

Defining Lean: 16 Must-Have Metrics For Any Lean Supply Chain

**HOW TO ELIMINATE WASTE AND
ESTABLISH AN AGILE SUPPLY CHAIN.**

Section 1 – Introduction and Concepts

Logistics is not a new concept. Since the Bronze Age five thousand years ago, the link between merchants bringing in the required resources to artisans requiring those resources has been the defining element of supply and demand. However, the systematic study of business connectivity through provision channels has only commenced since the late 20th century. What modern means of communication (telegraph, telephone and now the Internet) have enabled is a transformation of the commerce world by providing the capability to exchange a vast amount of data, resulting in improved efficiencies of logistics links.

This paper examines the concepts of Lean Six Sigma (LSS) logistics, with a particular focus on metrics and measurements, and recommends measures that an enterprise can take to reduce various wastes, and to establish a speedy and agile supply chain.

Section 1 - Introduction and Concepts

Section 2 – Comprehensive Metrics for LSS Logistics

Section 3 – Following up on LSS Metrics

Collaborating to Create World Class Supply Chains

Smart. Efficient. Logistics.

JUNE 23, 2015

Corporate Offices

☎ 800.451.6680

✉ info@gdtr.com

📍 50 Commerce Drive
Morton, IL 61550



Supply chain arrangements which are designed to increase speed and flow, and eliminate wasteful resources in the channel, focusing on an error free operation at every step of the supply chain.

- LEAN SIX SIGMA (LSS) LOGISTICS

INFORMATION, PRODUCT, SERVICE, KNOWLEDGE & FINANCIAL FLOWS

MATERIALS → SUPPLY NETWORK → MANUFACTURING ENTERPRISE → DISTRIBUTION NETWORK → CUSTOMERS

A Generalized Supply Chain Model

In essence, a supply chain links a firm to its suppliers through supply networks and to its customers through distribution networks. The goal of all logistics studies is to evaluate methods through which value can be created in the channel between material procurement and end service/product delivery.

The Evolution of Supply Chain Optimization

Since the industrial revolution, any effort to improve efficiency involved improving the efficiency of individual functions. Managers believed that improving the efficiency of each specific function would yield an overall more efficient process. However, it is now understood that increasing the efficiency of individual functions does not yield the lowest total cost of operations or increased efficiency of the entire process. For example, if a forwarding station attempts to dispatch every arriving consignment in the shortest time possible, the cost of transportation would be higher than if multiple consignments were combined.

Lean Supply Chain

The Toyota Motor Company suggested the lean model in the 1970s, which focuses on eliminating waste, increasing speed and streamlining flow. The Lean Theory also highlights that excess inventory tops the list of known wastes. A lean supply chain is established on the principle of eliminating waste (any material which does not add value to the product or service in the eyes of the customer), decreasing lead time (time elapsed between order and delivery) and increasing process speed and flow (speed refers to the velocity of required resource from supplier to manufacturer, flow refers to interruptions or lack thereof in the supply chain.)

Six Sigma (Business Management Strategy)

The six-sigma or zero defect performance level has been the focus of manufacturing and supply chain professionals since Motorola USA presented this business strategy in 1986. The basis of Six Sigma is the control of variation in performance. Six Sigma is a rigorous performance standard that entails three standard deviations (the measure of performance variability) between process mean and either of the limits (upper and lower). Such fine tuned performance is possible only if the system and processes are directed at creating quality at every step of the process and ensuring close conformance to acceptable performance parameters. Upon successful execution, the process would suffer no more than 3.4 defects per million, and defects would cost no more than 1% of sales.

The Six Sigma or 6 model suggests the process optimization mechanism known as DMAIC (define - measure - analyze - improve - control). The methodology is phased as follows:

- Define objectives and problems
- Measure relevant data
- Analyze the data and identify cause and effect relationships
- Improve the processes (if possible run pilot projects to validate efficacy of optimization scheme)
- Control processes to restrain deviations

Section 2 – Comprehensive Metrics for LSS Logistics

The key to implementing a high performance logistics system is measurement. Measurement of logistics systems performance parameters in areas critical to efficiency and effectiveness provides essential insight to manage and control relevant processes, and of optimum utilization of human, material and knowledge resources.

