

Lean Distribution

Breaking the forecast barrier to customer service and profits with Lean Manufacturing and Supply Chain Management practices

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Chapter 1 – Taking the Lean Approach

Lean Distribution breaks the forecast accuracy barrier to improving customer service and profit with flawless execution of simplified operating processes

Competition is growing at an ever increasing rate and price tends to be the main battleground. Finding the lowest cost source or manufacturing location has been the strategy with China the preeminent destination. The implication is that distributing products across global supply chains is more challenging than ever. There is just no room for error in planning and moving products across complex, global supply chains.

Distribution in these price sensitive times must evolve to meet the competitive threats and realities of global markets. In the past, distribution processes relied on customer order forecasts to find the most cost effective plan, but forecast accuracy continues to be an elusive goal. These forecast based plans are becoming less reliable and cost reductions more elusive.

Some companies have been successful with new distribution processes and strategies that can transcend the forecast accuracy barrier to low cost. Dell Computer, Wal-Mart, Apple and others are using advanced approaches combined with Lean principles to drive new levels of competitive threat. These results are evident in any analysis of Dell's working capital: it is actually negative! With negative working capital, Dell's profit is increased by the leverage gained from current assets, a very uncommon effect. Can any other significant business boast similar results? Clearly, these companies are taking new approaches that their competitors cannot match.

Apple and Wal-Mart streamlined the global distribution model. Consider how some of the newest products are sourced, sold and distributed without any time in distribution centers in the US. The model is to reduce contact, reduce time to the consumer, and completely eliminate as much cost as possible. The ideal being direct from source to consumer.

Current operating paradigms, measures, and business processes that seek to forecast, plan and optimize distribution into perfection stand in the way of dramatic change that Dell, Apple, and Wal-Mart are pursuing. Consumers and industrial markets are just moving too fast for forecasts to be sufficiently accurate to optimize and execute a plan. The alternative? A simplicity, flexibility and market driven approach built around Lean principles in distribution.

The Lean Change in Distribution

Distribution operations are particularly susceptible to these globalization trends due to the direct linkage to customer service, the limited value added, and the high levels of cost across distribution. Changes in plans quickly impact customer service and/or costs. Only well optimized plans that are flawlessly executed meet distribution's exceeding stringent standards for both service and low cost. Plan changes challenge distribution optimization and the organization's ability to meet performance objectives.

The Lean Distribution approach increases flexibility and simplicity to reduce the reliance on forecasts and optimized plans to achieve results. With Lean, process and performance improvement is focused on reducing lead time, reducing lot sizes, and increasing reliability, yielding the flexibility and simplicity required to achieve consistent results. Lean Distribution takes a very different approach than an optimization and

planning approach that are based on fixed lead times and lot sizes. Optimization seeks to reschedule the orders and inventory within the plan in order to reduce costs, whereas Lean seeks to create flexible distribution operations that respond to changing market needs.

The RFID Change Dilemma

A customer driven initiative to streamline supply chains and sourcing that is currently impacting distribution is radio frequency identification (RFID). RFID is the latest initiative by Wal-Mart, the United States Department of Defense (DoD), and others to improve the flow of incoming products. These customer requests to tag pallets or cases with an RFID tag as well as the current bar code, appears to add cost and time to each supplier's distribution process. The benefits are most evident in the customer's operations (Wal-Mart, etc.), yet these customers are not willing to increase price for the tags and additional work suppliers must perform to transmit RFID data. The result being that suppliers are taking limited approaches to comply and distribution is where most of the added costs and time reside.

A majority of the professional conversation tends to relate to technical standards or RFID costs rather than specific distribution transformation capabilities. Like the bar code transition of 30 years ago, the RFID movement will continue to raise cost related objections until the technology becomes ingrained across nearly all supply chains and is nearly "invisible" to cost measurement. The benefit question remains focused on how the customer gains value and not how suppliers will transform supply chains and distribution.

This missing link to RFID benefits for suppliers is the fundamental disconnect for distribution processes. The operations paradigm is to reduce the most observable and measurable costs, such as transportation and warehouse labor. RFID technologies provide transformational capabilities, but ones which have not been sufficiently explored. The customers seek continual cost and service improvement, but how the supply chain will be operated differently has not been defined. With Lean Distribution, approaches to leverage RFID signals for replenishment can be identified.

The Forecast Barrier

Customer order forecasts are the starting point for nearly all business, operational and financial planning. It is very difficult to get around it: forecasts are the best estimates for the market directions, volumes and pricing necessary to make many decisions across any business. Commitments to suppliers, setting operating levels, and projecting financial results are all driven from the forecast. These many decisions require review, revision and change as forecasts are updated and revised, an almost daily process to keep pace with the market. So forecasts are absolutely necessary, but also have the unintended consequence of producing continuous disruption as organizations strive to hit plans driven by forecasts that are moving targets.

Forecasts change frequently as customers change plans to adjust to their market conditions. So why do companies spend so much time and place so much importance on demand forecasts that change frequently and at times change dramatically? The answer lies in the forecast as the foundation for all business, operational and financial planning. The forecast initiates and dominates these business processes as the organization

diligently works to ensure excellent customer service and low costs by planning from the forecast.

Distribution tends to be a lightning rod for forecasting issues and inaccuracy, because excess or inadequate inventory is highly visible in a distribution center. There are immediate impacts to service in distribution for inventory imbalances many of which are “blamed” on poor forecasts. So the success of forecasting and the subsequent planning processes can be assessed with distribution service levels, inventories, resources and costs. The effectiveness of these distribution measures are typically tied back to planning processes and in many ways are limited by the effectiveness of forecasting.

The Balancing Act

There is contention in the relationship between supplier and customer that while forecast change is inevitable, a supplier desires stability. This contention is shown in figure 1.1 as the difference in interests between customer and supplier. From a customer’s perspective the flexibility to change on short notice is preferred over firm plans that cannot change as the market or competition changes. However, suppliers seek certainty, long lead times and limited forecast changes. Clearly, customer and supplier interests may not be fully aligned. At the root of their differences can be a supplier’s focus on controlling costs with stable plans and lead time, while the customer may have the “luxury” of making changes to forecasts without concerns that prices will increase.

