	3	4	5	RATING	
6 **Standard WIP**	Standard WIP are used to minimize inventory and maximize service levels	No evidence	Standard WIP is established for every role, and each teammate only produces to standard WIP levels		**Standard WIP is established for each area, and each area only produces to standard WIP levels**		A process exists to continuously improve Standard WIP levels and how they are managed.	3	
Evidence	Evidence								
Improvement Opportunities	Improvement Opportunity								

LEVEL	1	L0	L1	L1	L2	L2	L3	Currrently :	L2
Question	Desired Behavior	0	1	2	3	4	5	RATING	
7 **Produce to Takt Time**	Products are produce at a specified rate to maintain continuous flow	No evidence	Takt Time is calculated and reviewed quarterly for all products		**Cycle time balanced to Takt Time, Takt time remains fixed for a period of time (ie one month)**		Business unit is producing to takt time: Procedures to manage and change takt time are documented	3	
Evidence	Evidence								
Improvement Opportunities	Improvement Opportunity								

LEVEL	2	L1	L2	L2	L3	L3	L4	Currrently :	L3
Question	Desired Behavior	0	1	2	3	4	5	RATING	
8 **In-Process Verification of Quality**	Defects are found immediately and repaired before moving downstream.	Only final inspection exists without feedback	In-process inspection of product w/ simple check devices where possible or within area if not possible.		**Defects tracked and reviewed hourly. Any defects initiate documented problem solving process.**		Error proofing is incorporated into design and process where possible or defect fed back to teammate within 10 mins.	3	
Evidence	Evidence								
Improvement Opportunities	Improvement Opportunity								

LEVEL	2	L1	L2	L2	L3	L3	L4	Currrently :	L3
Question	Desired Behavior	0	1	2	3	4	5	RATING	
9 **Assistance Signal (Andon)**	A signal is immediately activated when an abnormality is found, and assistance arrives quickly.	Work does not stop when a defect is found	Work stops when a abnormality is found or teammate cannot finish on time.		**Audio/Visual indicators in use so team lead immediately know when a defect is found by man or machine**		Team Lead / first responder arrives at station within cycle time	3	
Evidence	Evidence								
Improvement Opportunities	Improvement Opportunity								

LEVEL	2	L1	L2	L2	L3	L3	L4	Currrently :	L3
Question	Desired Behavior	0	1	2	3	4	5	RATING	
10 **Visual Factory**	Current status of all operations are easily visible. Abnormalities are immediately detected.	No evidence	Standardized visual status indicators exist in each area with current and standard conditions clearly identifiable		**Status indicators are updated real-time, with audits to ensure data is correct and properly maintained.**		Real-time status of all areas is transparent to everyone, with critical processes identified	3	
Evidence	Evidence								
Improvement Opportunities	Improvement Opportunity								

LEVEL	2	L1	L2	L2	L3	L3	L4	Currrently :	L3
Question	Desired Behavior	0	1	2	3	4	5	RATING	
11 **Issue Escalation Process**	Issues that arise follow a quick standardized escalation and resolution process.	No standardized escalation process	Process exists defining which problems, to who and in how long from bottom to top		**Process is used throughout the facility and all escalations are tracked with a closed loop process**		Escalation process is regularly reviewed to ensure countermeasure decisions are made quickly and at the right level.	3	
Evidence	Evidence								
Improvement Opportunities	Improvement Opportunity								

LEVEL	2	L1	L2	L2	L3	L3	L4	Currently :	L3
Question	Desired Behavior	0	1	2	3	4	5	RATING	
12 Problem Solving Tools	Quality tools (Pareto, histograms, fishbone, process maps, etc.) are used	No evidence	Team members are trained in use of root cause analysis (5 whys) and PDCA approach		A standardized problem solving process exists that uses 5 whys & PDCA and includes fast leadership decision making on corrective actions		Standardized problem solving process used in all Continuous Improvement Events	3	
Evidence	Evidence								
Improvement Opportunities	Improvement Opportunity								