Six Sigma theory gives us the basic methodology of DMAIC, as described earlier. The first two steps are Define and Measure. In order to implement Lean Six Sigma logistics, we must first determine areas in which waste most critically affects operational and financial performance, and in those areas seek to keep process variability down to a minimum.

In order to understand areas of waste, it is vital to examine the logistics process at each step and determine the most efficient manner of waste reduction at these granular levels.

Elements of Lean Logistics

A waste free logistics operation comprises the following steps:

- STEP 1** Correct order entry
- STEP 2** Correct part numbers cataloging and warehousing
- STEP 3** Order handled correctly (picked, kitted, packaged and shipped correctly)
- STEP 4** Correct scheduling (performance as per promised delivery time)
- STEP 5** Correct documentation (internal record and invoicing/ billing)
- STEP 6** Shipment on time without damage
- STEP 7** Reliable transport to meet committed delivery schedule
- STEP 8** Error free payment processing

Areas of Waste

Analyzing the sequence of the functions listed above, four areas can be identified in which any waste of material or effort is most detrimental to lean, variability-free performance:

 People	 Service
 Quality	 Cost

What follows is a discussion around the most suitable metrics that managers should understand and focus on in order to cut down these wastes and institute a lean, Six Sigma supply chain.

People Metrics

Highly skilled and highly trained employees, whose performance level is closely monitored and capabilities duly utilized for continuous process optimization is imperative for the success of a business enterprise.

Logistics operations are primarily people driven. Even with the IT enabled Warehouse Management System (WMS) and Enterprise Resource Planning (ERP) systems, logistics operations are labor intensive. From viewing a new order placed, to instructing the warehouse crew to make the shipment ready for transportation, to preparing shipment and billing documentation, to actual transportation, people are involved at every step. The efficiency of a logistics organization is rightly determined by the efficiency of the people who staff that organization. The quality and consistency of people is subject to the most variation, and hence is the first contender for application of Lean Six Sigma tools.

Human resource management has to be handled the same way as perfect order management - to have the right number of the right people at the right place at the right time at the right cost.



A successful logistics system foundation is built on two pillars: - A core team of well qualified and experienced supply chain management professionals - An informed and engaged work force.

- LEAN SIX SIGMA (LSS) LOGISTICS

List of Metrics

1. Recordable Injury Rate
2. Absenteeism
3. Employee Turnover
4. Continuous Improvement Suggestions
5. Training Hours Per Employee
6. Number of Internal Defects
7. Number of External Defects
8. Record Accuracy
9. On Time Delivery
10. Schedule Conformance
11. Supplier Performance
12. Unpaid Overtime
13. Workers Compensation Claims
14. Internal Cost of Poor Quality
15. External Cost of Poor Quality
16. Hours Per Unit (production/service)

The following metrics display the most comprehensive picture of the people element of the logistics framework, embracing all relevant areas from occupational health and safety to human resource management to training and growth.

1. Recordable Injury Rate

Maintaining and monitoring the RIR metric provides a visibility of the occupational health and safety spectrum of the logistics operation. The United States Occupational Safety and Health Administration (OSHA) considers recordable injuries to comprise three components: injuries that cause lost time, injuries that require medical treatment, and all disabling injuries.

Recordable Injury Rate (RIR) is the measure of work related incidents that result in fatality, loss of consciousness, restriction of movement or work or require medical treatment beyond first aid recorded over a certain number of working hours (OSHA specifies a reference number of 200,000, which is the amount of working hours produced by 100 employees working 40 hours per week in 50 weeks of a year). Recordable Injury Rate is calculated by multiplying the number of recordable injuries and 200,000 divided by total hours of work produced by the company in a year. This yields the injury rate for one year per 100 employees.