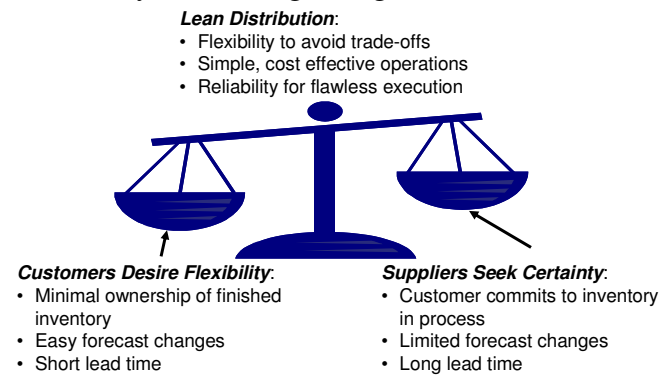


Figure 1.1 – Planning Balancing Act

Depending on their relative negotiating positions and strengths, this balancing act may shift toward one or the other party. Tilted towards the customer tends to focus more on maximizing the total sales through the supply chain with quick responses to market changes, despite concerns over cost implications at the supplier. Conversely, strong suppliers will receive more assurances and

control over forecast changes that may impact their costs or profitability. So, frequently the struggle really is within the supplier as Marketing seeks to maximize sales while Operations and Finance struggle to maintain profitability. In a “sales” driven organization, the internal struggle may not be pronounced, because the Operators know the changes must be accommodated and they may have some level of inefficiency budgeted to compensate.

Another view of the flexibility dynamic can be found by assessing the risks and resources across the supply chain. Figure 1.2 has circles representing the amount of inventory and resources across the supply chain. Customers typically desire to push inventory responsibility back to a supplier, displayed with arrows toward Internal Operations. On the other side, a supplier’s supplier will likewise seek to receive commitments and push inventory and commitment toward the Internal Operations of their customer. The longer lead times and higher inventories are, the more risk in the supply chain. The only question becomes which parties carry the risk.

Mapping the extent of resource commitment for each party, can assess the risk inherent in a specific supply chain and across distribution operations. Contract and business relationship negotiations tend to move these commitments around rather than to reduce or even eliminate them. The key to successful relationships across the entire supply chain lies in reducing risk and eliminating resource commitments, the fundamental tenets of Lean.

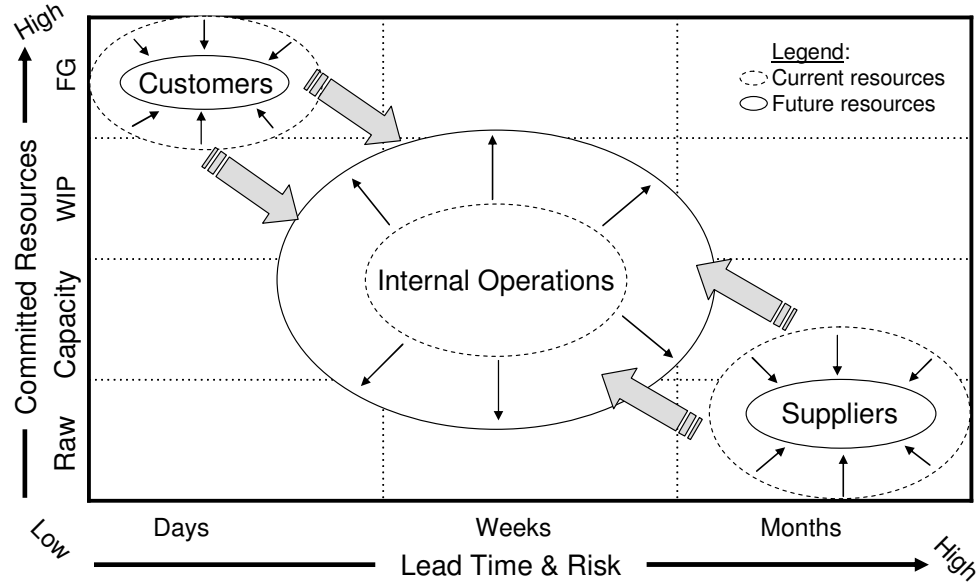


Figure 1.2 – The Resource Commitment and Risk Squeeze

With Lean Distribution, the approach is to clarify how the risks can be mitigated, total supply chain costs reduced and service improved, while increasing focus on maximizing total sales and volume throughput. The Lean approach requires a thorough re-evaluation of current processes and practices to break the trade-offs inherent in most forecast based planning and optimization processes.

Business and Operational Plans

Business planning may seem like a “necessary evil” to meet customer orders, reach financial results and optimize performance. Planning requires detailed customer demand forecasting, which can be time consuming, contentious, second guessed and frequently inaccurate. Executives’ time and energy can be sapped by these processes due the need to synchronize business plans to meet financial objectives. In the end, the business plan may be less a true reflection of the market and more a set of plans and objectives necessary to meet the financial performance required by shareholders and the financial markets.

Planning processes are focused on these important objectives because of the pressure executives are under to perform. Due to the difficulty meeting ever increasing objectives, the tendency may be to increase the detail of plans to improve execution, ownership and accountability across the organization.

What may be curious is the inaccuracy of the underling assumptions for these increasingly detailed and complicated plans. Market forecasts are the starting point and the data with the greatest degree of error and change. Forecasting customer demand may range from highly sophisticated analytics to rudimentary estimates, but ultimately require

frequent updates. Markets move fast and organizations devote an extensive amount of time and effort to forecasting and planning in a quest for accuracy.

As forecasts are revised and business plans updated, problems are created in the form of changing schedules across and down through the organization. The revised plans require many reactions to change all of the inputs to business planning: purchase orders, production schedules, transportation plans and many others. So, planning today creates numerous “ripple effects” in nearly all functions of the organization. This can be frustrating for the organization as more and more details are created and then changed with every new revision of the forecast.

Forecast Accuracy

How accurate are forecasts? Have they ever been sufficiently accurate for the planning, sourcing, operations, distribution and logistics users or are there complaints about inaccuracy? This may seem like an odd question, since logic dictates that forecasts are not correct, yet nearly all daily schedules are driven by detailed forecasts and commit large portions of resources based on them. In fact, these plans are the corner stone for nearly all operational performance and cost reduction efforts despite the fact that forecasts are rarely accurate, except in total sales dollars or an aggregate volume measure.

But accuracy in aggregate units does not support operational planning and cost reduction efforts. So if a product level forecast does not exist, Operations Planning must create another forecast by product which may need more work to make accurate and consistent with the business plan forecast. Any planning based on the “operations forecast” may be called into question due to differences with the real forecast that has proven to be accurate for business and financial planning.

Collaborating with customers to improve forecasting may be a worthwhile initiative, but one that does not guarantee accurate forecasts. Collaborating may improve forecasts by tightening the communications of market changes. Faster and better communications means being more responsive to changes in the customer’s market rather than creating a “fixed” forecast for the supplier. Is it in the customer’s best interests to stick by their input to the forecast despite their market changing? Since customers must respond to changes in their market, having their suppliers respond in kind is more beneficial than having their suppliers demand frozen schedules.

In the final analysis, forecasts are the best attempts to tell the future and by their very nature will always require revision and be challenged over accuracy. Detail plans driven from forecasts are the first cause of instability in daily operational schedules that are well intended, but based on hitting a moving “target”, the forecast. So a cycle is created starting with forecasting, then planning and then revising the forecasts to keep the plans current and accurate. For the folks down the line, the daily schedules are either a moving target or are artificially “fixed” to appease suppliers, operations and distribution. Hence, today’s planning driven by an inaccurate market forecast creates tomorrow’s operational problems as schedules must be continually revised.

