Abstract
Developing Lean skills across all the employees of an organization is the foundation to a successful Lean deployment. Much has been written about the multitude of Lean tools and techniques that are instrumental to a Lean process transformation and many have also noted that ‘soft’ skills are equally important in ensuring the success of a Lean transformation initiative. Delivering the appropriate learning to employees and company leaders that effectively teaches both these ‘hard’ and ‘soft’ skills can make or break a Lean transformation effort, but how can a company know whether or not their Lean learning programs are effective? An evaluation method that is linked to desired employee behaviors and business results is required to ensure learning appropriateness and effectiveness. This paper presents results from the research conducted and the application of developing a framework for evaluating Lean learning effectiveness by adapting the Kirkpatrick learning evaluation model. This approach includes a Lean learning case study performed within a large multi-national company where a methodology for predicting learning outcomes has been developed by adapting a learning evaluation model.

Key Words: Lean Transformation, Lean Skills, Lean Capability, Learning Evaluation, Learning Outcomes, Training Assessment, Kirkpatrick Learning Evaluation Model

1.0 Introduction
Fundamental to a successful Lean transformation is the development of employee skills around Lean principles and methods. While much has been written about these Lean methods and principles, there is little written about evaluating the effectiveness of the learning related to them and how it can enable a successful Lean transformation. An organization’s Lean skills development programs typically focus on building both rational and interpersonal skills in its employees. Rational skills include capabilities like; formal structured problem solving using the Deming Plan-Do-Check-Act (PDCA) method, process analysis methods using Value Stream Mapping (VSM) along with value-add analysis, and quality improvement techniques using Quality at the Source principles applied via Autonomation and Poka-yoke. These are just a few of the rational skills that Lean practitioners are taught in order to lead an organization through its Lean journey. These rational skill sets; while necessary are not sufficient to enable a successful Lean change effort. Employee interpersonal skills are also required as these ‘soft’ skills are the key enablers of the rational skills. Interpersonal skill sets include; group facilitation, team-based decision making, effective listening, constructive differing, conflict resolution and team consensus building. When interpersonal skills are enabled within employees, then the application of the rational skills becomes much more effective. And while it may be recognized that both interpersonal and rational skills are critical for a successful Lean initiative, it is not always so clear how an organization can determine whether or not these skills are being adequately adopted by its employees. One of the more popular approaches for the evaluation of learning effectiveness is the Kirkpatrick learning evaluation model.

In the late 1950’s, Dr. Donald Kirkpatrick had developed a popular evaluation method that has been used extensively by the education and employee training community. The focus of the Kirkpatrick Model is placed on measuring four kinds of outcomes that should directly result from a highly effective learning program. The Kirkpatrick Model for learning evaluation includes these responses to a training program into four levels or stages of learning outcomes. These four levels of assessment are: Level 1 – Reaction to Learning; Level 2 – Learning Gain; Level 3 – Change in Behaviors, and Level 4 – Business Results.
This paper presents the results from research conducted based on the application of a modified Kirkpatrick method by developing a framework for evaluating Lean learning effectiveness by adapting the Kirkpatrick evaluation model for a specific organization and its Lean transformation initiative. This approach includes a Lean learning case study performed within a large multi-national company where a methodology for not only measuring learning effectiveness was evaluated, but the model is proven to be useful for predicting learning outcomes. This methodology has been developed by adapting the Kirkpatrick learning evaluation model and applying it to assess the effectiveness of an extensive Lean transformation initiative.

2.0 Literature Review: The Kirkpatrick Learning Evaluation Model [1]
In 1959, Dr. Donald Kirkpatrick developed a popular learning evaluation model that has been widely used ever by the training communities across the world. The ‘Kirkpatrick Model’ focuses on measuring four areas of learning and business outcomes that should result from a highly effective training program.

Table I lists the four levels of the Kirkpatrick’s model for learning evaluation and describes each of these levels and their progression of learning and business outcomes:

<table>
<thead>
<tr>
<th>Level</th>
<th>Outcome</th>
<th>Description of the Learning Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Learner Reaction</td>
<td>To what degree do the class participants react favorably to the learning event?</td>
</tr>
<tr>
<td>2</td>
<td>Learning Gain</td>
<td>To what degree do class participants acquire the intended knowledge, skills, and/or attitudes as a result of their participation in the learning event?</td>
</tr>
<tr>
<td>3</td>
<td>Behavior Change</td>
<td>To what degree do class participants apply what they have learned during training event when they are back on the job?</td>
</tr>
<tr>
<td>4</td>
<td>Business Results</td>
<td>To what degree do targeted business outcomes occur, as a result of the learning event and the subsequent reinforcement of new behaviors?</td>
</tr>
</tbody>
</table>

These levels will be described in some detail in the following sections and will include an explanation of how these evaluations should operate in practice.