LEVEL	1	L0	L1	L1	L2	L2	L3	Currently :	L2
Question	Desired Behavior	0	1	2	3	4	5	RATING	
13 Measuring workplace	All operations are measured against established limits. Abnormalities are immediately acted upon.	No evidence	Key metrics with RYG tolerances exist for each area reviewed at least once per shift		Metrics are reviewed for each area at least once per hour, with out-of-standard conditions must be documented, displayed and communicated		Metrics are updated real-time throughout facility and abnormalities are addressed immediately	3	
Evidence	Evidence								
Improvement Opportunities	Improvement Opportunity								

LEVEL	3	L2	L3	L3	L4	L4	L5	Currently :	L4
Question	Desired Behavior	0	1	2	3	4	5	RATING	
14 Managing Operational Load Fluctuation	Production types and quantities are measured and adjusted to facilitate flow	No evidence	Order variability is tracked and reviewed		Facility capacity is sufficient to meet necessary service levels		Scheduling criteria is reviewed regularly and updated with new products.	3	
Evidence	Evidence								
Improvement Opportunities	Improvement Opportunity								

LEVEL	3	L2	L3	L3	L4	L4	L5	Currently :	L4
Question	Desired Behavior	0	1	2	3	4	5	RATING	
15 Operational Load Leveling (Heijunka)	Production types and quantities are leveled to meet customer demand, and minimize batching and inventory.	No evidence of Load Leveling	Process created and used to level production within facility over two hour time frame.		Process created and used by Production Control to level production within facility over a full shift or day.		Process created and used by Demand/Supply to level production within facility over a week. Orders received are becoming more level.	3	
Evidence	Evidence								
Improvement Opportunities	Improvement Opportunity								

LEVEL	3	L2	L3	L3	L4	L4	L5	Currently :	L4
Question	Desired Behavior	0	1	2	3	4	5	RATING	
16 Continuous flow	Products flow through the facility in direct and simple fashion without stopping	Batch processes; WIP turns in weeks	All areas run at the same production rate.		Processes have been "right-sized" for forecasted demand.		Areas run on single orders. Any batching constantly challenged for reduction.	3	
Evidence	Evidence								
Improvement Opportunities	Improvement Opportunity								

LEVEL	3	L2	L3	L3	L4	L4	L5	Currently :	L4
Question	Desired Behavior	0	1	2	3	4	5	RATING	
17 Just-in-time manufacturing	Raw Materials arrive the moment when they are needed	large amounts of inventory on line and in-between stations	Raw materials are supplied only when pull signal is initiated by material consumption		A process exists to select, monitor and improve pull signals for each part number		Material flows in just-in-time at point of use for each operation according to production schedule.	3	
Evidence	Evidence								
Improvement Opportunities	Improvement Opportunity								

LEVEL	2	L1	L2	L2	L3	L3	L4	Currently:	L3
Question	Desired Behavior	0	1	2	3	4	5	RATING	

18	Material Storage	Any materials that must to be stored are stored in a standard organized fashion	No evidence	Each part number is visually identifiable and has one or two clearly marked fixed storage location with clear inventory (min/max) levels		All parts only have one fixed storage location. Overflow is minimized, controlled, clearly identified and follows FIFO. No material is found outside of designated areas.		There is a process to continually reduce storage levels and optimize storage locations with the ultimate goal of eliminating storage.	3
	Evidence	Evidence								
	Improvement Opportunities	Improvement Opportunity								

LEVEL	3	L2	L3	L3	L4	L4	L5	Currently:	L4
Question	Desired Behavior	0	1	2	3	4	5	RATING	

19	Shipping/Receiving	The shipping/receiving area is well organized and runs according to a schedule.	No evidence	Roles and responsibilities developed between facility and each carrier with regular performance reviews. Receiving and Shipping areas are segregated and visual.		Inbound/Outbound shipments scheduled to balance workload and visual aids used to communicate schedule		Carriers arrive/depart at the scheduled window time and exception process exists for emergencies and shipments outside of scheduled time	3
	Evidence	Evidence								
	Improvement Opportunities	Improvement Opportunity								

LEVEL	1	L0	L1	L1	L2	L2	L3	Currently:	L2
Question	Desired Behavior	0	1	2	3	4	5	RATING	