RIR is a standardized index of safety performance across diverse industries. RIR provides a measure of the safety culture, safety awareness and safety policy of a business concern. A well monitored RIR and a well instituted Occupational Health and Safety System is the principal device to ensure a zero-accident organizational culture, which translates into minimizing waste of productive time and waste of costs incurred (medical treatment, compensation claims, paid leaves) due to unsafe practices and the neglect of safety standards. RIR also acts as a seed to provide insight into the occupational hazards of the operations which can be further focused upon to improve safety standards in the organization.

RIR is best recorded on a graph of moving averages against time (per week, per month or per year).

2. Absenteeism

A key performance indicator (KPI) pertaining to human resource management; absenteeism is measured as the ratio of the number of working hours that have not been spent in productivity to the total number of potential working hours over an appropriate time period (a working week at shop floor level, to a year at business unit or business division level).

Absenteeism is a cost critical but at times overlooked area in management, an aspect which an aspiring lean organization cannot afford to neglect. It describes the effectiveness of supervisory and junior to mid level management in an organization. Absenteeism should be monitored to maintain operational effectiveness of the work team, to prevent avoidable cost expense to business (because of employees paid for a work that they did not perform), and to prevent over employment

(ten people are required to do the job of seven because on average three are always on a leave of absence because of line managerial or supervisory failure).

Effective remedy of absenteeism requires that management processes provide managers with the means to quickly and accurately log absence, and provide meaningful information enabling them to reduce unwarranted absence by attending to sick or problematic staff. In order to manage absenteeism, it is necessary to have a clear policy in place, to monitor trends and to have a department nominated to provide necessary support and service to sick employees. Absenteeism, along with employee turnover, is the best visibility of employees' morale and loyalty.

3. Employee Turnover

Employee Turnover, like absenteeism, is a human resource KPI which measures the number of employees that have been separated from the organization (voluntary or compulsory) as a percentage of the total number of employees. Employee turnover is a measure of employees' commitment to and satisfaction from the organization.

Employee turnover is calculated by dividing the number of employees who have left the organization (either due to their own reasons or because of management decision, without counting lay offs/workforce optimization) by the number of employees at the start of the year plus the number of new recruitments. Employee turnover is typically measured on yearly basis.

Whereas absenteeism is indicative of the supervisory and line managerial effectiveness, employee turnover provides visibility into the organization across multiple functional areas and all tiers of the organization.

A high employee turnover in an organization implies skill dilution, that is skilled employees are constantly being replaced by novice workers, which translates into reduced performance levels of the overall organization. Turnover imposes an entire gamut of costs to the business, including the cost of new recruitment, cost of transition and training, cost of leaving as well as cost of reduced performance levels, and unnecessary overtime.

4. Continuous Improvement Suggestions

Continuous improvement suggestions have a twofold purpose: to tap into the employees' knowledge base to learn ways to improve business processes, and to empower employees.

The first stage of continuous improvement suggestion system is to encourage employees to participate in the system. Initially, management should not be overly concerned with the quality or effectiveness of suggestions,

but with breaking the inertia and hesitation to participate among the employees. In the second stage, the employees should be educated about their respective functional areas so that they can analyze their surroundings and offer meaningful suggestions. The third stage is to focus on desired results. The Japanese style suggestion system (KAIZEN) is aimed at morale boosting results of employee participation, while the American style suggestion system aims at seeking financial optimization through process improvement.

The suggestion system requires that each shop floor employee is engaged by the line manager or supervisor in a meaningful discussion (most optimally during education/training sessions) to seek the employees' point of view about following points:

- What is the purpose of their job?
- How can a 'job well done' be determined?
- What are the best work practices?
- How will the individual's performance affect the overall company's performance?

A well devised suggestion system ensures that employees feel a level of ownership of the organization and actively strive to improve organizational performance.