Another Approach

But is there another way to plan and manage? This is not obvious, because optimizing distribution requires some method to plan and take actions in advance that

reduce costs, such as scheduling carriers with the most cost effective rates. Unfortunately, these plans become subject to change as forecasts change, which happens frequently. Forecast changes create a “ripple effect” of increases to other costs, such as inventory, as attempts are made to retain the cost reduction obtained in freight. A conflict exists between attempts to reduce costs using the forecast and daily efforts to serve customers and revise the forecast as business conditions change.

An alternate approach to planning and optimizing must accommodate the variation that creates instability in forecast driven plans. Variation comes in many forms: customer demand that changes, operations that have good days and bad ones, suppliers that may not deliver, and many other factors affecting the daily plan or forecast. An approach to optimization which embraces variation rather than being whipsawed by it could greatly improve performance and total cost across the business.

The roadblocks to a new approach are the planning processes and optimization mindset. Organizations “teach” and measure their people based on the assumption that forecasts provide sufficiently reliable plans and productivity follows solid planning. Variability has only recently become a topic as quality improvement initiatives such as Six Sigma challenge traditional “inspect in” quality approaches. It is becoming accepted that variation in the production process is the cause of quality problems, but this concept has not moved into forecasting, planning and scheduling.

The Traffic Analogy

Consider the dilemma of answering the question “How long does it take to drive downtown?” For anyone in a major city the typical answer is “it depends.” There are many qualifications related to time of day, weather, carpool status, and other factors necessary to provide even a rough estimate. Answering the question may end up as a range of the best case to worst case scenarios, to insure the driver allows sufficient time.

The dilemma for this driver is not unique; it involves many factors to insure on time arrival as shown in figure 1.3. For the non-rush hour case, getting to and merging onto the freeway does not encounter lines or a wait. Once on the freeway, cars move at the speed limit allowing a predictable commute time and on time arrival based on the distance to be

covered. For the rush hour case, there is a wait to merge onto the freeway and many starts and stops once on the freeway, causing a highly variable amount of time commuting. During rush hour or any other high

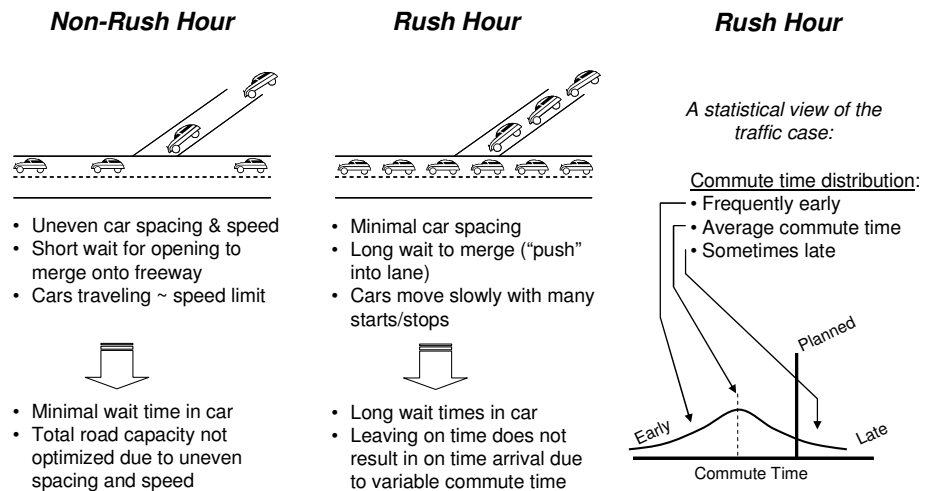


Figure 1.3 – The Traffic Analogy

traffic volume time, the commute time varies greatly requiring the driver to allow “more than enough” time. The more time allowed, the higher the chance that arrival will be very early. An on time arrival is purely chance rather than good planning or driving. Unless the arrival time really does not matter, the statistics show that very early arrival must occur much more frequently than on time.

Solving the traffic case requires reducing the variability for the commute time and maximizing the total volume. For each commuter this is difficult to accomplish, but can be addressed for all cars by focusing on maximizing the total flow of cars. During rush hour, speed and spacing between cars deteriorate as cars “push” their way onto the freeway, reducing the total flow. Once on the freeway, spacing is reduced causing speed to deteriorate. Because the flow of cars is dependent on the speed and spacing of cars, an optimal combination must be enforced for all cars to maximize flow. Improved speed and spacing could be accomplished by using Lean based Pull to bring cars onto the freeway up to the point where optimal speed and spacing start to deteriorate. Then maintain that level of pull (number of cars allowed on at each entrance) during rush hour. This Pull approach to the traffic analogy is showed in figure 1.4. For the Lean Pull approach to work, each driver must be ready to depart home on fairly short notice (the Pull signal) and able to maintain a constant spacing for the given speed (imaginary linkage to the next car).

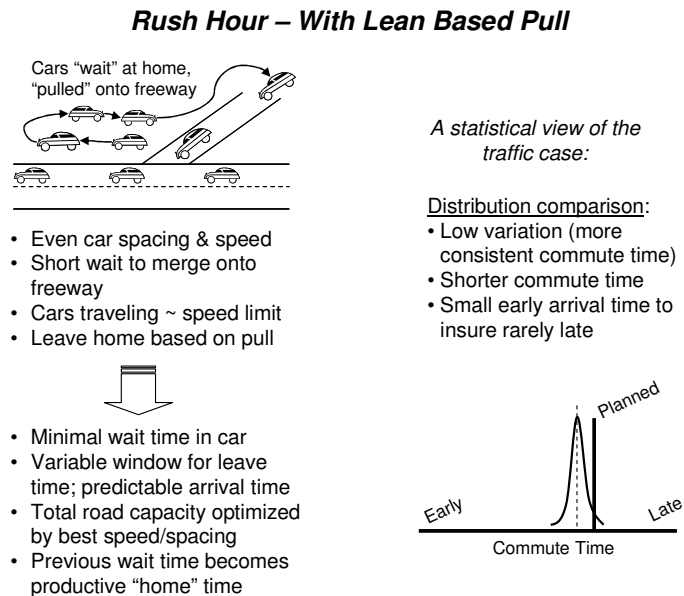


Figure 1.4 – Lean Pull Based Commute Time

These two principles of Lean: Pull and linkage across operations improves total flows across distribution. The Pull signal (time to leave home for the freeway) moves the current wait time in a commute to the beginning and the linkage (maintaining the proper speed and spacing) maximizes how much gets through existing capacity (the freeways). As pull and linkage are combined, the right products (cars) get to their destinations fastest (commute time).