20	Total productive, preventive or predictive maintenance (TPM)	Machines are fixed before they break to minimize schedule necessary downtime.	No evidence	Team members trained in TPM and TPM schedule is developed with supplier, maintenance, engineering and historical information		Communication channels between all shifts and groups are defined. Any failures are reviewed with problem solving process.		TPM activity shows a reduction or prevention of downtime. All TPM changes are measured to assure effectiveness. Spare Parts storage and ordering process established.	3
	Evidence	Evidence								
	Improvement Opportunities	Improvement Opportunity								

LEVEL	2	L1	L2	L2	L3	L3	L4	Currently:	L3
Question	Desired Behavior	0	1	2	3	4	5	RATING	

21	Production Process Preparation (3P)	New Processes are designed around flexibility, value streams and waste elimination	New processes created based upon existing methods	Process engineering team is trained in designing processes without waste.		Standardized simple process designs and layouts are developed and new processes are designed by value stream with flexibility to meet shifting demands.		New and existing processes are (re)designed by value stream	3
	Evidence	Evidence								
	Improvement Opportunities	Improvement Opportunity								

LEVEL	3	L2	L3	L3	L4	L4	L5	Currently:	L4
Question	Desired Behavior	0	1	2	3	4	5	RATING	

22	Shift Handoff	Information handoffs between shifts or activities is quick and without ambiguity.	Handoffs occur in an ad hoc basis. Information not standardized and times not tracked	Handoffs planned and standardized		Handoff times and feedback are tracked		Handoffs < 15 minute and without ambiguity, continuous improvement process in place	3
	Evidence	Evidence								
	Improvement Opportunities	Improvement Opportunity								

LEVEL	3	L2	L3	L3	L4	L4	L5	Currently:	L4
Question	Desired Behavior	0	1	2	3	4	5	RATING	

23	Quick changeovers (CO)	Operational changeover of products is standardized and quick.	Changeover times not tracked	Changeovers are identified and standardized		Changeover times are tracked		Changeovers < 1 cycle, continuous improvement process in place	3
	Evidence	Evidence								
	Improvement Opportunities	Improvement Opportunity								

| Operations Total | | | L2 = 7 | | L3 = 9 | | L4 = 7 | | |

E. Support Operations - Evaluate the degree of integration between the business unit and support functions and the extent to which improvement techniques and strategies have been applied in non-manufacturing functions up and down the value stream.

LEVEL	1	L0	L1	L1	L2	L2	L3	Currrently :	L2
Question	Desired Behavior	0	1	2	3	4	5	RATING	
1 Support Leadership & Participation	Support function leadership works with operations leadership to improve total value chain	No requirement	Support Leadership is invited to continuous improvement events and strategic planning events		**Support Leadership participates in continuous improvement events and strategic planning events**		Support leadership incentives reflect continuous improvement participation goals.	3	

Evidence	Evidence

Improvement Opportunities	Improvement Opportunity

LEVEL	2	L1	L2	L2	L3	L3	L4	Currrently :	L3
Question	Desired Behavior	0	1	2	3	4	5	RATING	
2 Lean Learning by support functions of organization	Lean training and Waste elimination occurs in support functions	No evidence	Support functions have gone through lean training.		**Support functions have lean consultant support and hold their own Kaizen events and improvement projects.**		Support functions share strategic focus with business unit and identify and eliminate waste throughout value stream	3	

Evidence	Evidence

Improvement Opportunities	Improvement Opportunity

LEVEL	1	L0	L1	L1	L2	L2	L3	Currrently :	L2
Question	Desired Behavior	0	1	2	3	4	5	RATING	
3 Information Flow to and from support functions	Information flows easily to and from support functions through standardized methods.	Information rarely moves between business unit and support functions	Information to and from support functions exists and is available upon request		**Information flow is standardized, reoccurring and often.**		Information flow is continuously improved to make sure everyone has the information they need	3	

Evidence	Evidence

Improvement Opportunities	Improvement Opportunity

LEVEL	3	L2	L3	L3	L4	L4	L5	Currrently :	L4
Question	Desired Behavior	0	1	2	3	4	5	RATING	
4 Align sales and marketing to production	Sales and marketing are aligned with production capabilities to continuously improve customer value	Marketing pushes product sales/bids with little consideration of current production capacity.	Information to and from Sales and Marketing functions exists and is available upon request		**Information flows are standardized and often (production capacities / orders & forecasts)**		Sales and Marketing are involved in the continuous improvement and strategic planning process	3	