5. Training Hours Per Employee

The metric of training hours per employee provides a measure of time (and effort) that an enterprise expends on its members; training them to perform their respective functions in a better manner. A well designed training program enables capitalization of the fullest potential of the work force, and minimizing waste incurred by the work force due to ignorance of optimum operating procedures and techniques. Training also serves to instill safety and regulations awareness.

Training hours per employee is determined by multiplying the number of employees attending training over a certain period (month, quarter or year) with the total duration of formal training (in hours) and dividing by the total number of employees in the business unit. After determining the current magnitude of training hours per employee, it is important to identify specific training needs of departments, functional areas and employees that need to be trained. Any training goals that are identified must be accompanied by appropriate training budget, arrangement of qualified trainers and training facilities, and training schedule as per requirement.

Training is often the most overlooked area of business improvement which results in suboptimal processes and performance leading to costs related to poor quality. It is wise to form a training department (the size of which depends on the size and training needs of the organization) if one doesn't exist, and identify skilled personnel who can impart their knowledge base to the rest of the team.

Quality Metrics

The purpose of the entire quality paradigm in logistics operations is to ensure service reliability. Almost all of the quality metrics relate to accuracy of individual functions, that is, conformance to the established standards of acceptable performance. There is an entire range of quality metrics, some of which monitor individual activities while others concern overall performance, including order entry accuracy, shipment accuracy, invoicing accuracy, number of customer returns, etc. However, three quality metrics are fundamental to implementing LSS standards: number of internal defects, number of external defects and record accuracy.

A defect is defined as non-conformance of a process or procedures to acceptable performance standards. LSS logistics aims at providing almost 100 percent defect free service to the customers. This level of efficiency is not possible unless each process is made mistake proof and mechanisms are incorporated into the system which prevent the mistake from traveling to the next process; as well as providing the employees with the means to correct mistakes as they occur.

6. Number of Internal Defects

Internal defects are those that occur in the internal processes of the logistics enterprise before the product or service is delivered to the customer. In manufacturing operations, internal defects are caused by poor design, poor quality control and quality assurance, improper inspection criteria, lack of training, etc. In logistics operations, internal defects are mostly related to damages during handling, documentation and records keeping, and picking/shipping accuracy. Whereas the damages, errors and faults of this nature are fairly visible and can be tracked, the internal defects that arise due to inefficient systems are not readily visible and need closer evaluation for detection.

In order to detect the internal defects, a number of mechanisms can be instituted, including in process and final inspection, sampled tests of products and services, as well as process and product/service audits.

The number of internal defects is most meaningful when measured separately for functional area or department, and

trend analysis is carried out because then this metric forms a fundamental optimization tool. The number of net internal defects for the organization or business unit provides the higher management a quick visibility of the general health of organization's processes, but does not tell the whole story and optimization activities based on this whole business view metric alone is flawed.

7. Number of External Defects

External defects are those instances of non-conformance to acceptable performance that are detected by the customer. In terms of cost of business, external defects are far more damaging than internal defects because one, these defects indicate a failure of systems internal inspection procedures, and two, a dissatisfied customer is a source of bad reputation for the business.

External defects can be broken down into warranty claims, damaged goods, incomplete orders, wrong orders, incorrect shipment address, returns and recalls as well as legal liabilities. External defects can incur costs upon the business that may be many times the costs incurred due to internal defects.

Recording the number of external defects provides a monitoring and control tool to take remedial actions.

8. Record Accuracy

Record accuracy means the correspondence of a stock record to the actual quantity on-hand. Record accuracy indicates the effectiveness of the firm's stock keeping procedures, and actual effectiveness of such procedures. It can also highlight possible pilferage and waste due to improper storage. A regular audit is instituted to conduct on ground count of inventory and check it against the figure noted on stock records.

Customer Service Metrics

The purpose of an LSS or any logistics enterprise is to provide as good customer service as possible and in logistics arenas, this focuses heavily on delivery. Customer service can be measured in terms of on time delivery, schedule conformance and supplier performance.