So how does this apply to distribution? Consider the similarities between inventory and the cars during rush hour: both must endure long transit time and arrive early to avoid being late. For inventory arriving late, customer service is impacted, which must be avoided at nearly all costs. So inventory arrives early increasing the requirements for capital, warehouse space, handling and tracking. The time for inventory to move may seem small for any one rushed shipment, but overall is long due to time taken to maximize shipments (freight) and operate efficiently (labor). If inventory can be moved faster and more reliably, then it could arrive closer to actual customer need and reduce many distribution costs and resources.

But what if the planned arrival time varied as well as the commute time? This does not happen for someone heading downtown for a sporting event or the symphony, because the starting time is fairly well fixed, although they may start a little late, they would never start early. A variable expected arrival time makes trip planning even more complex and risky.

The uncertain length of the commute time represents a company's lead times to respond to customer needs. They are not easily estimated and are subject to the conditions at the time, hence highly variable. Unlike the typical downtown traveler, customer needs are highly variable. So let's see, there is a variable time to respond and uncertain arrival time. Planning can only come up with the best estimate (forecast) of the needed arrival time and allow plenty of commute time (lead time) resulting in lots of excess time, except for the rare occasion when start time is early and drive time is long.

Planning becomes difficult for this commuter, who eventually decides to move downtown. By living in the city, the commute time is low and responding to a variable arrival time is easier. Relocating to a downtown home is like setting up a local warehouse for a customer, it decreases lead time to respond. The downside is that if the customer moves or the mix of customer requirements change, the warehouse location may become obsolete or at least sub-optimal. This is why many workers choose long commutes over relocating their residence: the commute may change requiring another move anyway and living outside the city is less expensive. Moving can be expensive as well and would limit other opportunities, such as moving to the south end of town might limit taking a new job on the north end because it would require yet another move.

The moral of the commuter's tale is that estimating an exact departure time is near impossible due to the variable time to drive downtown. An estimated time to depart is the best case, using an assumed commute time and whatever amount of safety time the particular driver is comfortable with, but in no case does a driver realistically expect to know exactly when to leave to arrive exactly on time.

For a business with physical distribution of products, lead times vary and have many of the same patterns as the commuter. Unfortunately, businesses attempt to obtain an exact expected arrival time from customers (a forecast) and then calculate an exact start time for operations and suppliers (a schedule or purchase order). A major difference with companies is the propensity to establish a local distribution center or warehouse to serve the customer, which is difficult to change as customer demand patterns change. Unlike the commuter, companies frequently err on the side of the added cost of warehousing facilities and operations close to customers rather the long commute (being more flexible) to respond to the changing arrival times.

Improving Distribution Operations

As initiatives to reduce cost are implemented, other areas across the distribution chain may be impacted which is described in Chapter 8 as the Distribution Cost Waterbed. The analogy represents that pushing down costs in one area may actually increase costs in another, such as reducing freight can increase inventory and handling costs. This identifies a conundrum: do all cost reductions reduce total cost? Some of the initiatives distribution operations have employed are shown in figure 1.5 along with common downsides.

Initiative	Description	Downsides
Improve forecasting	Collaborate with customers and work with Sales to make product level forecasts more accurate to reflect the customer orders expected over the near term planning time frame.	All forecasts are wrong, requiring significant time to revise and then re-plan. Lower level operating schedules are not stable or are fixed and not responsive to customer demand.
Reduce freight	Ship full truckloads, eliminate expedited delivery, and negotiate favorable rates with carriers.	Freight flexibility may become limited, which can be critical to reducing total supply chain costs.
Automate warehouse labor	Install material handling equipment and information technologies to speed material flow and reduce put away/pick times.	As capital investments are made the distribution network becomes more difficult to change as market and operating conditions change.
Automate data entry	Implement bar code, wireless terminals, and RFID to automate and increase the accuracy of data capture.	Increased tracking requires more controls to validate accuracy and complicates planning processes.
Maintain inventory for service	Place inventory in warehouses (public or owned) close to customers to enable quick response and readily available inventory for customer orders.	Inventory and planning complexity dramatically increase as locations are added which actually slows response to major market shifts

Figure 1.5 – Distribution Improvement Initiatives

The question may arise whether the improvements for one year are enough or are the best that can be achieved. Is this question answered with the “pound of flesh” approach? Or pushing for “cuts” until the organization nearly breaks? Interested in another way to understand how much improvement can be achieved and what actions would be required?

Another approach means better understanding the levers that can be “pulled” to consistently and productively reduce TOTAL costs in all distribution and logistics operations. But another approach also means focusing on flows and customer service approach rather than individual departmental budgets and isolated areas of spending.

Lean Paradigm Shifts

Lean Manufacturing started as the Toyota Production System (TPS) in Japan and later in the United States as companies studied Japanese methods. As the domestic automotive industry embraced TPS practices, such as kanban, the Just-in-time (JIT) movement transitioned into Lean as the more holistic approach to enterprise productivity. So, Lean Distribution is the natural extension for companies using Lean practices within their own operations or who have customers that embrace Lean.

Lean works to systematically improve the parameters that drive performance across the entire supply chain rather than to take independent actions seeking to improve departmental costs, service levels, and inventory. The main levers of a Lean Distribution approach are cycle time, variation, and flexibility. These parameters become the drivers for inventory levels, cost profiles and other aspects of the distribution chain so the relationships and interactions are readily apparent.

Lean takes the approach that markets move and the supply must move quickly with them rather than a forecast and plan based approach which attempts to optimize and execute a “frozen” plan. With Lean, market shifts are expected and taken in stride because variability and flexibility are built in. A forecast and plan approach resists market changes, because it upsets the plan and all of the actions being taken to optimize and

execute. A more complete comparison of the traditional “forecast and plan” approach and Lean is provided in figure 1.6, which tackles each of the main paradigms related to managing distribution.

Paradigm	Traditional Approach	Lean Distribution
Customer Service	Collaborate to forecast, then ship to firm orders/releases.	Manage flow as customer consumes, “own” replenishment.
Forecasts	Are accurate enough, but should strive to make more accurate	Limited accuracy, use for longer term and aggregate planning only
Inventory	Is an asset and should be close to the customer to meet lead time demands	Consolidate at the source and redirect flow quickly for changing replenishment needs
Variability	Not explicitly used in planning, but measured in operations if Lean and Six Sigma is embraced	Operational, customer demand and supply chain variability factors used in Lean processes
Transportation	Changes with forecasts and orders; seek to reduce	Replenishment cycle driven; stabilize lanes to reduce
Optimization	Reduce each component of cost while filling forecasted demand	Streamline distribution total cost to replenish actual demand
Assumptions	Forecasts are sufficiently accurate and stable for planning. All cost reductions add to net profit. Inventory costs less than labor.	Pull reduces variation and improves service. Only TOTAL cost reduction adds to profit. Inventory, handling & storage costs are under stated

Figure 1.6 – Lean Distribution Paradigm Shifts

The Lean paradigm is to work with the realities of the market and improve “internal” flexibility and cycle time. These two components of distribution and operations are within the control of all businesses, whereas market fluctuations may not be within anyone’s control. The beauty of taking the tact to control what you can and be flexible is that market variation frequently can be reduced with Lean replenishment. The faster and better a supplier responds, the less a customer induces variation into the market shifts they experience, because they will “hedge” market shifts less. Customers hedge market shifts by ordering more than needed for an up tick in the market and then later ordering less to compensate for the over ordering, causing an ever increasing “see-saw” effect. This trend has been called the Bull Whip Effect to illustrate the reactions to market change become larger for suppliers.