Evidence	Evidence

Improvement Opportunities	Improvement Opportunity

LEVEL	3	L2	L3	L3	L4	L4	L5	Currrently :	L4
Question	Desired Behavior	0	1	2	3	4	5	RATING	
5 Financial Systems Supports Lean Transformation	Financial system supports production system to continuously improve customer value	Finance system provides basic data; Financial metrics not aligned with production goals	Finance team trained in Lean Culture and participate in kaizen events		**Finance metrics are reviewed and revised to provide data and financial information to support a lean transformation**		Financial systems are periodically reviewed for ensure proper alignment with lean transformation	3	

Evidence	Evidence

Improvement Opportunities	Improvement Opportunity

III Quality, Cost & Delivery   When "Positive Trend" is requested but not accomplished, drop score by one increment

A. Quality - Insure no human or machine errors get into customers' hands and in-process defects are continually reduced. The goal is zero defects.

	LEVEL	2	L1	L2	L2	L3	L3	L4	Currrently :	L3
	Question	Desired Behavior	0	1	2	3	4	5	RATING	
1	**Internal Process Quality (yield)**	Processes are capable of deliver defect-free results, and continually improving	First Pass Yield < 90%	First Pass Yield 91 - 100%; Positive Trend	RTY: 80%-89.9% Positive Trend	RTY: **90% - 94.9%** **Positive Trend**	RTY: 95%-96.9% Positive Trend	RTY: > 97% Positive Trend	3	
	Evidence: (prework)	Evidence								
	Improvement Opportunities	Improvement Opportunity								

	LEVEL	2	L1	L2	L2	L3	L3	L4	Currrently :	L3
	Question	Desired Behavior	0	1	2	3	4	5	RATING	
2	**M/W/D Feedback Loop**	Root cause of defects are fed back for effective process improvements	There is no feedback back to team	A process exists to provide and track M/W/D feedback to Product Team, Process Team and Execution Team		**Team creates and tracks actions items based on root causes**		Improvements are made as scheduled, and there is evidence of consistent positive improvement	3	
	Evidence:	Evidence								
	Improvement Opportunities	Improvement Opportunity								

	LEVEL	3	L2	L3	L3	L4	L4	L5	Currrently :	L4
	Question	Desired Behavior	0	1	2	3	4	5	RATING	
3	**External Customer Quality (ppm)**	External customer quality is measured in parts per million defects and aggressively approaches world-class.	>22750 (3.5 sigma)	<22750 (3.5 sigma)	<6210 (4 sigma)	**<1350** **(4.5 sigma)**	<233 (5 sigma)	<3.4 (6 sigma)	3	
	Evidence: (prework)	Evidence								
	Improvement Opportunities	Improvement Opportunity								

	LEVEL	3	L2	L3	L3	L4	L4	L5	Currrently :	L4
	Question	Desired Behavior	0	1	2	3	4	5	RATING	
4	**Rework as percent of COGS**	Cost of rework is minimized and constantly improving	> 5%	4.1 - 5.0% with a positive trend	3.1 - 2.0% with a positive trend	**2.1 - 3.0% with a positive trend**	1.1 - 2.0% with a positive trend	< 1.0% with a positive trend	3	
	Evidence: (prework)	Evidence								
	Improvement Opportunities	Improvement Opportunity								

	LEVEL	3	L2	L3	L3	L4	L4	L5	Currrently :	L4
	Question	Desired Behavior	0	1	2	3	4	5	RATING	
5	**Total Scrap as percent of COGS**	Scrap is minimized and constantly improving	> 5%	4.1 - 5.0% with a positive trend	3.1 - 2.0% with a positive trend	**2.1 - 3.0% with a positive trend**	1.1 - 2.0% with a positive trend	< 1.0% with a positive trend	3	
	Evidence: (prework)	Evidence								
	Improvement Opportunities	Improvement Opportunity								

Quality Total		L3 = 2	

B. Cost & Productivity - Assess the improvement trend and level of cost and productivity with the aim to continually improve both.