2.1 Level 1: Learner Reaction
The goal for Level 1 (L1) learning evaluation is to assess the participants’ reactions to the training program they just received. Their reactions should be measured immediately after the learning program is delivered. Level 1 evaluation should include more than just reactions toward the overall program; i.e., did the participant like the program as measured by degree of satisfaction (or dissatisfaction) using a 5-point Likert scale for example. This evaluation should also include an assessment of all participants’ reactions and attitudes toward the specific learning elements of the training program. These elements include such factors as: instructor effectiveness, the appropriateness the topics covered, the presentation style, the class schedule, and the use of audio, visuals and other relevant learning technology are a few of the key training components that should be evaluated. In addition, each of these elements can be further assessed by defining sub-components for learning evaluation. For example: it is insightful to evaluate the specific characteristics of the instructor’s style, the presentation content and format, the effectiveness of the learning environment, etc. In summary, Level 1 learning evaluation is intended to be much more than simply the measurement of overall learner satisfaction and should include learning effectiveness measurements as well.

Since Level 1 evaluation relies largely on the measurement of learners’ attitudes and reactions to learning, then the assessment is typically performed by way of a questionnaire using a survey-based approach. An effective construct for these post-learning event surveys is to include both closed-ended questions (that include numerical rating scales; i.e. the Likert scale) as well as open-ended questions where the participants can provide valuable insights as to the reasons behind their numerical ratings. While the numerical assessment provides a quantitative benchmark of continuous improvement, the open-ended feedback often provides the detailed feedback needed to make specific and meaningful changes to the training program.

One application for the Level 1 evaluation is to provide the formative evaluation information that can be used to improve future versions of the training program. In other words, fix the learning elements and sub-components that
the class participants disliked about the program. For example: add, remove or change content to address the participants specific likes and dislikes about the learning program.

The Level 2 and Level 3 evaluations measures the learning gains and learning transfer to the ‘real world’; respectively (to be described further) which do not typically occur unless the participants have positive experiences and hold favorable attitudes toward the training program. Also, the participants’ positive reactions are important because word of mouth referrals of the learning event can help to either promote or prevent the future success of a training program. Similar to the Level I assessment, by measuring these specific aspects of the training program, it provides important insights about what elements of the training program can be improved for future learning events.

2.2 Level 2: Learning Gains from the Training Event

In Level 2 (L2), the extent to which the class participant internalizes their new learning as a direct result of the training program is evaluated. The course sponsor, learning curriculum designer, and training instructor(s) should have specific learning objectives, desired participant exit skills and clear learning outcomes. These learning outcomes include; changes in knowledge, skills, and/or attitudes. The post-training evaluation should focus on measuring the extent to which the learning objectives were met as a result of the training event.

Like the Level 1 assessment, Level 2 evaluation should be done immediately after the training event has completed to determine if the participants have gained the desired knowledge, skills, and/or attitudes. A couple of the common questions during Level 2 learning evaluation are: (a) how shall the knowledge, skills, and attitudes of the class participants be measured, and (b) what research design should be use to demonstrate improvement in level two outcomes?

For Level 2 learning evaluation, it is helpful to consider Bloom’s Taxonomy for cognitive development as a way to assess the degree of knowledge and skills gained as a result of a learning event. In 1956, and just prior to Dr. Kirkpatrick’s work, Benjamin Bloom created this taxonomy for categorizing the level of individual competency relative to questions that are commonly asked in educational settings. These questions serve as a sound foundation for evaluating the learning gains made by the participants of a particular learning event, and since the taxonomy consists of six (6) levels of progressive competency gain this growth can be more accurately evaluated and compared using the Bloom’s ‘scale’. For example, if a learning program is targeting an “Application” competency level using the Bloom’s scale, and the participants exit the training event with “Comprehension” competency, then the event owners will recognize the need for more applied learning activities to be included in the training. These competency levels should be incorporated into Level 2 learning assessment to objectively evaluate the extent of knowledge gain by the participants of the training. Table II lists and describes Bloom’s taxonomy of cognition and skills development. [2]