Book Approach and Contents

Lean Distribution is a guide to assessing current distribution practices and paradigms to enable greater flexibility and lower costs. It takes a general approach based on Lean Manufacturing to streamline and optimize product flows enabling a simpler customer service and inventory replenishment model. The general theme is that forecasts are not sufficiently accurate to plan and execute short term customer service requirements and therefore, a Lean Pull replenishment model delivers lower TOTAL COSTS while maximizing customer service.

In this Chapter 1, the stage is set and overall approach described. This chapter is an executive overview to align the leaders of the organization on the transformation. In many cases, executives may only read Chapter 1 and selected other chapters and chapter summaries to appreciate the implications of a Lean model to their portion of the business. For example, Sales and Marketing executives may read Chapter 1 and then focus primarily on Chapter 6, Customer Service Policy.

Lean Distribution starts in Chapter 2, Distribution Challenges, with perspectives on the business and competitive drivers that led to today's intense pressure to reduce each element of distribution cost. The short historical discussion enables a common view of the business issues that have impacted various industry segments at different times over the past decade resulting in today's distribution focus and challenges.

The underling structure and configuration of distribution networks is addressed in Chapter 3, Optimizing Distribution. This chapter describes how organizations responded to the profitability pressures with the design of distribution facilities and operations in order to optimize total distribution costs while still meeting customer service requirements. The various optimization techniques are presented and contrasted to link the decisions for physical layout and location of distribution assets to the quest to lower overall costs.

As information technology (IT) developed over the past decade, applications in distribution have multiplied. Chapter 4, IT Transformation, addresses how IT has been employed to automate many distribution processes and enable forecast based optimization. Freight, labor, and warehouse expenses have been prime targets for automation with IT by cost cutters and operators seeking to excel. IT has transformed Distribution in a number of ways and delivered many benefits, but also has created complexity and a set of processes that stymies improvement past the limits of forecast accuracy.

An overview of the content and concepts in Chapters 1, 2, 3 and 4 is provided in figure 1.7. These first chapters form the basis for the background on Distribution which has led to the relevance of Lean practices. Themes for each chapter indicate the concluding ideas being presented that challenge existing norms and paradigms.

The IT transformation has been beneficial in many ways, but has tended to focus performance improvement on planning based optimization and automation. This future focus places too much emphasis on data for forecasts, customer orders and operating schedules that are all changing more rapidly than ever before. It is an attempt to plan based on a number of moving targets that can only be most successful over the longer term. The organization can balance the "futures" based plans with Lean driven execution to be more flexible and responsive to day-to-day customer needs.

	Chapter 1 Lean Distribution	Chapter 2 Distribution Challenges	Chapter 3 Optimizing Distribution	Chapter 4 IT Transformation
Theme	<i>Lean simplifies Distribution to flawlessly execute and break the forecast accuracy barrier to service and profit.</i>	<i>Distribution: from silos to streams</i>	<i>Networks and people: grow and mature, but are difficult to change</i>	<i>Technology implies accurate planning, when businesses must concentrate on flawless execution</i>
Overview	Customer order forecasts are the basis for business planning and optimization, yet forecasts are always wrong and create as many problems as they solve.	The pressure on Distribution has been increasing as customers streamline their supply chains, companies globalize, and cost scrutiny intensifies.	The Distribution optimization cycle has been broken as fewer networks are modified to demand changes resulting in excessive cost reduction investments.	Information Technology has taken a large role in Distribution success as processes have become highly automated, but difficult to manage.
Concepts	Forecasts are inaccurate Variability stymies cost reduction Lean enables execution and reduces reliance on forecasts	Organization silos Customer driven streamlining	Optimization framework Technology enabling capabilities Asset structure alternatives Inventory tracking points	Planning process maturity levels Forecast usage tug-of-war Snowball Effect Forecast confidence over time

Figure 1.7 – Distribution Trends Leading to Lean

Lean Distribution Framework

The Lean Distribution approach is shown in figure 1.8 Lean Distribution Framework. The five elements of the Framework form the solution to a Lean transformation. The top and most critical element is customer service policies, defining the lead times, order parameters and service levels for specific customers, groups of customers and/or products. All aspects of the Lean approach must be focused on these policies, which are frequently not formalized or well communicated. On the bottom, operational capabilities are the foundation for the approach to insure the Lean processes can be successfully executed. Operational capabilities can be defined to drive a Lean Distribution approach, even if the current operations are not Lean Manufacturing enabled, but the benefits will not be as substantial.

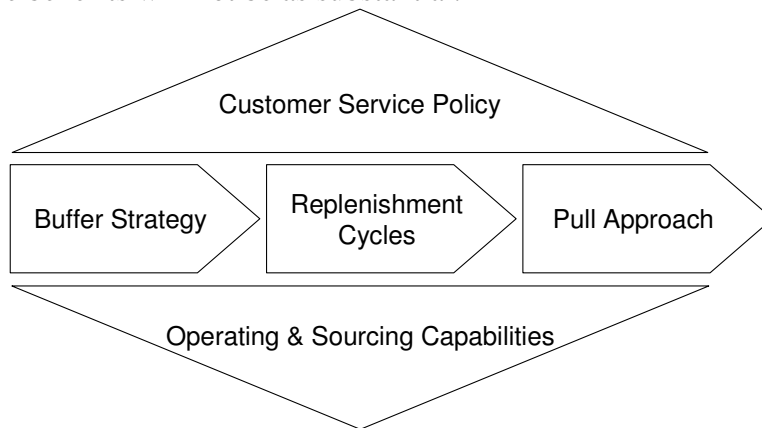


Figure 1.8 - Lean Distribution Framework

These five elements of the Lean Distribution Framework contain the paradigm shifting enablers necessary to break the forecasting barrier to customer service and profits. Figure 1.9 Lean Distribution Enablers displays the critical enablers in each element. These eight enablers come from Lean Manufacturing and Supply Chain practices as tailored to the distribution environment:

- *Formal service policies* – all organizations have some established “norms” and guidelines for customer service, but few examine and formalize policies to optimize the entire supply chain. The formal policies required for Lean Distribution revolve around articulated customer needs and key internal capabilities.
- *Support for pull* – customers seek dependable service and generally are willing to allow suppliers more latitude and responsibility to deliver. Support for Pull signifies that the customer recognizes the advantages and allows requirements to flow to the supplier without undue modification or hedging.
- *Isolate variability* – variability exists in all environments and requires at least some buffer to isolate both customers and internal operations from daily gyrations in forecasts and orders. The trick is to have buffers in the most advantageous places rather than in many or all places customer demand occurs. Placing buffers enables Operations and Sourcing to hit more stationary targets rather than the ever changing and moving target of a forecast based plan.

