Value Velocity or How Do I Know Lean Is Working?

By William Botha

Is lean working? How does my lean program compare to our competitor's program? How lean is our industry? What stocks to buy? What stocks to sell? What's more important – cutting cost or cycle time? Inventory is good – isn't it? These are all questions heard every day, in a swarm of different ways, in every industry and in every boardroom across the nation. And the leader asking the question does not need a ninety-minute presentation to substantiate a "gut-feel" answer.

The first response by mid-management to the question is to look at cycle times, "Yeah, sure lean has worked! The cycle times have come down from 63 days to 45!" Immediately that person's detractor will chime in, "No, but we're producing the wrong product; it's sitting in the outlet!" or even worse, "We're spending tons of overtime to do it, Harry!" So the leader then asks to see the data on cycle times, margin mix, sales figures, inventories, and overtime. Two weeks later, the data is presented and the discussion has just begun. At the end of the quarter, somebody mentions a fulfillment metric and by the end of the year the leader is looking at pages of data with frequently contradictory insinuations and implications.

The next response is to look at expenditure but everyone knows that simple expenditure is too simple a metric with too many variables to supply the meaning the leader is looking for. Suppliers are competing and the company may be reaping the benefit of a price war, or inbound consumables inventory may be consumed, showing an inaccurate impact on the bottom line. Lastly the headcount may have been reduced, which has an immediate impact upon the bottom line but a far more dire impact on the company's knowledge base, which usually becomes evident later in escaped defects, missed deadlines and escalating material costs.

Somebody is bound to mention inventory at some time or another, so everyone tramps out onto the floor to take a snapshot unit count of the inventory. Then they present the result as sure-fire proof that since the inventory has dropped since the end of the financial year that lean is working! But what about the adjustment made at the end of last year? And what about that huge shipment that shipped yesterday?

A difficulty of lean is that multiple metrics are involved (safety, quality, delivery, cost, productivity, morale, etc.) that need to be balanced. Over the past 10 years one could argue that Toyota's inventory turns have gotten worse due to increased production overseas. However, profits have improved dramatically the past few years. Can anyone offer the business world an explanation and a way to balance all the metrics so that quality and delivery don't suffer while velocity improves?

Profit Equals Value

The explanation must begin with the customer if we want to unravel this Gordian knot. The entity that makes the decision to purchase the product or service is the customer. Everything else between that entity and the business or process you're trying to measure is either a downstream partner or a team member. Thinking of downstream functions as

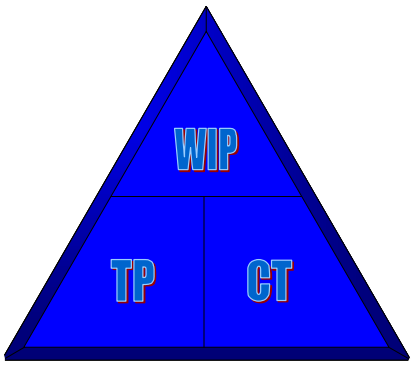
internal customers goes against value-stream thinking and should be avoided. These internal customers may be unaware of the customer's requirements and can therefore not represent them!

All of the definitions of value describe it as being "that which the customer is willing to pay for." So, payment can be accepted as being a measure of value. Payment is expressed in currency units or, in our case, dollars. But we are expected to "add value" to the product or service. For this added value, it is deemed acceptable that we add to the price of the product or service. This we call profit or net income. So, the amount of "added price" the customer is willing to pay for may be deemed equal to the "value" that has been added.

So, profit is value in the eyes of the customer. This is represented on the income statement. The income statement captures the impact of safety, quality, delivery, cost, productivity, morale and management. If safety is bad, workers compensation must be high and the profits must therefore be lower. If quality is great, first pass yield must be good and the costs of rework must thus be low, increasing the profit level. If delivery is shabby, the customers are going to vote with their feet and go elsewhere for the service or product we're offering, dropping the top line and ultimately the bottom line as well. A good productivity number means that the labor input (expense) is in good shape versus the output or revenue – another ratio captured on the income statement and ultimately described by the margin of profit. And isn't sustained productivity the result of good morale and management? Yes, it most certainly is.

