When a Higher Price Pays Off

By Julie Lockhart, CMA; Audrey Taylor; Karl Thomas; Brenda Levetsovitis; and Jason Wise

Especially now, the lowest-priced products often sell best. Yet higher-priced products frequently have hidden benefits that keep maintenance and other costs low over the life cycle. As a matter of fact, in one case, a low sticker price could mean higher costs to business, the military, personal safety, and the environment. On the other hand, imagine spending $50,000—which appears to be a high sticker price—and saving $180,000 in just two years! The only real additional cost is what it would take to educate users on the advantages of reusing fuel rather than disposing of it.

In *The Balanced Scorecard*, Robert S. Kaplan and David P. Norton discussed the difference between a low-cost and low-priced supplier, arguing that the advantages of using low-cost suppliers in place of low-price suppliers are many. Factors businesses often don't consider are the costs of idle time from late deliveries, rework from low-quality inputs, or the extra cost of warehousing items that must be purchased in large lot sizes. Beyond this, customers with environmentally risky processes must also consider how a low-priced product may increase their hidden environmental costs and risks. Fully capturing the total cost savings of these "externalities" in an environmentally sensitive industry helps customers understand what they are paying for in a higher-priced product.

Take the example of Clarus Technologies, a small engineering and manufacturing firm headquartered in Bellingham, Wash., that specializes in innovative products and services for reprocessing fluids, including fuel oil and solvents. The unique benefit of using Clarus's filtration systems is the ability of the customer to reuse filtered fluids, which saves money and helps avoid expensive disposal issues. Since most of these fluids are environmentally harmful, the company contributes to a cleaner environment while providing a cost-effective method of reusing the fluids.

If Clarus struggles at all with sales, it's in the initial "sticker shock" for its products. When comparing Clarus products to those offered by competitors, consumers notice that Clarus's prices are usually significantly higher. But once they learn about the long-term savings and about eliminating disposal fees, consumers can see that Clarus is a low-cost supplier. Full cost accounting (FCA) and life-cycle analysis can help.

Full cost accounting was developed by the Environmental Protection Agency (EPA) and Tellus Institute, then further modified by Jan Bebbington, Rob Gray, Chris Hibbitt, and Elizabeth Kirk in their 2001 work, *Full Cost Accounting: An Agenda for Action*. FCA looks not only at cost savings, but it recommends including environmental costs and benefits that the accounting systems of both the supplier and customer typically ignore, also called "the social costs of doing business." By applying a life-cycle analysis to a product, full cost accounting can financially quantify the cost savings.

The Tornado

Clarus is a lean manufacturer where sales orders trigger production, and its production process is flexible and labor-intensive. Since its products are assembled primarily from purchased parts and represent unique solutions, the company can delay the production process until it receives orders from customers. By delaying production until the orders are received, the company retains precious cash, protecting it from overproducing.

In 2009, Karl Thomas, founder and CEO of Clarus Technologies, was in charge of the company's technical and sales information. He was receiving orders for a product called the Tornado, which appeared on the company website but wasn't being pushed by the sales force and hadn't been produced in the previous year. The unexpected orders caught his attention and caused him to review the financials for the product.

According to the company website, the Tornado "is a state-of-the art fuel processing/tank cleaning system that uses three stages of filtration, high volume flow rates, and variable speed to create a new standard in fuel inventory maintenance." In other words, it cleans tanks containing heating oil, diesel fuel, JP-8, solvents, hydraulic oil, and turbine oil.

The Tornado's advantages are safety, quality, and speed. Through a process that includes inserting a suction and discharge hose into the tank and then circulating and filtering the fluid in the tank, the Tornado is able to clean both the tank *and* the fuel with minimal disposal. Less-expensive competitive tank cleaning systems require personnel to enter the tank to clean it once the contents of the tank have been removed. Entering a fuel tank can be dangerous and requires specialized training because fumes could ignite. Beyond the safety issue are the cost and disposal issues; once removed, contaminated fuel can't be reused and must be disposed of according to environmental regulations, which can be costly.