	LEVEL	3	L2	L3	L3	L4	L4	L5	Currrently:	L4
	Question	Desired Behavior	0	1	2	3	4	5	RATING	
1	**Cost Per Box**	Costs are minimized and continually improving	Increased	Decreased < 5%	Decreased 5 - 10%	**Decreased 10 - 15%**	Decreased 15 - 20%	Decreased > 20%	**3**	
	Evidence: (prework)	Evidence								
	Improvement Opportunities	Improvement Opportunity								

	LEVEL	3	L2	L3	L3	L4	L4	L5	Currrently:	L4
	Question	Desired Behavior	0	1	2	3	4	5	RATING	
2	**Cycle Count Accuracy**	Inventory records are accurate, and root causes of inaccuracy are eliminated	No cycle counting	Cycle Counting and inaccuracy resolution processes are standardized and occurs weekly		**Cycle Count accuracy is improving with root cause analysis and corrective actions. Cycle Counting once per shift**		Inventory Record Accuracy > 95%	**3**	
	Evidence:	Evidence								
	Improvement Opportunities	Improvement Opportunity								

	LEVEL	3	L2	L3	L3	L4	L4	L5	Currrently:	L4
	Question	Desired Behavior	0	1	2	3	4	5	RATING	
3	**Finished goods inventory turns (Post 5700)**	Orders are not started early and finished goods are promptly delivered to customer	> 1/week	4 - 5 days	3 - 4 days	**2 - 3 days**	1 - 2 days	< 1/day	**3**	
	Evidence: (prework)	Evidence								
	Improvement Opportunities	Improvement Opportunity								

	LEVEL	3	L2	L3	L3	L4	L4	L5	Currrently:	L4
	Question	Desired Behavior	0	1	2	3	4	5	RATING	
4	**WIP inventory turns (5150 - 5700)**	WIP levels are not too high and slowing down the facility	> 16 hrs	8 - 16 hrs	4 - 8 hrs	**2 - 4 hrs**	1 - 2 hr	< 1/hour	**3**	
	Evidence: (prework)	Evidence								
	Improvement Opportunities	Improvement Opportunity								

	LEVEL	4	L3	L4	L4	L5	L5	L6	Currrently:	L5
	Question	Desired Behavior	0	1	2	3	4	5	RATING	
5	**Raw Materials inventory turns**	WIP levels are not too high and slowing down the facility	> 5 days	2 - 5 days	16 - 48 hrs	**8 - 16 hrs**	4 - 8 hrs	< 4 hrs	**3**	
	Evidence: (prework)	Evidence								
	Improvement Opportunities	Improvement Opportunity								

LEVEL	3	L2	L3	L3	L4	L4	L5	Currrently :	L4
Question	Desired Behavior	0	1	2	3	4	5		RATING
6 **Business Unit Downtime %**	Downtime effectively measured and is minimized	Greater than 10%	8.1 - 10%	6.1 - 8.0%	**4.1 - 6.0%**	2.1 - 4.0%	Less than 2.0%		**3**
Evidence: (prework)	Evidence								
Improvement Opportunities	Improvement Opportunity								

LEVEL	4	L3	L4	L4	L5	L5	L6	Currrently :	L5
Question	Desired Behavior	0	1	2	3	4	5		RATING
7 **Business Unit Overtime %**	Downtime effectively measured and is minimized	Greater than 10%	8.1 - 10%	6.1 - 8.0%	**4.1 - 6.0%**	2.1 - 4.0%	Less than 2.0%		**3**
Evidence: (prework)	Evidence								
Improvement Opportunities	Improvement Opportunity								

LEVEL	4	L3	L4	L4	L5	L5	L6	Currrently :	L5
Question	Desired Behavior	0	1	2	3	4	5		RATING
8 **Productivity Improvement (Value Added/Payroll$)**	Every employee adds value and is continually improving	Unchanged or Decreased	Increased 0.1 to 1.0% Month to Month	Increased 1.1 to 2.0% Month to Month	**Increased 2.1 to 3.0% Month to Month**	Increased 3.1 to 4.0% Month to Month	Increased > 4.1% Month to Month		**3**
Evidence: (prework)	Evidence								
Improvement Opportunities	Improvement Opportunity								

Cost & Product Total   L5 = 3

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C. **Delivery** - Identify whether or not the customer is getting what they need in the time and quantity desired.