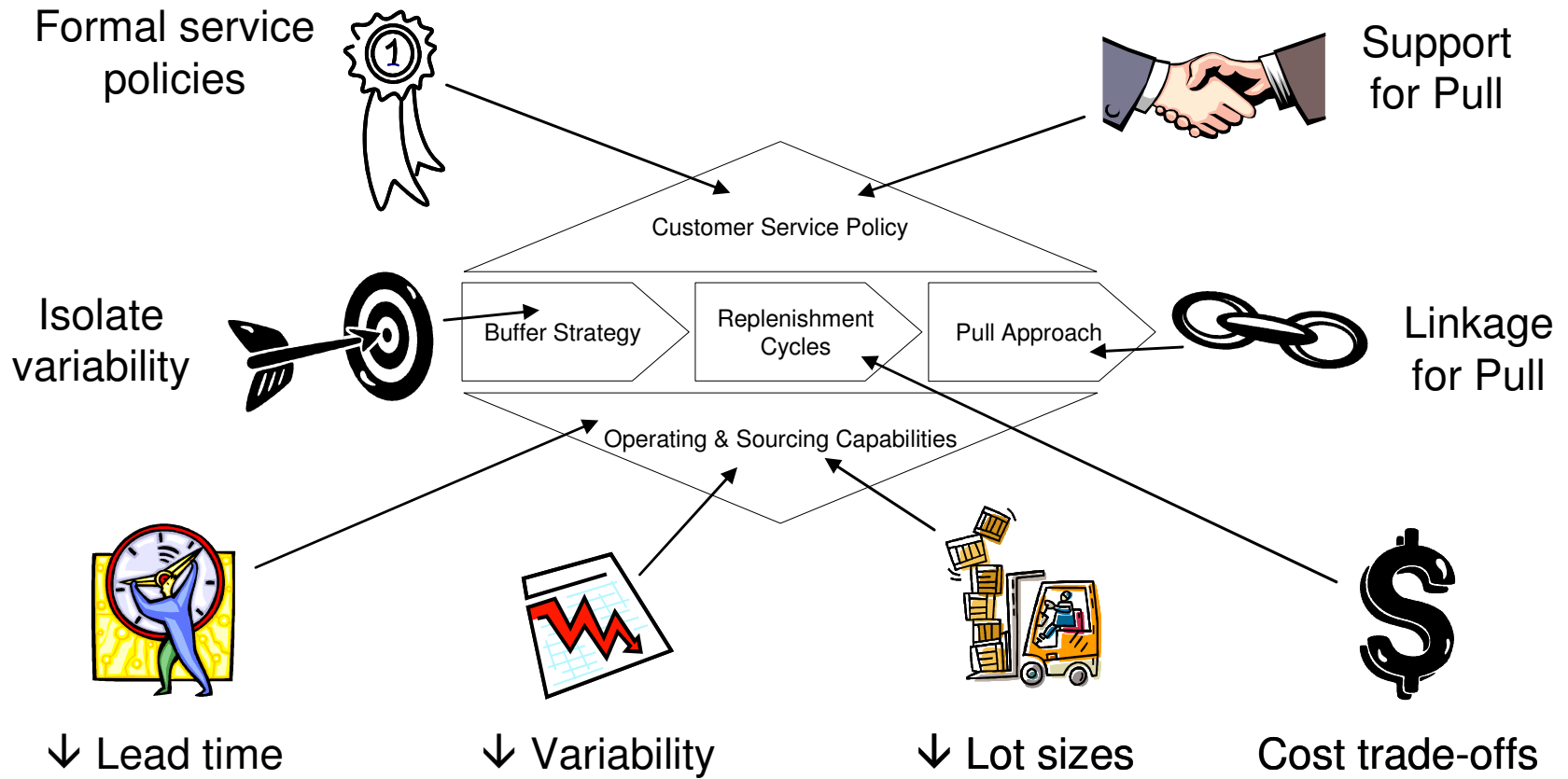


Figure 1.9 – Lean Distribution Enablers

- *Cost trade-offs* – assess and decide cost trade-offs on a structural level rather than obsess on cost trade-offs every day. It may seem counter intuitive to increase profit by cost optimization of the distribution paths rather than individual replenishment shipments. This more structural approach addresses the variability which is a major barrier to most forecast and order driven cost reduction.
- *Linkage for Pull* – making the links between customer usage or consumption and distribution replenishment processes is the tactical connection required to synchronize the supply chain to consistently meet customer requirements. Pull is more than a kanban or an “ordering” signal, Pull is the philosophy for replenishment.
- *Reduced lead times* – lead times are generally too long. Lead times for internal operations and from suppliers include a high level of safety time to accommodate unforeseen events. Lean helps reduce lead times, improving flexibility and responsiveness. Short lead times enable many wonderful cost and service improvements in distribution, particularly when paired with Lean.
- *Reduced variability* – despite variability existing in all processes, few organizations focus on quantifying and reducing variation in the supply chain, the typical focus is product quality. The first step is to quantify the current variation in order to operate distribution processes based on the limits of current capabilities. For example, distribution center replenishment times may vary causing Planning to use a “high end” time for all planned shipments “just to be safe”. This longer lead time results in some excess inventories and a realization that not all orders must be shipped on the day planned, requiring expediting and overrides to insure priority orders are shipped when needed.
- *Reduced lot sizes* – the quantity produced or sourced at one time or lot size has a direct relationship to flexibility and total costs. Larger lot sizes usually mean lower costs in sourcing or production but can increase cost and reduce service across the rest of the supply chain. Lean Manufacturing practices help reduce lot sizes while eliminating waste, thereby enabling both low product and supply chain costs.

The eight enablers combine to form a cohesive system to improve distribution costs, asset utilization and customer service. These enablers must be linked and implemented to leverage the overall approach and not as a series of disjoint cost reduction initiatives. The approach is tied together by the Lean waste reduction philosophy and the transition away from forecasts to serve daily customer needs. The end result is a new paradigm to view profitability and customer relationships, shown in figure 1.10

Profitability and Total Distribution Costs. As lead time, variation and lot sizes decrease, profit approaches gross margin (excluding other SG&A items). When

$$\text{Profit} \cong f [\text{Gross Margin} - (\text{Lead Time} - \text{Service Policy}) - \text{Variability} - \text{Lot Size}]$$

The problem:

- All of these factors currently result in costs > 0 reducing profit!

