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PIMS: Constructing a Cost Efficiency Index for Lubricants Production Plants

As the world invents more and more different devices to lubricate, with increasingly sophisticated requirements, new lubricants are developed to meet the diversifying needs. Other lubricant innovations are mandated by ever stricter health, safety, and environmental concerns. This inevitable increase in complexity represents both an opportunity and a challenge for lubricants manufacturers. On the one hand, opportunities for differentiation and better margins are continually being created, while on the other hand the supply chain gets more complex and costly to manage.

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In particular, it creates a problem for performance measurement. The best lubricants plant is not the one with lowest cost, but the one with the best ability to manage complexity. The necessary elements to managing complexity are:

» Effective systems to keep the product offer and raw material diversity within bounds (verifying which new products should be made, which old ones discontinued)
» Close co-ordination with the sales organisation to ensure that the plant produces this morning what will be in demand this afternoon
» Flexibility to switch production at short notice with minimum changeover times and minimum flushing
» Intelligent systems for procurement, production planning, inventory control, quality assurance, slop handling and warehouse management
» Having the right people and the right equipment in the right places doing the right things.

Given all that, we still want a way of determining whether a plant is performing well, given the job it has to do and the location it is in. Just being "best quartile" on cost by eliminating all complexity (and all the margin) will not do. The search for a reliable "cost efficiency index" is the subject of this article.

Starting in January each year and on a two yearly cycle (the next round is in January 2009), PIMS conducts a benchmarking exercise with many of the main lubricants (and greases) producers around the world. We collect about 200 data items per plant capturing the cost of raw material receipt, blending, filling (small packs, large packs, bulk), laboratory, warehouse, general and administration. These may be people costs, energy, maintenance, utilities, transport, security, other purchased supplies and services, depreciation or leases. We also capture the differences that influence cost: complexity, automation, type of equipment, scale of operation, labour rates, use of contractors, outsourcing, quality control, health & safety, even the weather. We also measure activity: number of movements for inbound materials and outbound product (by mode), number of blend runs, number of packing runs, number of lab tests, number of orders and line items per order, etc.. Companies that account for over half of the world's lubricants volume now take part from across the globe.
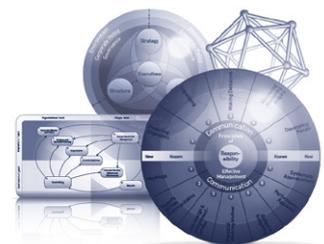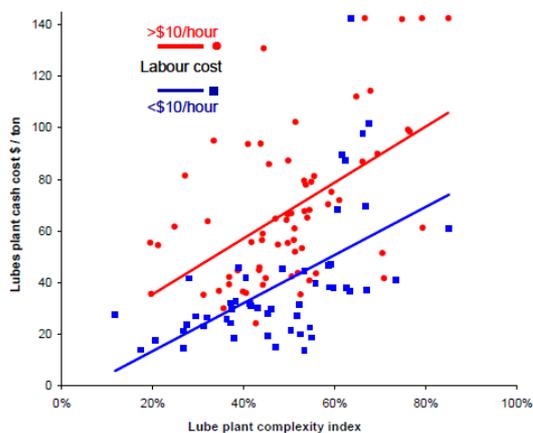

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For the last couple of rounds, we have developed indices for complexity in each area of the plant. The factors we take into account are those that are intrinsic to the job done by the plant: number of grades (for blending), number of SKUs (for packing and warehousing), number of orders and line items per order, lead times for raw materials, the proportion of complex industrial grades, number of components per batch, etc.. The main purpose of the complexity index has been to select "look-alike" plants for any plant, that have similar scale, complexity, country labour costs, and major "givens" for configuration (e.g. getting base oil by pipe or not). Comparing a plant to the average of the best half of its look-alikes (e.g. best four out of eight) we can pinpoint areas of strength and areas of potential improvement. Note that we specifically want to exclude activity measures (e.g. number of batches or verage batch size) because we want to see if look-alikes perform better by organising activity differently given the same complexity and scale.

While look-alikes give the necessary insights on where to improve, they leave something to be desired if we want to use the ratio of actual to benchmark cost as a performance index. A small change in complexity may have no effect on the benchmark, if the look-alikes don't change, or a big effect (conceivably in the wrong direction) if the look-alikes do change. What we want is a benchmark that responds smoothly in the right direction to changes in complexity and scale.

First we aggregate up the complexity indices in each area of the plant to get an overall complexity index for the lubes plant (and the greases plant and warehouse). The scale is from 0% to 100% with 50% being the global average; Exhibit 1 shows how complexity drives cost per ton for 143 lubes plants globally (2006 data). We have split the sample into plants where labour costs over $10/hour and plants where labour costs under $10/hour.

Scale is an important driver too: Exhibit 2 shows how volume of lubricants produced (on a log scale) drives cost per ton, again split between high and low labour cost plants. Some plants at the top end are omitted to protect data confidentiality.