9. On Time Delivery

OTD is measured as the number of orders that were accepted by the customer's acceptance (inspection at receipt) department within the delivery date bracket commitment. (An early delivery is often no less problematic for the customer than a late delivery due to docking and storage issues.) This measure of OTD refers to manufacturing. For logistics and sales, OTD is measured as the number of orders that were committed for delivery by the first dates requested by the customer.

OTD is the first measure of customer satisfaction and the defining metric of the net revenues generated by a logistics enterprise. OTD reflects the state of health of all operational processes that lead up to delivery. An OTD metric maintained within Six Sigma requires a no-fail order filling capability, dependable and variability-free order cycle time, visibility of order through filling and shipment, and reliable transport service. A logistics enterprise that focuses on OTD is the right fit for a business enterprise that operates on Just In Time logistics policy.

The measure of OTD must not be done at individual department level without a high level perspective, because manufacturing/supply and sales departments usually have divergent perspectives unless synergized. A customer perspective of OTD will depict not only the performance level of the logistics organization, but any aberrations will also highlight the need for further interdepartment coordination if found to be the source of the problem. Other areas that give rise to OTD failures are stockouts/ manufacturing delays, late shipments and transit/delivery delays.

10. Schedule Conformance

The schedule conformance metric is a measure of adherence to the schedule of all preplanned activities. Schedule conformance does not pertain to on time deliveries (which are measured by their own metric) but to scheduled activities such as arrival and departure of transport, transport fleet periodic maintenance, data collation and audit, report and returns to be compiled and disseminated.

Schedule conformance is best measured on departmental level, broken down into functions in order to determine in which area schedule adherence is violating Six Sigma operations.

11. Supplier Performance

The supplier performance metric provides visibility of a supplier's impact on your supply chain's operational effectiveness, measured through supplier's quality performance and supplier's time performance. Supplier quality performance is measured as the number of instances that the supplier delivered material or services which failed to meet your business's acceptance criteria, as a ratio of total number of deliveries made by the supplier. Supplier's time performance is measured as the number of instances that the supplier delivered material or services failed to meet the delivery date requested by your business, as a ratio of total number of deliveries made by the supplier.

A Lean Six Sigma logistics operation cannot operate in conjunction with a supplier that does not adhere to the demanding performance parameters of a six sigma business. Suboptimal supplier performance results in excess inventories, performance unpredictability, and internal



The goal of a Lean Six Sigma enterprise is to minimize all wastages, particularly the most important of all-time.

- LEAN SIX SIGMA (LSS) LOGISTICS

scheduling conflicts that arise due to supplier performance variability. A business that seeks to minimize its cash-to-cash conversion time and maximize its return on investment must rely on suppliers that operate on similar business principles.

Quality/Cost Metrics

12. Unpaid Overtime

Lean operations suggest that all scheduled working hours are rightly managed, and processes correctly mapped to business operating requirements and time, so that business load is efficiently managed within standard working hours. While sporadic requirement of overtime/expedited operations is perfectly normal, periodic recurrence of such additional work is not. If an enterprise frequently requires overtime to meet its business requirements, serious deficiencies and inefficiencies in business processes are indicated.

Customers are as a rule, unwilling to pay extra for the same service already committed to at a certain rate. An enterprise that needs to put in unplanned or unscheduled work to meet a committed service schedule, because of its internal deficiencies, cannot pass the costs on to the customer.

Unpaid overtime is thus an important performance index that depicts the efficiency of business operations in terms of cost. Unpaid overtime is typically caused by absenteeism, lack of training or inefficient process flow. Unpaid overtimes should be measured as the number of orders that require expedited internal operations without just cause, or as the total cost of additional work hour required to meet such orders.

13. Workers Compensation Claims

Workers compensation claims are filed by employees who are injured on the job. Compensation claims payments can take the form of reimbursement of medical treatment, rehabilitation, disability insurance payment or life insurance. Each instance of workers compensation paid indicates a possible lack of safety culture and correct operational health and safety procedure awareness in the organization.