LEVEL	3	L2	L3	L3	L4	L4	L5	Currently:	L4
Question	Desired Behavior	0	1	2	3	4	5	RATING	
1 **Facility Process Time (IP - 9999)**	Process ensures time from order received at site to order shipped is minimized and continually improved	> 48 Hours	< 48 Hours	< 24 hrs	**< 8 hrs**	< 4 hrs	< 2 hrs	3	
Evidence: (prework)	Evidence								
Improvement Opportunities	Improvement Opportunity								

LEVEL	3	L2	L3	L3	L4	L4	L5	Currently:	L4
Question	Desired Behavior	0	1	2	3	4	5	RATING	
2 **Ship to Commit % (Internal Measure)**	Products are completed and shipped before the internal promise date	Less than 90%	90.0% - 92.9% Pos Trend	93.0% - 94.9% Pos Trend	**95.0% - 96.9% Pos Trend**	97.0% - 98.9% Pos Trend	99.0% - 100% Pos Trend	3	
Evidence: (prework)	Evidence								
Improvement Opportunities	Improvement Opportunity								

LEVEL	4	L3	L4	L4	L5	L5	L6	Currently:	L5
Question	Desired Behavior	0	1	2	3	4	5	RATING	
3 **Order Lead-time**	Process ensures time from order received to order delivery is minimized and continually improved	> 21 Days	15 - 20 Days Pos Trend	10 - 15 Days Pos Trend	**5 - 10 Days Pos Trend**	3 - 5 Days Pos Trend	2 Days or Less Pos Trend	3	
Evidence: (prework)	Evidence								
Improvement Opportunities	Improvement Opportunity								

LEVEL	4	L3	L4	L4	L5	L5	L6	Currently:	L5
Question	Desired Behavior	0	1	2	3	4	5	RATING	
4 **Deliver to Desired % (Customers measure)**	Products are completed and shipped close to and before the customer's desired date	Less than 90%	90.0% - 92.9% Pos Trend	93.0% - 94.9% Pos Trend	**95.0% - 96.9% Pos Trend**	97.0% - 98.9% Pos Trend	99.0% - 100% Pos Trend	3	
Evidence: (prework)	Evidence								
Improvement Opportunities	Improvement Opportunity								

LEVEL	4	L3	L4	L4	L5	L5	L6	Currently:	L5
Question	Desired Behavior	0	1	2	3	4	5	RATING	
5 **Orders Expedited**	Orders are processed on time and without expediting	> 5%	4.1 - 5.0% pos trend	3.1 - 4.0% pos trend	**2.1 - 3.0% pos trend**	1.1 - 2.0% pos trend	< 1.0% pos trend	3	
Evidence: (prework)	Evidence								
Improvement Opportunities	Improvement Opportunity								

Delivery Total

L4 = 2	L5 = 3

Examiners: Person A, Person B, Person C, Person D, Person E, Person F

IV. Business Results

When "Positive Trend" is requested but not accomplished, drop score by one increment

A. Customer Satisfaction - Evidence of customer satisfaction data that is reported and clearly defined, and used to improve the customer experience.

LEVEL	3	L2	L3	L3	L4	L4	L5	Currrently : L4
Question	**Desired Behavior**	0	1	2	3	4	5	RATING
1 **Customer Satisfaction Tracking and Feedback**	Customer satisfaction is tracked at the facility, and team makes improvement countermeasures quickly.	CSAT not tracked at the facility	A common metric exists to measure CSAT inside facility and within DAO		**CSAT metric is showing a positive trend**		CSAT data is fed real-time, CSAT is meeting world class standards	3

Evidence	Evidence

Improvement Opportunities	Improvement Opportunity

LEVEL	4	L3	L4	L4	L5	L5	L6	Currrently : L5
Question	**Desired Behavior**	0	1	2	3	4	5	RATING
2 **Customer awards, audits, etc**	Customers recognize the facility's excellence in quality, cost or deliver performance.	No recognition for quality, cost, or delivery	Corporate (Dell / DAO) recognition for quality, cost, or delivery performance		**Site recognition within Dell for quality, cost or delivery performance.**		Site recognition outside of Dell (industry / customer) for quality, cost, or delivery performance.	3