Consider the possibilities:

- Short lead time; therefore: $\text{Lead Time} - \text{Service Policy} \cong 0$
- Minimal variation; therefore: $\text{Variability} \cong 0$
- Lot sizes < customer order quantity; therefore: $\text{Lot Size} \cong 0$

The result:

$$\text{Profit} \cong f [\text{Gross Margin} - (1 - 1) - 0 - 0] = \text{Gross Margin}$$

Figure 1.10 – Profitability and Total Distribution Costs

these factors decrease sufficiently, there is a net addition to profit above gross margin from the effect of negative working capital, an example being Dell Computer (accounts payable is three times the amount of inventory and accounts receivable combined).

This total cost paradigm is more than just adding up all of the usual department budgets into a total. It is a view of the *drivers* of cost rather than the results. Results are the freight, labor, inventory, overhead, and other costs included in financial reports and departmental budgets. These results are driven by other factors, such as lead times and lot sizes. It is these drivers that require the cost reducing focus, budgets and financial reports are the measures of results.

Lean Distribution Transformation

The Lean transformation is built on the eight enablers to achieve new operating and customer service paradigms which leverage inherent capabilities. The enablers in figure 1.9 and paradigm shifts in figure 1.6 provide the flexibility required for short term customer requirements with simpler distribution planning and replenishment processes, transforming the forecast into a longer term and more aggregate focus. But to make this transition, an organization must thoroughly and critically re-evaluate current processes and insure that the paradigm shifts are well understood and articulated. The Lean Distribution Transformation is summarized on figure 1.11 to show the major themes, steps and concepts involved in moving to a Lean enabled operations.

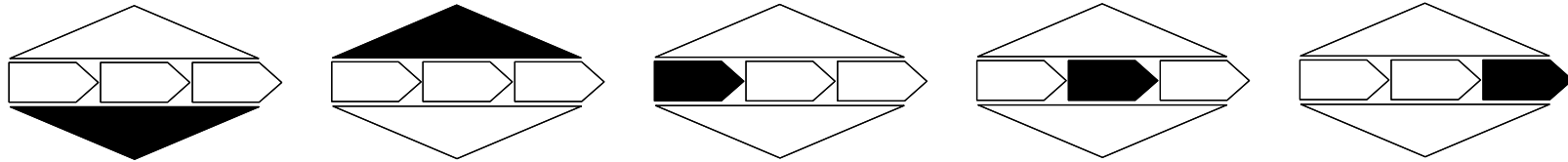
To initiate the transformation, Chapter 5, Lean Capabilities, describes the differences between traditional planning based processes called Distribution Requirements Planning (DRP) and Lean. The emphasis is on responding to actual short term customer needs rather than planning far into the future. The Lean processes are described and contrasted to DRP. Pull is defined and contrasted to Push based replenishment within DRP. Pull as shown as the key ingredient for the Lean Distribution approach to responding faster to shifts in market demands, product lifecycles, and customer relationships.

The implications and need for customer service policies is presented in Chapter 6, Customer Service. These policies can be taken for granted, just assumed or possibly not communicated, but are fundamental drivers for all Lean Distribution process design. Meeting the customer needs is paramount and the primary driving force for Lean and Distribution.

Making the transition from a forecast driven process to Lean based Pull is accomplished with a combination of buffer inventory, replenishment processes, and Pull based execution. These elements of the Lean Distribution framework are described in Chapters 7, 8, and 9. The general principles are presented and then application to specific environments discussed. Each principle must be tailored to meet the unique aspects of an organization's environment.

Lastly, the Summary chapter provides some perspectives on implementation and how to view the dynamics of a Lean Distribution transformation. Lean Distribution provides a transformed view of the organization and operating dynamics. The paradigm shifts shown in figure 1.6 above are the visible indicators of change, but a much deeper principle must be embraced: an organization's flexibility is the key to customer relationships, profitability, and performance measurement.

----- *Lean Distribution Transformation* ----->



	Chapter 5 Lean Capabilities	Chapter 6 Customer Service	Chapter 7 Buffer Strategy	Chapter 8 Replenishment	Chapter 9 Pull Approach
Theme	<i>Ship one, replenish one and make one is Pull perfection</i>	<i>Service excellence builds sales confidence</i>	<i>Murphy says: variation happens, so don't self inflict it</i>	<i>Create Distribution Pipes and let replenishments FLOW</i>	<i>Customer orders may not be Pull demand</i>
Overview	Lean Manufacturing practices provide the underlying capability to transform Distribution from Planning to Executing.	Customer needs and value must be aligned and improved with the Distribution transformation.	Buffers are necessary due to demand or other variation with a strategy that supports excellent customer service.	Replenishment processes are the structure enabling reduction of total distribution and logistics costs	Pull creates the actual link with customers to insure the supply of product and respond quickly to changes in demand.
Concepts	DRP versus Lean Summing demand	Segmentation Service strategies	Service buffers Demand patterns Service policies Variation and lead time	Distribution cost waterbed Delivered cost analysis Distribution pipes	Replenishment triggers Replenishment process Inventory graphs Inventory zones

Figure 1.11 - Lean Distribution Transformation

Role of Information Technology

Information technology plays a pivotal role in optimizing distribution and executing Lean processes. The Lean approach is to simplify processes, especially replenishment and inventory targets, but they still should be automated to leverage the time of people and provide fast response to customers. Some of the technology investments that leverage the Lean Distribution approach can include:

- *Delivered Cost* – calculates the total of all costs to source/produce, inventory, sell, and deliver to each customer or similar group of customers. This Delivered Cost concept is critical in developing customer service policies and distribution processes that maximize profit potential for each customer or group.
- *Delivered Profit Ratio (DPR)* – is a comparison of the revenues to the number of products and locations providing a summary level assessment of the difficulty to operate the network and serve all customers, a group of customers or an individual customer. Typically is calculated manually, but for more complex environments may require specific reports and analytics.
- *Total cost view* – combines all departmental budgets and costs into a total supply chain cost picture. Use activity drivers such as orders picked and shipped to identify trends affecting the cost picture, especially variable costs.
- *Replenishment order triggers* – obtains customer daily demand (POS for retail, consumption for other customer industries) and process against inventory targets to identify replenishment quantities and timing. Generate replenishment orders and communicate back to the customer status for their planning system. This may also be called electronic Kanbans.
- *Variation and cycle time analysis* – these two key drivers of the replenishment process must be tracked and quantified in order to drive the entire Lean transformation. The inventory levels and replenishment cycles are determined based on these two parameters which should be quantified and tracked, even though they may initially only be estimated. Variation can be split into multiple components such as demand, supply and lead time each of which require different actions to improve.
- *Buffer Management* – tracks and monitors inventories across the three zones: green, yellow and red. Calculate the buffer inventory target levels, establish the three zones, flag items based on time in zone, and report aggregate statistics.
- *Forecast confidence* – establishes the level of confidence in forecasts across the planning horizon to drive the planning system. Forecasts are more accurate in the near term, but also change frequently creating ripple effects.
- *Network modeling* – uses the forecast to simulate changes to the network and make changes over the long range. Uses modeling capabilities to determine the trade-offs for freight, warehouse size/location, inventory and other costs to best meet customer delivery requirements.