In order to minimize worker compensation claims, management must commit to cultivating a safety culture in the organization, and middle and line management must ensure that shop floor workers are mindful of safety requirements of their job. Monitoring RIR (section 2.3.1) is an effective means of minimizing compensation claims. Also, the organization must have clear policies and procedures in place to prevent damaging law suits that could be avoided by suitable compensations.

14. Internal Cost of Poor Quality

Internal costs of poor quality are costs that would disappear if processes, systems, services and products were perfect. This cost is the cumulative value of all costs incurred due to poor quality before the receipt of service by the customer.

In manufacturing operations, internal costs of poor quality can be directly measured through monitoring the costs of scrap, rework, re-inspection, material review, sorting inspection and downgrading product. In logistics operations, internal costs of poor quality relate to buffer inventories, expediting shipment due to internal operations shortcomings, unused capacity, excess administration costs, scheduling conflicts forcing idle inventory or requisitioning additional transport arrangement.

15. External Cost of Poor Quality

A perception made earlier in this paper about quality was that ensuring high quality meant high costs. However, it has been firmly established that systems, processes and services or products that lack in quality incur more costs if any deficiencies or imperfections exist.

Costs that are incurred due to defects found by the customer after delivery are called external costs of poor quality. The hard costs are fairly obvious and can be directly found from the ledger including warranty claims (cost of repair/replacement under warranty stipulations), customer returns (loss of sales and profit as well as cost

of replacement) and customer complaints (work hours expended at complaint resolution at the rate of dollar value per work hour for the complaint department).

A significant portion of the external cost comprises the soft cost, primarily due to loss of customer, who does not return after one unsavory incident. Also included in soft costs is the impact of an unsatisfied customer's feedback to the market about performance, capability or yield of a particular firm.

As a rule of thumb, a close control over the hard costs of poor quality will result in lowering of the costs, both hard and soft. In order to control external costs of poor quality, management should aim at minimizing the costs incurred by customer returns, warranty claims and complaints. A customer feedback scorecard is a vital tool for ascertaining problem areas.

16. Hours Per Unit (production / service)

Hours expended per unit of production or service is the most direct measure of productivity, right alongside cost per unit of production or service. Productivity is in effect the ratio of monetary value of output to cost of input. In a business, the inputs are generally differentiated as manpower (measured in man hours), machinery (measured in operating hours), material (measured in material units) and money. In logistics operations, which are typically labor intensive, hours per unit of production or service is the most representative metric of productivity.

Hours per unit describe the efficiency of the work force including the work area/shop floor crew and the supervisors. Hours per unit can be improved by work flow optimization, mechanization of manual labor and scheduling optimization.

To be meaningful, the hours per unit metric should be monitored in view of previous trends, an outstanding record from previous periods, industry standards, as well as an organization's own standards.

16 Must-Have Metrics

PEOPLE METRICS		QUALITY METRICS		SERVICE METRICS		COST METRICS	
1.	Recordable Injury Rate	6.	Number Of Internal Defects	9.	On Time Delivery	12.	Unpaid Overtime
2.	Absenteeism	7.	Number Of External Defects	10.	Schedule Conformance	13.	Workers Compensation Claims
3.	Employee Turnover	8.	Record Accuracy	11.	Supplier Performance	14.	Internal Cost Of Poor Quality
4.	Continuous Improvement Suggestions					15.	External Cost Of Poor Quality
5.	Training Hours Per Employee					16.	Hours Per Unit

Section 3 – Following up on LSS Metrics

Cascading Metrics

In order for the above listed metrics to be useful towards the financial and operational success of an enterprise, it is vital that each employee is a stakeholder in the net performance of the enterprise. To this end, cascading metrics is the process of selecting a well balanced representative measure of company's performance and communicating it down to each employee contributing to the success of the enterprise.

The basic idea is that each employee of the company understands the objectives of the company, and has a regular update on how their performance impacts the overall performance of the company. Cascading metrics not only encourages employees to excel by observing their contributions being translated into success of the company, but it also serves to increase team cohesion at all levels.