The customer for the Tornado is usually a service company hired to clean tanks and filter fluids for owners of heating oil tanks, diesel fuel tanks, and the military.

Table 1: U.S. Army Corps of Engineers Ranking for Life-Cycle Costs

Provided by Michelle Hanson, Construction Engineering Research Laboratory, and Manette Messenger, HQ FORSCOM, at the 1999 Joint Services Pollution Prevention Conference in San Antonio, Texas

VENDOR*	INITIAL COST	O&M COST	LIFE-CYCLE COSTS	MECHANIC SATISFACTION	SOLVENT QUALITY	EASE OF USE	SPILL PREVENTION	SIZE	OVERALL RATING
Competitor 1	$1,795	★★	★★	★★	★★★	★★	★★★★	★★★	63
Clarus	$3,495	★★★★	★★	★★★	★★★	★★★★	★★★★	★★★★	78
Competitor 2	$2,115	★★★	★★★	★★	★★★	★★★	★	★★★	63
Competitor 3	$2,195	★★	★★	★★★	★★★	★★★	★★	★★★	66
Competitor 4**	n/a	★	★	★★★	★★	★★★★	★★★★	★★★★	69
Competitor 5	$1,233	★★	★★★	★★	★★	★★	★★	★	53

*Competitors' names have been changed from the original presentation. The prices are also changed, but the proportions remain constant.

**This product was leased rather than purchased.

★ = lowest rating, ★★★★ = highest rating.

Overall rating = weighted average of Life-Cycle Costs, Mechanic Satisfaction, Solvent Quality, Ease of Use, Spill Prevention, and Size.

Mechanic Satisfaction, Ease of Use, and Size ratings based on mechanics' ratings.

O&M Cost rating based on four months of data.

Solvent Quality rating based on stress test results.

Purchase Price vs. Total Cost

Thomas decided to document the full cost projections over the Tornado's life cycle and compare them to the costs of competitors' products.

Only five Tornado units were manufactured and sold in 2009. If more were made, stretching the ability of the current personnel to manufacture the full demand, then labor costs would be relevant in any cost-benefit analysis. It appeared that either more laborers would have to be hired or that some products currently being manufactured would have to be outsourced or eliminated. Given the current production process, however, only 7% of the prime costs of the Tornado were due to labor. Once the learning curve effects were factored in, the labor component would decrease to an even smaller percentage.

Minimal marketing was done to sell the original five units beyond listing the product on the website and following up on leads. But given the high degree of customer satisfaction, Thomas tried to determine whether the company should launch new marketing efforts. Could a full cost analysis with information and quantification impact customer decision making?

Thomas had several options for promoting his product. If price were the only barrier, then the price might be dropped to increase sales. But if the main reason sales crested at five units was simply because of lack of consumer knowledge, then an educational approach using full cost accounting should be investigated.

In the past, Clarus had provided total cost analysis to customers to prove the benefit of purchasing its products. Plus, customers occasionally provided proof of the cost advantage on their own. For example, in the late 1990s, U.S. Department of Defense researchers Michelle Hanson and Manette Messenger of the U.S. Army Corps of Construction Engineering Research Laboratory (CERL) presented a total cost analysis of one Clarus product, the PCS-25. The analysis consisted of comparing the total cost of the PCS-25 to its lower-priced competitors. When evaluated by CERL, the Clarus PCS-25 had the lowest total cost to the U.S. Army, despite having the highest purchase price. It turns out that what you pay to purchase a unit may only be one component of what it costs (see Table 1).

In addition to the purchase price, Hanson and Messenger included the costs to operate and maintain the product over four months and then extrapolated these costs to

Full Cost Accounting and Life-Cycle Analysis

Jan Bebbington and her coauthors summarize five tiers of costs, the first being the usual direct and indirect costs of production (referred to as Tier 0). Cost categories for environmental impact include hidden costs, liability costs, and less tangible costs as created by the EPA/Tellus Institute. Bebbington, et al., added a category called "environmental focused costs."

