Summary
This article is written about transport modes, which is possible to combine for environmentally effect of transport. Then also must be written about Lean production, lean distribution and its benefits. This article contains percentage of road, rail, air and water transport today using in the world.

Keywords: lean production, lean distribution, benefits, results, costs of distribution

Streszczenie

Słowa kluczowe: system odchudzony, lean management, logistyka odchudzona, koszty dystrybucji
1.1. Transport modes

Various options for moving products from one place to another are called transportation mode. Road, rail, air, water, and pipelines are considered the five basic modes of transportation by most sources. However, all transport modes may not be applicable or feasible options for all markets and products.

Road transport known as highway, truck, and motor carriage steadily increased its share of transportation. Road transport became the dominant form of freight transport in the United States, replacing rail carriage and it now accounts for 39,8% of total cargo ton-miles, which is more than 68% of actual tonnage.

Rail carriage accounts for 37,1% of total freight ton-miles (more than 14% of actual tonnage) in the United States, which places railroads after motor carriers as the second dominant mode of transportation. However, in some countries such as the People’s Republic of China, the countries of the former Yugoslavia, and Austria, rail remains the dominant transportation mode. [4], [5]

Air carriers transport only around 0,1% of ton-mile traffic in the United States. Although airfreight offers the shortest time in transit (especially over long distances of any transport mode, most shippers consider air transport as a premium emergency service because of its higher costs. However, the high cost of air transport may be traded off with inventory and warehousing reductions or justified in some periods, and in an emergency. [5], [6], [7], [8], [9]

Water carriage as the oldest mode of transportation accounts for 5% of total freight ton-miles (around 3,3% of actual tonnage) in the United States. [5]

The Lean Distribution approach is shown in Figure 1. The five elements of the framework form the solution to a Lean transformation. The top and most critical element is customer lead times, order parameters, and service levels for specific customers, groups of customers, and/or products. All aspects on 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 ensure 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. [1]

These five elements of the Lean distribution framework contain the paradigm-shifting enablers necessary to break the forecasting barrier to customer service and profits. These eight enablers as a formal service policies, support for Pull, isolate variability, Linkage for Pull, Lead time, Variability, Lot sizes, and Cost trade-offs come from lean manufacturing and supply chain practices as tailored to the distribution environment [1]:

- 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. Strategically placing and managing buffers enables Operations and Sourcing to hit more stationary targets rather than the ever-changing and moving target of a forecast-based plan.

- **Cost trade-offs.** Assess and decide cost trade-offs on a structural level rather than obsess on cost trade-offs for specific transactions every day. It may seem counterintuitive to increase profit by cost optimization of the distribution paths rather than individual replenishment shipments. This more structural approach addresses the variability that 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 and customer service excellence.

- **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 accom-
moderate 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 Pull.

- **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 excess inventories and a realization that not all orders must be shipped on the day planned, requiring, expediting and overrides to ensure 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 appear to 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 forecast to serve daily customer needs. The end result is a new paradigm to view profitability and customer relationships. As lead time, variation, and lot sized decrease, profit approaches gross margin (excluding other general expense items). When 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 (where accounts payable is three times the amount of inventory and accounts receivable combined.)

This total cost paradigm is more than just adding up all 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 a lead times and lot sizes. It is these drivers that require the cost-reducing focus, budgets and financial reports are the measures of results. [1],[2]

### 2. The benefits of Lean distribution

Lean distribution bears immediate fruit – both tangible and intangible. The benefits are straight forward and significant:
A 10 to 50 percent improvement in labor productivity
- Smoother and more accelerated product and work flows
- Happier and more productive associates, which improves retention
- More capable management team
- Greater facility throughput and capacity
- Avoidance of major capital outlays – i.e., not having to build a new DC to handle incremental growth [10].

As in the case of the major big box retailer cited at the outset of this article, the potential savings derived from applying lean to distribution operations run in to the millions of dollars.

The lean distribution approach provides an operational foundation for service excellence and low total costs. A combination of service and cost performance is what differentiates how a Lean approach both simplifies the business and delivers results. Service and cost are typically considered to be conflicting objectives where trade-offs must be made, but Lean focuses efforts on changing the dynamics of this trade-off by reducing cycle time, improving reliability, and increasing flexibility. These changes deliver benefits in customer service, total costs, and asset utilization.

Customer services benefits accrue from improvements in service policies and value provided to customers with Pull. As service policies are formalized and segmented with the Lean distribution approach, benefits relate to service delivery for customers grouped into segments with various levels of service. By formalizing service policies, improvements result from:
- Providing differentiated levels of customer service,
- Improving execution of service delivery,
- Examining and segmenting customers for price/value,
- Directly linking (Pull) with customer usage to improve the customer’s material flows.

Within Distribution operations, Lean improves the flow of products to mitigate fluctuations in customer demand. With buffer strategy developments, Lean takes inventory placements and management from a just in case approach to a proactive setting of inventory to ensure service excellence. The buffer “shock absorber” is consolidated, lowering total inventories and protecting against variation. This reduces the pressure to maintain inventory availability so Distribution can focus on executing replenishment to customers and the critical elements of cost.

Benefits also accrue across “downstream” operations both internally and with suppliers. As Pull with customers improves the connection with actual demand, the disruption in planning and customer orders can be decreased, eliminating the snowball and bullwhip effects created as small changes in forecasts and customer orders are magnified. Operations (and supplier) schedules are stabilized by insu-
lating the market variation with the strategic buffers. As schedules stabilize, Lean practices further improve flexibility, reliability, and costs without the distractions of daily disruptions to meet spikes in demand.

The planning function also benefits from a Lean Distribution transformation. Often the attention and effort required to update forecasts and revise plans lessens as forecasts and planning become more strategic and less tactical. Planners spend less time managing the plan and internal replenishment orders and more time determining and supporting longer-range decision making. The total time required for the Planners may not be less, but certainly more value added time.

Lean benefits may seem counterintuitive to traditional measures; however, they are quantifiable. As lean takes hold, benefits can be quantified along key measures of performance and cost:

- Inventory reductions across the entire supply chain as buffers become strategically located and managed,
- Distribution cost reductions as customer and distribution center replenishments become distribution pipes designed using delivered costs,
- Customer service readily measured against segmented policies and expectations,
- Operations schedule stability as measured by the disruption to schedule within the window of time a specific operation.

These and other benefits can be linked back to key operational parameters and improvements. Cycle time is an example parameter that improves with Lean and can be related to inventory and service costs. As cycle time is reduced, the improvements in inventory and costs are readily apparent. These relationships make lean benefits more transparent and linked with day-to-day operational improvement efforts and measures.[1]

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Bibliography