The decision point is selecting the right metrics that are most applicable to each tier: the shop floor employees need those metrics that depict the performance of the shop floor towards the company objective, line managers need additional metrics that display a performance measure of their subordinate team, while higher level managers need visibility of the business financial performance as well.

Cascading metrics, like most optimization strategies flow top down: the higher level management has to decide upon a set of metrics that afford the management visibility of the business financial and operational performance at business division or business unit level. The management is also made aware of the metrics that will be used by the manager at the tier below, the tool kit that allows their subordinate managers to monitor the performance of their respective responsibilities, as well as to take control measures as necessary. The process trickles down to the shop floor or work area in a similar manner.

The following model is suggested for efficient utilization of cascading metrics. The ground metrics (work area and department) should provide a real time picture of supply chain effectiveness, the mid level metrics (operating unit) should bring cash flow and ROI concerns into the picture, whereas the high level metrics (division and business unit) should provide an assessment of the health of the business.

Hourly by Work Area - A running tally of shop floor performance is maintained by the work area professional, for example, number of truck loads dispatched, number of packaging units loaded/unloaded, etc. These metrics can be employed by the work force members to develop suggestions for continuous improvement by finding out ways to improve performance, reduce errors and improve job satisfaction. These metrics are best maintained by the workforce members themselves, and tracked hourly on boards located in their work area and readily visible to those with a stake in that area's performance.

Daily by Department - The supervisor and line manager should monitor the performance of their department on a daily basis focusing on the level of performance achieved, variability in performance, the number of internal defects, and schedule conformance.

Weekly by Operating Unit - The middle managers should employ metrics of quality and customer service as well as cost, from a consolidated perspective of the earlier tiers in the cascading metrics to monitor waste and variability on a weekly basis.

Monthly by Division - On a business division level, the accumulated metrics should indicate not only operational performance to functional managers, but also cost performance to financial managers and safety and people's performance to OHS and HR managers.

Monthly by Business Unit - At the corporate headquarters, a monthly review of all the metrics described before serve to link the performance of business units to corporate strategic objectives.

Balanced Scorecard Review

The initial concept of a balanced scorecard was created to provide senior management with a tool to measure the performance of their team and business towards strategic business objectives. A balanced scorecard (BSC), as per accepted standards, comprises four areas: financial, customer, internal processes, learning and growth. These four areas provide visibility of the business from a financial point of view, customer satisfaction perspective, the angle of internal processes that must be honed and optimized for strategic advantage, and from areas where value creation processes can be started.

In order to institute a balanced scorecard as a management strategy tool, it is necessary to determine specific goals in each of the above areas, linking said goals to individual and collective performance, establishing a method of measuring performance towards the goals, and adjusting the strategy according to feedback.

An improved usage of the balanced scorecard recommends formulating a corporate BSC which ties the business strategy to definite objective in each of the four areas, and communicating the BSC to the management tier below so that the managers are aware of the indices on which senior management measures performance of the business as well as of the specific areas in which their suggestions for improvement can contribute towards organizational success.

Based on the corporate BSC, the managers at the sub business unit and sub-sub business unit levels can formulate their own scorecards to monitor the performance of their respective areas of responsibilities.

In the balanced scorecard, each strategy objective can be tracked through measures instituted to achieve the strategy objective, targets of specific measures, and initiatives taken to achieve the targets. The fundamental performance metrics as described in the previous section can be used to measure the impact of the initiatives taken for reducing waste in people, quality, customer service and costs.

Project Updates

A project is work undertaken to create a unique product or to deliver a unique service. A project is differentiated from operations in terms of repetition – a project typically has a definite start and a definite end upon meeting the project objectives, however operations are processes sustained through the existence of a business unit, continuously driving towards strategic objectives.

A project can be undertaken in a business at any time and for any purpose, for example, a logistics consultant devising an optimization plan for the operations of a client, or in a 3rd party logistics enterprise developing a new line of service.