Evidence	Evidence

Improvement Opportunities	Improvement Opportunity

LEVEL	4	L3	L4	L4	L5	L5	L6	Currrently : L5
Question	**Desired Behavior**	0	1	2	3	4	5	RATING
3 **Tell Dell: Manager**	Employees are satisfied with their management	No survey taken	< 65%	65% - 74.9%	**75% - 79.9%**	80% - 89.9%	> 90%	3

Evidence: (prework)	Evidence

Improvement Opportunities	Improvement Opportunity

LEVEL	4	L3	L4	L4	L5	L5	L6	Currrently : L5
Question	**Desired Behavior**	0	1	2	3	4	5	RATING
4 **Tell Dell: Culture**	Employees are satisfied in the facility & Dell culture	No survey taken	< 65%	65% - 74.9%	**75% - 79.9%**	80% - 89.9%	> 90%	3

Evidence: (prework)	Evidence

Improvement Opportunities	Improvement Opportunity

LEVEL	4	L3	L4	L4	L5	L5	L6	Currrently : L5
Question	**Desired Behavior**	0	1	2	3	4	5	RATING
5 **Tell Dell: Engagement**	Employees are satisfied in the facility & Dell culture	No survey taken	< 65%	65% - 74.9%	**75% - 79.9%**	80% - 89.9%	> 90%	3

Evidence: (prework)	Evidence

Improvement Opportunities	Improvement Opportunity

Cust Sat Total		L5 = 4

B. Profitability - Level and trends of profitability are defined and tracked and relevant to the business.

LEVEL	3	L2	L3	L3	L4	L4	L5	Currrently :	L4
Question	Desired Behavior	0	1	2	3	4	5	RATING	
1 Value Understanding	Team members understand their impact on customer value	Plant financials not understood by most staff members	Business Deployment Boards post information on area, facility and corporate conditions.		**Value Stream Maps have identified internal and external customers**		Team members are trained in understanding customer value and what in their roles drive cost	3	
Evidence	Evidence								
Improvement Opportunities	Improvement Opportunity								

LEVEL	3	L2	L3	L3	L4	L4	L5	Currrently :	L4
Question	Desired Behavior	0	1	2	3	4	5	RATING	
2 Profitability Tracking & Feedback	Profitability is tracked at the facility, and improvement countermeasures can be made quickly.	Profitability not tracked	A common metric exists to measure profitability within the facility and within DAO		**Profitability metric is showing a positive trend**		Profitability data is fed real-time. Profitability is meeting world class standards	3	
Evidence	Evidence								
Improvement Opportunities	Improvement Opportunity								

LEVEL	4	L3	L4	L4	L5	L5	L6	Currrently :	L5
Question	Desired Behavior	0	1	2	3	4	5	RATING	
3 (new business health metric)	…	…	…		...		…	3	
Evidence: (prework)	Evidence								
Improvement Opportunities	Improvement Opportunity								

LEVEL	4	L3	L4	L4	L5	L5	L6	Currrently :	L5
Question	Desired Behavior	0	1	2	3	4	5	RATING	
4 Operating Income on Manufacturing assets ratio	High ratio of income on manufacturing assets	Misses targets	Achieves targets 50-60% of time	Achieves targets 60-70% of time	**Achieves targets 70 - 80% of time**	Achieves targets 80 - 90% of time	Achieves targets > 90% of time	3	
Evidence: (prework)	Evidence								
Improvement Opportunities	Improvement Opportunity								

LEVEL	4	L3	L4	L4	L5	L5	L6	Currrently :	L5
Question	Desired Behavior	0	1	2	3	4	5	RATING	
5 Operating Income on Sales ratio	High ratio of income to sales	Misses targets	Achieves targets 50-60% of time	Achieves targets 60-70% of time	**Achieves targets 70 - 80% of time**	Achieves targets 80 - 90% of time	Achieves targets > 90% of time	3	
Evidence: (prework)	Evidence								
Improvement Opportunities	Improvement Opportunity								

Profitability Total   L4 = 2   L5 = 3

Examiners: Person A, Person B, Person C, Person D, Person E, Person F