Inventory Days Represents Velocity

Little's Law postulates that work-in-process, or WIP, is the result of throughputs and cycle time. The amount of inventory is usually represented at cost value. An arithmetical equation converts inventory units into dollars and, using cost of goods sold, one arrives at a theoretical number of days inventory on hand.



Little's Law

Assuming the throughput remains steady, if the inventory drops, the cycle time must descend by an equal margin.

Why don't we just use cycle times as a measure of velocity? You'd be right if you asked that question. But how easy is it to measure cycle times every day? Cycle times are not tangible, they don't get in your way, and they can be forgotten, misrepresented, or

otherwise not tracked. And how do you account for inventory waiting for processing or incorrectly processed at speed?

Inventory on the other hand is very real. You stumble over it, it has to be handled, and it is easy to reconcile, even in the most complex of processes.

Inventory is easier to manage than cycle times – you simply leave no place for it to be set. People can take longer to produce something — but if there is no place to put it, there's no place to put it.

Inventory is the single item on the balance sheet that truly reflects "leanness." It is lean dogma that less inventory is better and a single piece of standard inventory is the ultimate goal in the search for perfection.

Since inventory and cycle times share a direct relationship, and inventory is very much easier to see and control, let's use inventory days as the representation of velocity. Inventory is depicted in the assets portion of the balance sheet.

Value Velocity as the Measure of Lean

Ideally, lean thinking is the design, raw material acquisition, production, assembly, distribution, and purchasing of a perfect product by the customer with no waste and no inventory. Lean thinking is the production of these products one piece at a time, while improving upon the efficiencies and productivities supposedly achievable in a mass production system. Lean thinking is the mature devolution of authority and accountability to the workers who have the obligation to stop production if the potential for defect is identified. Lean thinking is teams, peer-to-peer communication without the safety nets of management control systems, scheduling or inventory. Lean thinking is cost and cash flow, effectiveness and efficiency, income statement and balance sheet.

The measure of lean that we are looking for must fulfill Occam's Razor, a philosophical rule that the most simple theory that provides the solution must be the one that is selected. Freely translated, we need to find the simplest measure that reflects both cost and cash flow, both efficiency and effectiveness.

The more profit made, the more value the customer perceives in your product or service. Sustained margins demonstrate how effective your business model is. If your costs are low, your efficiencies must be high and your profits will follow. Profit is the ideal numerator in our equation.

In a stable system, a higher inventory level is an unequivocal sign of overproduction. Overproduction is a result of bad management, weak forecasting and a lack of control. While the assets may be utilized efficiently, the net effect on the business is negative as the cash conversion cycle is stretched to breaking point. Inventory levels are also directly related to cycle times, dragging processing velocity into the mix. Therefore, inventory makes for a good denominator.

The speed (velocity) at which we add profit (value) to the product or service is thus a simple measure of leanness.

Theoretical Velocity vs. Value Velocity

In high school we learn that velocity is the distance traveled in a period of time; the unit of distance is feet and the unit of time is a second. Therefore v = f/s. If we are trying to measure the rate at which we are adding value, the formula must therefore become:

VV = $/second or, more appropriately thousands of dollars profit per day;

Value Velocity = $K/Day

$K (thousands of dollars/day)
We may use net income before tax, profit before tax or just profit, as the numerator.

Day
The inventory value is averaged over the period to be evaluated and computed in inventory days. It is accepted accounting practice to use 360 days as the denominator.

Time Period.
You may use years, quarters or weeks. Try to avoid months. You cannot fairly equate one month to another that may have a different number of working days. Once the system is mature, you may be able to compute this indicator by day.