<table>
<thead>
<tr>
<th>Competency</th>
<th>Knowledge and Skills Demonstrated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge</td>
<td>• <strong>Description</strong>: Observing and recalling information; knowledge of dates, events, places and major ideas; and the mastery of subject matter</td>
</tr>
<tr>
<td></td>
<td>• <strong>Learning objectives include the participant’s ability to</strong>: Arrange, define, repeat, label, list, memorize, name, order, recognize, relate, recall, duplicate, and reproduce</td>
</tr>
<tr>
<td>Comprehension</td>
<td>• <strong>Description</strong>: Understanding information; grasping meaning; translating knowledge into a new context; interpreting, comparing and contrasting facts; ordering, grouping, inferring causes; and predicting consequences</td>
</tr>
<tr>
<td></td>
<td>• <strong>Learning objectives include the participant’s ability to</strong>: Summarize, describe, interpret, contrast, relate, predict, associate, distinguish, extend, differentiate, discuss, and estimate</td>
</tr>
</tbody>
</table>

Table II: Bloom’s Taxonomy of Cognitive Development

[2]
| Application          | **Description:** Using information, methods and concepts; applying theories in new situations; solving problems using required skills or knowledge  
|                     | **Learning objectives include the participant’s ability to:** Apply, demonstrate, compute, complete, illustrate, show, solve, examine, modify, relate, change, classify, experiment, calculate and discover |
| Analysis            | **Description:** Seeing patterns; organizing the parts of a whole; recognizing hidden meanings; and identifying the components  
|                     | **Learning objectives include the participant’s ability to:** Analyze, separate, order, explain, connect, classify, un-layer, arrange, divide, compare, select, decompose, explain, extrapolate, and infer |
| Synthesis           | **Description:** Using old ideas to create new ones; generalizing from given facts; relating knowledge from several areas; predicting and draw conclusions  
|                     | **Learning objectives include the participant’s ability to:** Combine, integrate, modify, rearrange, substitute, plan, design, innovate, invent, perform, develop, compose, formulate, prepare, generalize, and rewrite |
| Evaluation          | **Description:** Comparing and discriminating between ideas; assessing value of theories and presentations; making choices based on reasoned argument; verifying the value of evidence; and recognizing subjectivity  
|                     | **Learning objectives include the participant’s ability to:** Assess, decide, rank, grade, test, measure, recommend, convince, select, judge, explain, discriminate, support, conclude, compare, and summarize |

2.3 Level 3: Behavior Changes of the Training Participants

In Level 3 (L3), the goal of this learning assessment is to find out if participants in the training program changed their behavior when back on the job. Measuring the positive effect to on-the-job-behavior (OJB) as a direct result of their attending and participating in the training program is the primary focus of Level 3. The Level 3 evaluation method involves measuring the specific transfer of knowledge, skills, and attitudes from the training event to the workplace. Of course, favorable Levels 1 & 2 results increase the likelihood of a positive Level 3 outcome; as the proper employee motivation exists as the learner exits the training event and re-enters the workplace. While favorable Levels 1 & 2 outcomes are shown to increase the likelihood of positive Level 3 results, it does not always guarantee that desired L3 outcomes are achieved.

In addition to employee motivation, learning transfer is likely to occur only if the conditions in the work setting are favorable for this transfer. The skills-to-workplace transfer is certainly affected by “training factors” before the participants return to their work area; as well as there are “workplace factors” that exist when the learner returns to the job. Some factors in the training program or event that can help facilitate transfer of learning are: Ensuring the learning environment, the training context and/or culture is similar to the actual work environment. Setting a realistic context for training is called ‘situated learning’. Learning that takes place in an authentic context is more likely to be used later by the learner. The training should provide plenty of real world examples and actual (OJB) experiences by enabling the participants to perform and practice these new behaviors within the training environment. During the training event, an emphasis key learning principles and their importance will also help with the skills-to-workplace transfer. Ensuring that trainees understand the general principles behind their new behaviors and there importance to the business is called enabling ‘learning transfer through principles’. [1]