In order to improve upon each of the fundamental metrics described before, a project can be initiated either with integral resources of a functional area or a department, or by a dedicated project office recruiting required skill from relevant departments. The metrics will provide an evident measure of the efficacy of projects undertaken, and also make business case for undertaking further projects to optimize business processes.

Conclusion

Today's business environment is characterized by competition, high customer expectations and pressure on profit margins. In logistics operations, the only way forward is to establish supply chains that identify and eliminate all possible waste, deliver consistent high performance and constantly guard against inefficiencies creeping into the system and processes. Lean Six Sigma (LSS) logistics is the embodiment of these principles, supported by a sound body of knowledge, a comprehensive set of measurement tools, and an effective methodology of performance improvement.

This paper has identified the four principle areas of waste and variability, namely people, quality, customer service and cost. Further, it has described the most important representative metrics that should be monitored in each of the said areas to attain performance optimization. The paper has also suggested a methodology of putting these metrics to use across all tiers of an organization so that the effort of the work force, assisted by supervision and management, can be orchestrated towards corporate strategic goals.

Putting It All Together

It's not enough to just have knowledge in today's workforce – you need to demonstrate your understanding, put it into practice, and establish a record of success. The following case study displays the steps that one company took to measurably improve their supply chain operations by looking closely at some of the metrics discussed in this paper. In particular it shows just how powerful the right metrics can be for an organization, especially when implemented with a leading logistics partner.

COLLABORATING TO CREATE WORLD CLASS SUPPLY CHAINS

G&D Integrated partners with global manufacturer for success

Situation: G&D Integrated provides assembly and logistics services for delivery to a global customer's assembly plants, service parts distribution centers and special order customers. Both G&D Integrated and their customer embraced and adopted Lean Six Sigma manufacturing systems and standards. G&D Integrated and the customer collectively sought to improve delivery performance and reliability, reduce inventory and lower total landed costs. The goal was to achieve full system-wide benefits in people, quality, delivery performance and cost.

Solution: The two organizations made a collective commitment to simultaneously embrace lean manufacturing best practices. Using 5S methodology, Value Stream Mapping and Rapid Improvement Workshops, G&D identified significant opportunities for operational improvement in assembly, logistics and maintenance in manufacturing and supply chain operations.

Safety improvements included investment in robots and automation technology to eliminate manual processes with potential for operator injury. G&D made additional investments in laser guided assembly and data collection technology to drive quality and reliability improvements.

G&D revamped inventory systems and receiving, warehousing and cycle count processes to improve inventory record accuracy. Storage systems, dock slotting and yard management processes were reconfigured to optimize material flow through the facility. Material handling movements were reduced by 49% and storage space was reduced 20%.

The process improvements extended upstream in the supply chain to G&D suppliers. G&D led improvement workshops and process improvements with component suppliers to improve communications, schedule performance and quality. Schedule visibility and pull systems were developed to orchestrate component deliveries to arrive 4 hours before being assembled.

Results: G&D transformed its operations, systems, standards and culture to more effectively manage the entire supply chain. Through purposeful collaboration, G&D and the customer established a proactive operational partnership with mutual goals and strategy, all supported by enhanced communication, transparent technology and ongoing metrics and analysis.

It took commitment and collaboration across the extended global supply chain to produce these impressive results. Beyond the operating performance improvements, these improvements will help the customer extend their global leadership by providing superior quality, responsiveness and differentiated products. This will help fuel profitable business growth for both organizations.

Significant collaborative operating improvements made by G&D and its client include:

People: 60% reduction in recordable injury frequency

Quality: Reduced defects per million by 49%

Velocity: 77% reduction in past due deliveries

Cost: Reduced inventory 60% and total costs by 8.5%

“

By working together, the two organizations achieved their mutual goal of producing the highest quality products with greater safety and efficiency

**- LEAN SIX SIGMA (LSS)
LOGISTICS**