Exhibit 2: Effect of scale and labour cost on operating cost, lubes plants 2006
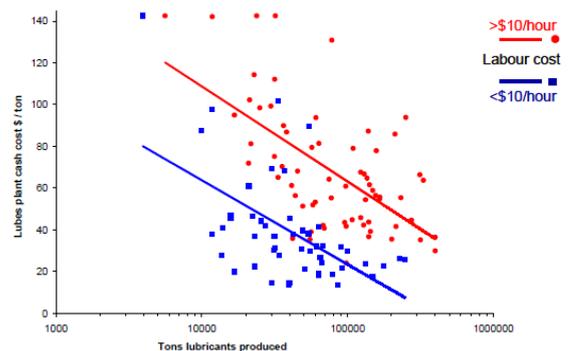

A number of other factors, in addition to scale, complexity and labour cost environment, also systematically affect cost per ton:

- » Fixed assets (historic investment gross book value) per ton
- » Level of automation
- » % base oil received by pipe
- » Mix of packed vs bulk
- » Average annual temperature (particularly affects energy costs).

Putting these all together into a multivariate regression equation allows us to plot , for each plant, its actual versus its par (or expected) operating cash cost per ton, as in Exhibit 3.

Exhibit 1: Any benchmark for cost must take complexity and labour rates into account

Exhibit 3: Actual vs par operating cash cost per ton: global lubes plants 2006
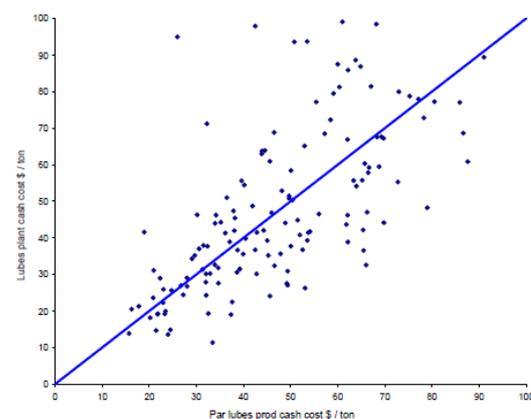
But while operating cash cost per ton is important, it is not the only thing that matters. Losses can be a big area for improvement, so can inventories (stocks). There are also two other areas of cost – depreciation and allocated costs – which are normally omitted from operating cash cost, for good reasons, but which cannot be ignored entirely.

Each of these costs can in turn be compared to its par level derived from a regression equation with the same driver variables as for operating cash cost. For example, Exhibit 4 shows days of raw material plus work in progress stock for the 143 lubes plants in our database.

Exhibit 4: Actual vs par days of raw material plus work in progress stock: global lubes plants 2006
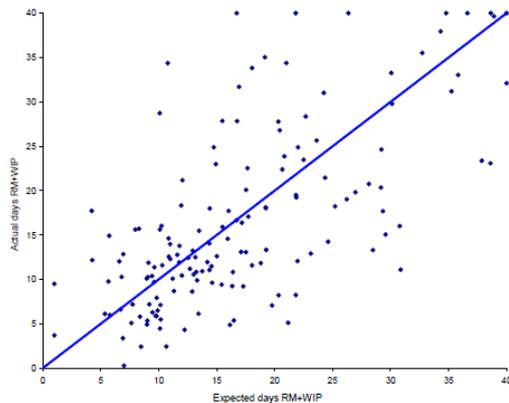
 All these ratios of actual vs par cost can be put into a balanced scorecard, and with appropriate weights an overall performance index calculated, where 100% represents "at par" or average performance. In the example in Exhibit 5, operating cash cost is $72 per ton, 87% of par. This puts the plant in quartile 2 globally and in quartile 1 for the region and the country. Depreciation, on the other hand, at $19.9 per ton, is well above par and in quartile 4 for all relevant geographies. Losses are high, stocks are lean, and allocated costs are zero. The weights used here are generally "neutral", i.e. proportionate to the average cost in each area, converting days of stock to money using an average raw material cost and cost of capital, but halving the "neutral" weight on depreciation and quartering it on allocated costs.

Exhibit 5: Example of balanced scorecard to calculate overall cost efficiency

| Plant X | | | Actu-al/Par | Percentile | | | |
Lubricants	Actual	Par		Global	Region	Country	Weight
Operating cash cost $/ton	72.0	82.9	87%	30%	22%	17%	70%
Depreciation $/ton	19.9	13.4	148%	**83%**	**78%**	83%	9%
Losses $/ton	10.9	7.0	155%	70%	68%	67%	8%
Days RM & WIP stock	13.0	28.3	46%	9%	6%	17%	12%
Allocated costs $/ton	0.0	5.5	0%	0%	0%	0%	1%
Overall cost efficiency index			92%	29%	18%	17%	100%

This plant is overall in quartile 1 for its region and country (a reasonable goal to set), but must still improve to get to quartile 1 from a global perspective.

So, we seem to have achieved our goal: a cost efficiency index that is comprehensive, takes into account factors like scale, complexity, and location, and yet can be ranked on a percentile basis globally, by region, and by country, and so used as part of target-setting by senior management. We now propose to test it and refine it in practice with leading lubricants producers worldwide.

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Fredmund Malik, founder and chairman of Malik, is an acclaimed international management expert, awarded scientist, and professor of corporate management and governance at the University of St. Gallen, Switzerland. He is the award-winning author of a dozen bestselling books, including the classic "Managing Performing Living", and a regular columnist in opinion-forming media. He is one of the leading and most innovative management thinkers of our time. Amongst others an expert in corporate governance, he is a member of the board of directors or advisory board of several world-leading corporations. Since the early 1990s, he has been the first in the German-speaking countries who discovered and consistently criticized the errors of neo-liberalism and of the shareholder value approach developing also the innovative right and proper solutions. Using his system-cybernetic methods and instruments, he was among the very first to predict and write about the current crisis, the Great Transformation21 and its complex challenges for which he has developed cutting-edge solutions.