Of course, there are many factors that are outside of the instructor’s control and influence, and these factors can either enable or inhibit effective learning transfer to the workplace. These factors include: 1) An organizational culture and climate that supports or inhibits change, 2) The support of the participant’s direct supervisor or manager, and 3) The support of others with whom the trainee works. These new behaviors can also be enabled through extrinsic rewards and recognition such as; assistance, encouragement, praise, increased autonomy, more responsibility, exposure, rewards and pay increases. When these extrinsic rewards are present, they lead to the participant’s intrinsic reinforcement; as the application of the new skills translates to personal gain by the employee.
By applying their new found knowledge, skills, and/or attitudes; the employee likes what they have learned and enjoys performing the new job related behaviors; especially when the business recognizes the employee for it.

2.4 Level 4: Business Results
The goal of a Level 4 (L4) learning evaluation is to determine if the training program resulted in tangible business results, especially business outcomes that contribute to business profits and growth. Level 4 business outcomes are not just limited to financial gains and subsequently the return on training investment (ROI). Level 4 outcomes include other major business results that contribute to the effective functioning of an organization. These include any outcome that organizational members generally agree are good for the business; like a more positive employee attitudes and a more constructive culture. Level 4 outcomes do typically include changes in the business financial results; like a positive ROI, revenue growth and/or increased profits; although other ‘soft’ business benefits are considered as well. Some examples of Level 4 learning outcomes that improve business results include: 1) Improved quality of work, 2) Higher productivity, 3) Reduced turnover, 4) Improved quality of work life, 5) Improved human relations, 6) Increased sales and revenues, 7) Improved job satisfaction, 8) Increased profits, 9) Improved Culture, and 10) a favorable return on learning investment (ROI). Recently the learning ROI has been expanded to include Return on Expectation (ROE); which is the desired behavior change (L3) and business outcomes- hard and soft- (L4) that management team is expecting to realize from the training program. Per Dr. Kirkpatrick, it is generally wise to develop a training program that is a part of a larger organizational improvement program as that is typically designed to produce Level 4 changes. [1]

3.0 Lean Transformation Initiative Overview
3.1 Organization Description
The Smart Lean transformation initiative takes place in a globally integrated enterprise of thousands of employees who creates and applies technology to make and deliver products and services that make world a better place. Today, more than 400,000 employees around the world invent and integrate hardware, software and business services to help forward-thinking enterprises, institutions and people succeed on a smarter planet. Within this company, the globally Integrated Supply Chain (ISC) organization manages the critical supply chain operations of Procurement, Engineering, Logistics, Manufacturing, Customer Fulfillment and Operations consisting of thousands of employees in over 100 countries. The Procurement function is responsible for effectively managing over $40B in supplier expenditures, which support the computer and storage systems that comprise around 30% of the company’s annual revenue. Corporate revenues also include approximately $10 Billion in business transformation outsourcing expenditures managed on behalf of external customers. In this summary, the Lean business transformation effort implemented across the manufacturing and customer fulfillment operations of the ISC is presented in this paper. The ‘Smart Lean’ business transformation deployment encompasses six product fulfillment sites in 6 countries: 2 in the United States and 1 each in Mexico, China, Hungary, France and Singapore.

3.2 Background and Business Need
Lean business transformation initiatives have become a business imperative for many organizations in just about every industry domain. While many companies are attempting to implement Lean and Lean Six Sigma methodologies, the vast majority of these organizations fail to meet their business transformation objectives and/or fail to sustain their business transformation gains. Research has shown that the most common reasons that these efforts fail to achieve or sustain their improvement results are 1) the lack of leadership support, and 2) the lack of focus on the organizational culture.[4] Traditional Lean transformation initiatives focus merely on Lean tools and techniques to make a significant and sustainable change; while overlooking or under-appreciating the important role of leadership and culture on making a meaningful and sustainable change.

About 5 years ago, the ISC global Manufacturing organization was facing serious cost challenges with ever changing product design requirements along with a mature workforce in its major markets and a young, rapidly expanding workforce in the growth markets. While the organization continued to have a perfect on time delivery of customer orders, this performance came at a significant operating expense as a result of inefficiencies in its production and business processes. Furthermore, the design complexity of the high-end servers and storage systems was driving significant delays and increasing costs in the design through production cycle. Moreover, the key performance indicators of the manufacturing balanced scorecard deviated widely from its targets. All these factors presented a compelling reason to change the current course and engage in a business transformation effort. As previously mentioned, the traditional process transformation efforts such as Lean Six Sigma, Lean and Agile consist
of a tool-based approach, leading to sub-optimal results. A novel approach was needed, one that incorporates a methodology focused on both process and people transformation and was designed for addressing these compelling reason for change.