Technology investments are critical to fast response to customer demand and effective Lean Distribution. Technology serves to automate replenishment processes, provide the consumption signals, and measure the entire supply chain. The Lean

measures can be new views of the supply chain that are holistic and cut across current departments.

Applications for Lean Distribution

Lean Distribution provides the capabilities which address a variety of business situations and challenges. It is not necessarily a “solution” to these business issues, but can provide the necessary responsiveness and cost reduction to address the underlying issues driving many current topics on executive agendas. From customer driven cost reduction to considering the implementation of new technologies, Lean can provide a framework to assess the benefits and construct approaches for success. Lean Distribution practices link the operational cycle times and variability to all aspects of process, enabling a clearer link between operations and results. As various initiatives alter operations or customer demand characteristics, the benefits and implications become more readily apparent and easier to deliver.

Customer Service

Customer service is the top priority for most distribution operations. It can be measured in order fill rates and inventory stock outs to identify when customers are not receiving products when needed. If these measures fall, the typical reaction is to increase inventory levels. The difficulty can be that service level is a function of a number of parameters and increasing inventory tends to mask the parameter causing the problem rather than addressing the root cause.

With the Lean approach, customer service levels are well defined and communicated prior to designing service processes. Defining service helps to minimize differences in expectations or communications such that the main parameters required are documented and quantified. With the service policy, actual levels that depart from expectations can be addressed with root cause analysis to seek out and address the real underlying problem.

Vendor Managed Inventory (VMI)

Inventory at a customer’s or distributor’s location such as VMI, supplier managed inventory (SMI) or consignment inventory is intended to provide better customer service with inventory “always available”. While service may be improved, it may present challenges to controlling costs and inventory. The customer’s demand variation and desire to control inventory may be obstacles to managing this relationship effectively.

Using the retail industry as an example, point of sale (POS) data provided to suppliers enabled the transition of responsibility for replenishment from the retailer to supplier. As suppliers receive POS data, they can produce and ship to actual sales rather than a series of purchase orders from the retailer.

For other industries, there may be a parallel to manage VMI using a Lean Distribution approach. The starting point is actual demand from the customer which drives replenishment processes geared to Pull rather than customer order based Push. The trick to effectively managing the relationship is designing the replenishment process on operational and demand statistics rather than gut feel and intuition. Inventory can be managed and service maintained while keeping costs in line using the Pull based approach in Lean Distribution.

Radio Frequency Identification (RFID)

Collecting data as inventory moves through the supply chain has been increasing since the introduction of bar codes and point of sale data collection. As technology progressed, RFID has become the latest capability to collecting data by attaching a tag to the product, case, or pallet which can be “read” remotely via radio waves. The cost of tags has been the main obstacle to broad application, but as it continues to decrease, applying RFID tags to less expensive products will increase.

Wal-Mart, the Department of Defense, and others have successfully piloted RFID applications and required some level of support from major suppliers. For suppliers, RFID efforts appear to increase their costs as tags and radio frequency devices must be purchased and implemented. The debate for suppliers relates to finding the benefits for RFID, because customers are not willing to pay extra to receive products RFID enabled.

A Lean Distribution viewpoint on RFID is to determine whether a more effective trigger for replenishment can be obtained. For the retail industry this may be product movement from the backroom to the sales floor. These moves are not tracked by the retailer’s inventory system, but are crucial to maintaining sufficient inventory at the store. Store backroom space is limited making a quick response to an empty backroom shelf critical. Using POS data can be a proxy, but includes assumptions about backroom inventory and movement to the shelf rather than positive tracking.

Cost Reduction

The pressure to reduce costs across the entire supply chain comes from nearly all directions: customers, executives, and channel partners. What is driving the demands and expectations for cost reduction? Increasing profitability is the most likely answer, but could some derive from the perspective that applying pressure will produce at least some results?

In distribution, the challenge for cost reduction efforts is to insure that customer service or other cost reduction efforts do not suffer. As one cost reduction idea is contemplated, can all of the other “balls in the air” be maintained? For example, it can be complex to assess freight savings opportunities when shipping schedules continually change and so forth.

A Lean Distribution approach to cost reduction is to clarify the factors driving the existing cost structure. Each parameter for the Lean design can be assessed to determine cost reduction opportunities which can be implemented with fewer impacts to other portions of the distribution processes. Customer service policy, variability, and supply lead time are the three primary examples of these parameters. With a Lean approach, changes to any one can easily be translated into savings potential. In this way, cost reduction efforts are focused on sustainable and measurable change.

Other Business Situations

Consider a water pipeline analogy, the utility can “push” water into the pipeline creating the pressure that enables immediate flow to each point of use, the faucet. The pipeline has a fixed volume that allows pressure to build. Unlike the pipeline, supply chains allow materials to build up at numerous points prior to the consumption point; therefore, pushing materials into a supply chain creates excess cost and inventories. So

the trick is to find material movement and consumption data that further synchronizes the entire supply chain and improves service and reduces total cost.

As information technologies and Lean practices make further inroads across all industries, additional opportunities to apply Lean Distribution will be presented. The transformation seeks to synchronize the supply chain by using actual sales and material movement data rather than various “orders” that are processed from forecasts by planning systems.

Summary

The forecast, plan and then execute approach to managing Distribution has a lot of appeal and momentum for serving customers and achieving profitability objectives. It developed from the progression of information technology applications that translated detail customer order forecasts into operational plans with a high degree of precision. Organizations assumed these detail plans would improve execution, ownership, and measurement. This is a logical approach, but is built on a shaky foundation of a forecast that will always be inaccurate, resulting in higher than necessary inventories and complex business processes.

Improving forecast accuracy can be a tough task, even with customers willing to collaborate. The resulting “consensus forecast” may have significant customer input, but not much commitment to meet the numbers. For organizations seeking to maximize market share and meet all customer commitments there is a tendency to plan high. Optimistic planning can create a frustrating cycle with a risk of obsolescence for forecasts that are high and expediting cost incurred to react to forecasts that are low.

Despite long sourcing and production lead times, a Lean Distribution approach can improve response to shifting markets without relying on more accurate forecasts or higher distribution costs. This paradigm shift can be tough to believe, because the forecast presumption is so strong. Evidence can be found in the difference between attempting to plan with an inaccurate forecast and then control variability to flawlessly execute versus the Lean approach to operate to actual customer demand and operate around variation inherent in all processes. With Lean the focus is on flawless execution based on the realities of current operational processes rather than to assume a forecast is correct and then hope execution can be flawless.

Lean Distribution also delivers lowest TOTAL costs with a flawless execution and demand driven approach. In the traditional plan and execute approach, variation from suppliers, operations or customer orders may lead to some portion of the plan being off. As the plan is adjusted and changes made, costs can easily be impacted. With Lean, variation is expected and built into the total cost picture rather than being a surprise which upsets the plan. With the focus on customer demand, Lean consistently delivers to customers while streamlining total distribution costs.