OK, let's take this new metric out for a test run. Let's see how value velocity handles inventory;

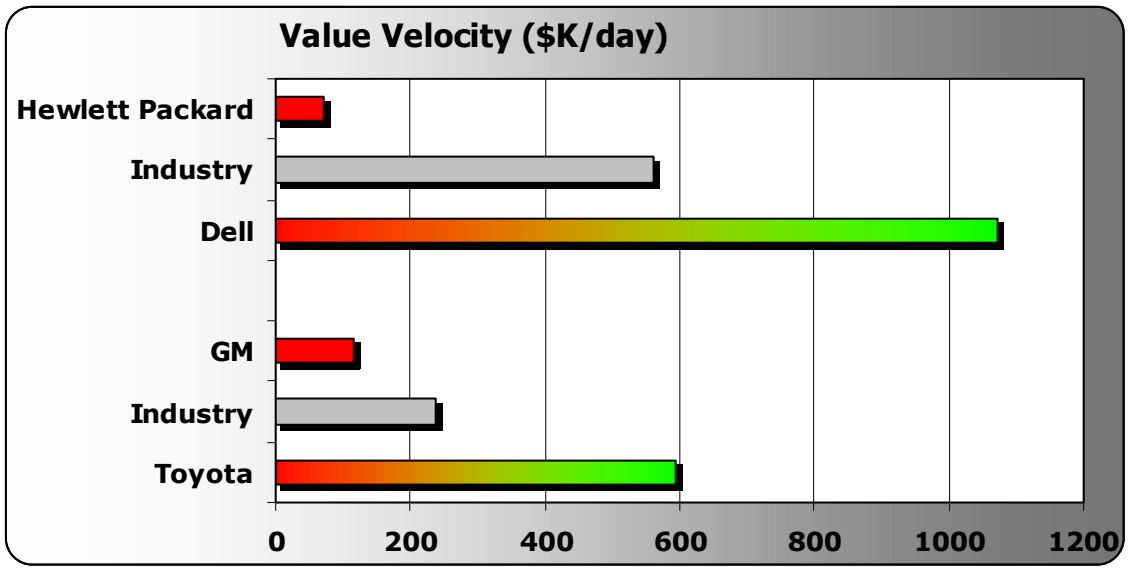
Company	Pre-Tax Profit ($)	CoGS ($)	Inventory ($)	Inventory Days	Value Velocity ($K/Day)
LeanCo	5,500,000	25,000,000	2,500,000	36	153
FatCo	5,500,000	25,000,000	5,000,000	72	76

LeanCo is obviously leaner than FatCo. But how does it handle profit?

Company	Pre-Tax Profit ($)	CoGS ($)	Inventory ($)	Inventory Days	Value Velocity ($K/Day)
LeanCo	8,500,000	23,000,000*	2,300,000	36	236
FatCo	5,500,000	25,000,000	2,500,000	36	153

*(The example assumes that LeanCo cut its CoGS by $2MM and its overhead by a million dollars. This ratio is usually reversed – Lean decimates overheads!)

OK – that's clear. We can benchmark companies of fairly equal size in similar industries. We can even define the industry norm per industry, giving the analyst a single fair measure of leanness for the first time. What does this look like in the real world?



Value Velocity Data

Industry	Recognised Lean Co				Competitor				Industry			
	Name	Pre-tax Profit	Inv Days	VV ($K/day)	Name	Pre-tax Profit	Inv Days	VV ($K/day)	SIC Code	Pre-tax Profit	Inv Days	VV ($K/day)
Motor Vehicles	Toyota	16707000	28.1	594	General Motors	2981000	25.9	115	336105	5705617	23.9	239
PC Assembly	Dell	3724000	3.5	1072	Hewlett Packard	2888000	40.7	71	334110	19948680	35.6	560

Inventory Days - (Inv$/CoR$)*360
Industry norms derived from Wiley ValuSource 2003
Business Financials downloaded from finance.yahoo.com on Oct 15, 2004.

Summary

Although Toyota's inventory may have increased in proportion to it's cost of goods sold over the last few years, and their inventory days metric is greater than that of GM, it is clear from the Value Velocity metric that they have been able to uncouple their fixed costs from their volumes. Toyota has been able to exploit increased volumes and added innovations with a massive decrease in cost, which, ultimately, is lean thinking!

Michael Dell's model of sell what you have and sell to the credit card market, is an example of extended value-stream thinking in that someone must have considered the cash flow impact of each step of the value chain from supply to receipt of the monies in the account.

Both examples show that the Value Velocity index clearly indicates leanness of a company within its industry. It is simple to define and easy to explain. It is a robust and meaningful indicator that may be used by supervisor, manager and industry analyst alike to compare companies or even to show improvement or degradation over time.

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