3.3 The SMART Lean Methodology
Since 2009, the SMART Lean Transformation methodology has started with tops-down senior leadership commitment to the change initiative, with a bottoms-up employee implementation plan. This approach promotes an adaptive operating culture that operates under the guiding principle of employee-identified improvement opportunities within a management-sponsored change initiative. The very foundation of SMART Lean is built on creating a high-performing and constructive organizational culture that develops transformational leaders who empower their employees and promote an environment of learning and continuous improvement. There are three main phases of this deployment methodology:

Phase 1 – Understand the organizational readiness for change: This phase involves the leadership team defining its vision of success, success measures and gaining their commitment to the Lean change strategy. Also, three key assessments are conducted; (i) Organizational Culture Inventory (OCI), an organizational culture assessment developed by Human Synergistics International [3], (ii) Smart Lean assessment that provides insight into the Lean process and employee skills maturity, and (iii) Readiness for Change assessment that highlights the barriers to achieving the Lean Vision of Success that is established by the senior leadership of the organization. Based on these assessments, the entire leadership team and change agents from within the business develop action plans to address the key organizational barriers that will inevitably impede the success of its Lean transformation effort.

Phase 2 – Leadership and Employee Development: In this phase, a concentrated focus on developing transformational leaders and at the same time providing training to the entire employee population to develop their Lean and change leadership skills. For the leadership team, an individual assessment, called as the Leadership Impact (a product of Human Synergistics International, Inc.) is also conducted that provides them with a 360-feedback on the impact their leadership styles and strategies have on the operating culture of the organization and its members. Using this assessment, the leaders develop individual and collective management team development plans to become less transactional and more transformational leaders at effecting change. In parallel, the employees undergo an intensive training and certification program, geared towards improving both their rational and interpersonal skill sets. Employees immediately apply their newly acquired skills on real life business challenges within their organization, and they are recognized with a formal Lean certification when successful.

Phase 3 – Continuous improvement: One of the key success factors of the Smart Lean methodology is the management system employed to sustain the efforts of the transformation. In order to ensure the adoption rates of the desired Lean behaviors are sustained, employees are encouraged to apply their skills to address real business challenges, and once they have addressed these challenges using the appropriate Lean and teaming techniques; employees are recognized and rewarded for their contributions. Novel business improvement ideas are encouraged and are evaluated by peers based on impact to the business’s balanced scorecard and operating culture. There is also a requirement for sustaining certification that encourages employees to continue to apply their Lean skills.

3.4 SMART Lean Methodology – Leadership and Employee Key Programs

Transformational Leadership Roadmap: A leadership training program which helps leaders to understand their impact to the operating culture in the organization. Individual development plans help them transition from a transactional leader to a transformational leader. (Intended to promote the non-training factors that inhibit a positive employee skill-to-workplace transfer (L3))

SMART Lean Bronze, Silver and Gold Certifications: A certification program that imparts both rational and interpersonal skills. This program has three levels – Bronze, Silver and Gold. After the training, there is applied learning in the workplace. (Intended to promote a positive L3 outcome)

Lean Kaizen Week: A dedicated week for the entire organization to participate in improvement projects in their area. Over $1M savings have been generated through each of these Lean Weeks. (Encourages favorable L3 results and learning outcomes)

Recognition Programs: Every contribution to the business transformation effort is recognized by the leadership team and peers. A points-based system is used to track the adoption rates of the employees and also monitors that the initiative is sustaining and even growing to meet the challenges of the business. (Encourages favorable L3 results and learning outcomes)

World Wide Best Practice Sharing and Benchmarking: A monthly forum from all the six sites to share improvement projects and best practices during implementation of the lean initiative. There are benchmarking
Testani, Ramakrishnan and Sobeski

efforts that IBM does externally with the industries ranging from healthcare to the automobile industry. (Intended to take global advantage at all 6 sites of favorable L4 results within 1 site)

In summary, this methodology is one of the first methodologies where employees are provided team-based decision making and problem solving skills (both analytical and interpersonal) to transform their own business and production processes across their organization, which is in contrast with the “consulting” approach. This approach focuses on building the Lean transformation expertise within an organization; and integrating a SMART Lean management system into existing business processes. Since 2009, the SMART Lean deployment has seen that the buy-in from the employees to Lean transformation initiative has grown significantly.

3.5 Business Impact of the Initiative
The SMART Lean approach to business transformation has had a significant impact on the balanced scorecard measures of learning and business outcomes (people learning & growth, internal process efficiency, financial excellence and customer satisfaction) for the ISC, across all of its global sites. A strong emphasis is placed on developing constructive people and an adaptive operating culture. This emphasis is an overt focus of the Lean transformation effort and not a desired outcome from the transformation initiative itself. In other words, some Lean experts believe that enable the rational Lean skills will result in improved interpersonal skills, while the SMART Lean program believe the opposite is the case. It is by developing, applying and recognizing the ‘soft’ Lean skills that enables the ‘hard’ or rational skills. Once the people and cultural enablers to change are addressed, only then will the problem solving and process improvement techniques be successfully applied. Applying the ‘hard’ Lean techniques to process transformation are focused on improving business efficiencies and reducing operating costs, and all of the ISC sites have demonstrated a measureable impact to their revenue growth while efficiency gains have resulted in the excess capacity brought about through employees applying their Lean skills. This excess capacity has allowed several sites to bring in new mission to continue to grow their businesses.

4.0 Research: Adapting the Kirkpatrick Model for the SMART Lean Training Program
The following describes how the Kirkpatrick Four Levels Evaluation Model has been adapted and applied to help evaluate, diagnose and increase the effectiveness of the Smart Lean Transformation initiative.

4.1 Smart Lean L1 & L2: Reaction to Lean Training & Learning Gains
Since both the Level 1 & 2 (L1 & L2) evaluations are performed post-training event, they are always performed simultaneously via anonymous surveys taken by each of the class participants. The L1 & L2 reactions to all the SMART Lean training sessions is measured by way of a post-class survey that is taken immediately following the learning event, and performed prior to the employee returning to the workplace. Participant satisfaction feedback for a Lean training event is evaluated for several sub-components of the learning event. Both close-ended numerical ratings as well as open-ended questions are gathered to identify opportunities to improve the learning activities for future events. These learning events range from a variety of Lean related activities and audiences across the organization. These sub-components include: Overall Satisfaction with the learning event; Instructor Effectiveness; Degree of Learning Gain; Appropriateness of the Learning Environment, Learning Materials Effectiveness and Use of Technology; to name a few. Lean certification classes (Bronze, Silver and Gold), Kaizen workshops, Leadership workshops, Facilitation training and Live Virtual Lean learning events are all evaluated using Level 1 assessments. Additionally, these training activities are summarized by reporting a Net Satisfaction Index (NSI), Net Effectiveness Index (NEI), Percent Satisfied After Training (PSAT) and Learning Gain (% Gain/Loss) for all of the class participants. The NSI, NEI and PSAT calculations are described in equations (1), (2) and (3) below [6]:

\[ NSI = \text{Net Satisfaction Index (a response of 1 = 100, 2 = 75, 3 = 50, 4 = 25, 5 = 0)} \]  
\[ NEI = \text{Net Effectiveness Index (a response of 1 = 100, 2 = 75, 3 = 50, 4 = 25, 5 = 0)} \]  
\[ PSAT= ((\text{Sum1} + \text{Sum2})/\text{total responses})*100; \text{where} \]  
\[ 1=\text{Very Satisfied, 2=Satisfied, 3=Neutral, 4=Dissatisfied, 5=Very Dissatisfied} \]

In Table III, an example of a post-learning evaluation for a SMART Lean learning event and its Level 1 and Level 2 summary of results is shown: These data, along with the participant feedback by way of open-ended participants’ responses are leveraged to drive the continuous improvement for future event offerings.
threatening' l

associated Bloom's competency for each level of employee certification and demonstrated skills.

develops "Synthesize and Evaluate" competencies. Figure 1 depicts the progression of Lean certification for Bronze and Silver certified employees with their Lean change efforts; therefore the training for Gold certification activity required to achieve that desired skill level. For example, a Lean Bronze certified employee is expected to coach and mentor Bronze and Silver certified employees with their Lean change efforts; therefore the training enables the participant’s personal motivation and eagerness to apply their new Lean skills.

The key to achieving a learning environment that adequately reflects the workplace environment is the extensive use of well-designed Lean applied learning exercises and simulation activities. During the design of the training event, it is useful to identify the desired competency levels the participants are expected to achieve as a result of the training. Using the Bloom’s Taxonomy is key in terms of defining the desired competency level and associated learning activity required to achieve that desired skill level. For example, a Lean Bronze certified employee is expected to ‘Comprehend and Apply’ Lean techniques, while a Lean Gold certified employee is required to coach and mentor Bronze and Silver certified employees with their Lean change efforts; therefore the training for Gold certification develops “Synthesize and Evaluate” competencies. Figure 1 depicts the progression of Lean certifications and the associated Bloom’s competency for each level of employee certification and demonstrated skills.

Table III: L1 & L2 Learning Evaluation Summary (WW SMART Lean Virtual Conference)

<table>
<thead>
<tr>
<th>Learning Evaluation Performed</th>
<th>Summary of Evaluation Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Net Satisfaction Index (NSI)</td>
<td>95%</td>
</tr>
<tr>
<td>Net Effectiveness Index (NEI)</td>
<td>94%</td>
</tr>
<tr>
<td>Percent Satisfied (PSAT)</td>
<td>98%</td>
</tr>
<tr>
<td>Before/After Learning Gain/Loss (%)</td>
<td>+ 150%</td>
</tr>
<tr>
<td>Total Learning Hours Completed</td>
<td>2594</td>
</tr>
<tr>
<td>Percent Participation (% of Enrollment)</td>
<td>78%</td>
</tr>
<tr>
<td>Number of Learners Enrolled (Total #)</td>
<td>1288</td>
</tr>
</tbody>
</table>

4.2 SMART Lean L3: Behavior Change (Applying Lean Skills on the Job)
The Level 3 (L3) evaluations are, of course, assessed post-training event and after the employees have returned to their job. L3 is considered the critical link in the Lean Learning Evaluation Model. If the desired L3 behaviors do not change as anticipated, then the expected Level 4 business results will never become a reality. An effective training event design can certainly help to increase the probability of L3 success. There are many training factors that should be considered for increasing the likelihood of a successful change to on-the-job-behaviors (OJB). As a part of the Smart Lean training programs these factors are: 1) Making the learning environment and training context similar to the actual workplace environment to ensure that ‘situated learning’ takes place; 2) Providing in plenty of real world examples and actual OJB experiences as well as enabling the participants to perform and practice their new behaviors in a ‘safe and non-threatening’ learning environment; and 3) Ensuring that trainees understand the general principles behind these new behaviors and there importance to the employee as well as for the business.

By allowing training participants to apply Lean techniques in a team-based Lean turnaround simulation (example: A simulated production process with realistic and aggressive balanced scorecard objectives), the learners are motivated to apply Lean techniques to help their team achieve cycle time, delivery, quality, profitability and customer satisfaction targets. When successful, the participants return to the workplace, and they are confident and motivated to apply these techniques on business challenges that impact their daily work. In addition, the training event should adequately answer the “What’s In It For Me?” (WIIFM, pronounced ‘whiffum’) question for each employee, then the training enables the participant’s personal motivation and eagerness to apply their new Lean skills.

The key to achieving a learning environment that adequately reflects the workplace environment is the extensive use of well-designed Lean applied learning exercises and simulation activities. During the design of the training event, it is useful to identify the desired competency levels the participants are expected to achieve as a result of the training. Using the Bloom’s Taxonomy is key in terms of defining the desired competency level and associated learning activity required to achieve that desired skill level. For example, a Lean Bronze certified employee is expected to ‘Comprehend and Apply’ Lean techniques, while a Lean Gold certified employee is required to coach and mentor Bronze and Silver certified employees with their Lean change efforts; therefore the training for Gold certification develops “Synthesize and Evaluate” competencies. Figure 1 depicts the progression of Lean certifications and the associated Bloom’s competency for each level of employee certification and demonstrated skills.

Figure 1: The Smart Lean Certification Skills Progression
While favorable L1 & L2 evaluation results will motivate learners to apply what they’ve learned on the job, there is no guarantee that L3 results will be favorable as well. Many non-training related factors, but rather workplace related factors must be considered to help increase the likelihood that class participants will be successful at applying the learning on the job. These factors include, but are not limited to: 1) An organizational culture and climate that supports behavior change, 2) The support and encouragement of the participant’s direct supervisor or manager, and 3) The support of others with whom the trainee works. These new behaviors are also enabled through extrinsic rewards and recognition such as; assistance, encouragement, praise, increased autonomy, more responsibility, exposure, rewards and pay increases. These extrinsic rewards are clearly leadership dependent; so it is imperative to train and develop leaders to support and encourage the Smart Lean transformation. The Smart Lean initiative also utilizes leadership and organizational culture transformation techniques to develop ‘Transformational Leaders’ who help create a constructive and adaptive operating culture that enables the Smart Lean transformation. Human Synergistics International, Inc. is a leader in providing organizational culture and leadership development instruments. The Organizational Culture Inventory (OCI) ® and Leadership Impact (LI)® (OCI and LI are registered trademarks of Human Synergistics International, Inc.) [4] assessment are two instruments utilized during the Smart Lean transformation initiative that help an organization develop the leadership and organizational culture that allows the training participant to successfully apply their new Lean skills when back on the job. The operating culture of an organization and a leader’s impact on that culture can be measured using a circumplex. Figure 2 shows a circumplex that illustrates the twelve (12) behavioral norms of an organizational culture. The behavioral styles 11, 12, 1 and 2 are referred to as ‘Constructive’ behaviors and by promoting these behaviors, the Smart Lean initiative can increase the likelihood that the desired Level 3 behaviors are realized post-training event.

Figure 2: Human Synergistics Circumplex ® and Cultural Norms Supporting Learning (L3) Behavior Change

4.3 Level 4: Achieving the Desired Business Results
During the Level 4 (L4) learning evaluation process, the training outcomes that result in measurable business benefits are determined. One of the common challenges during the L4 evaluation is to determine those results that are ‘directly’ related to the learning event. With the Smart Lean initiative, determining the direct business outcomes associated with Lean skills and capabilities is quite feasible. Since employees are required to apply their newly acquired Lean skills on improvement projects; in which a business case for improvement is documented and presented to the management team, hence the hard (and soft) benefits of the Smart Lean initiative is clearly quantified, communicated and agreed upon by the organization. Figure 3 illustrates the L1 through L4 results of the Smart Lean transformation initiative.
In addition, a Level 5 (L5) or Return on learning Investment has been calculated. The learning ROI is determined by simply dividing the business results (L4) by the learning investment. The learning investment is the cost of the Lean training had been delivered to the organization reporting the business results. As shown in figure 3, the Smart Lean Initiative has accumulated an ROI of 44:1 over the past few years. It should also be noted, that a favorable L4 and L5 results, help to ensure the continued investment in Lean skills development as well as it secures the ongoing support of the Smart Lean transformation initiative by the organization's leadership team.

5.0 Conclusions
By adapting the Kirkpatrick Model for Learning Evaluation to the training programs related to the Smart Lean transformation initiative, the initiative has been continuously improved and has sustained itself as a viable training program over the past several years. By measuring and improving the learner satisfaction of the Smart Lean training program and through the use of applied learning activities and hands-on simulations, the participant satisfaction and learning gain has been quite favorable (L1 and L2 results, respectively). These learning evaluation results help to motivate training participants to apply their new skills when back on the job. Other non-training factors are also addressed in the Smart Lean transformation initiative to create a workplace that supports the application of newly acquired lean skills. These factors involve creating an adaptive and constructive organizational culture by developing transformational leaders who promote a positive environment for Lean change. When the desired Level 3 (L3) behavior changes take place in an organization, then the Level 4 (L4) business results and Level 5 (L5) return on learning investment are assured. The Smart Lean transformation initiative has been using this learning evaluation model to effectively guide the training program design and delivery for the past 5 years. An ROI over more than 44:1 has been experience as a result of these Lean training programs. The transformation effort has resulted in hundreds of employees achieving their Lean certification while delivering business improvements projects and business outcomes like; lowering operating costs, increasing profitability, growing mission, improving product quality and increasing customer satisfaction.

References
2. Bloom, B.S., Taxonomy of Educational Objectives, Allyn and Bacon, Boston, MA 1984