Tier 1: Hidden Costs

Many customers overlook hidden costs, which can include:

Regulatory Costs: notification, monitoring, reporting, training, inspections, pollution control, spill response, taxes/fees.

Upfront Costs: site preparation, permitting, research and development (R&D), engineering.

Backend Costs: closure, disposal, post-closure care.

Voluntary Costs: training, audits, recycling, remediation, habitat protection, sustainability reporting.

Tier 2: Liability Costs

Also given "short shrift" in cost analyses are the long-term effects of substandard products and environmentally damaging processes:

- Contingencies,
- Future compliance costs,
- Penalties/fines,
- Response to future releases,
- Remediation,
- Damage—property and personal injury, and
- Legal costs.

Tier 3: Less Tangible Costs

Image and perceptions of stakeholders (e.g., customers, suppliers, employees, community members) translate into financial costs and benefits. These financial impacts can arise from:

- Positive or negative environmental performance and
- Perceptions and attitudes of stakeholders

Tier 4: Environmental Focused Costs

In this fourth tier, Bebbington, et al., acknowledge and recommend quantification of social costs that typically aren't recorded in the accounting records. While Tier 4 costs are the most difficult and sometimes impossible to quantify, an environmentally conscious customer may hang a decision on a product's positive or negative impact on the environment. Bebbington, et al., call this the "shadow price" (opportunity cost) of eliminating negative environmental impacts. For example, a shadow price would be the cost of the trees that would have to be planted to completely offset carbon dioxide emissions during a year.

Costs that companies could incur if a project had no negative impact on the environment could include:

- Design costs to eliminate environmental impacts;
- Costs of alternative, less damaging processes;
- Reducing ecological footprint; and
- Costs of cleaning up damage to the environment.

simulate a comparable five-year period. These costs included filter replacement, providing replacement solvent, and, for one competitor, the cost of a service plan. Mechanics were surveyed to determine satisfaction and ease of use. Once all of the factors were weighted and summed, the Clarus product was determined to have the lowest total cost.

Building on the analysis provided by CERL and using a full cost accounting model, we performed an analysis for the Tornado tank cleaning unit. The question to be answered by the analysis was: "How do the customers

benefit from using the Tornado as a substitute to traditional tank cleaning methods? Is it less costly to spend the extra time and effort to clean a tank and reclaim the fuel with the Tornado vs. disposing of the fuel and entering the tank to clean it?"

Full Cost of Cleanup

To illustrate the full cost savings of using the fuel reclaiming benefits of the Tornado, we'll present an example from a local military base in which tanks containing 60,000 gallons of fuel were cleaned and the fuel was reclaimed for use over a two-year period. The contaminated fuel was JP-8, which is of higher quality than diesel and thus more expensive. A typical competitor tank cleaning process would require people to enter the tanks for cleaning and disposing of the fuel under federal regulations, which included a paper process called "manifesting" to track the waste fuel.

In the case of the military base, the fuel would have been unusable at the base if the competitor's cleaning process were used. Instead, the Tornado cleaned the fuel on-site and generated less than 55 gallons of waste. The fuel as it was processed met new fuel specifications and was ready for use by the installation. Or as Karl Thomas puts it: "Recycle a gallon, get a gallon." In addition, the military installation was able to avoid the cost of replacing the fuel. If a competitor's process had been used, most likely the fuel would have been transported as hazardous waste to a processing site and eventually used in making asphalt. This would require significant regulatory manifesting paperwork and pose insurance and long-term liability issues. The more contaminated the fuel, the higher the risk in transporting and disposing of it.

Long term, it's important to recognize that if all fuel tank cleaning operations used equipment similar to the Tornado, the infrastructure of manifesting and tracking waste streams would be greatly reduced, and an environmental waste stream would be equally reduced. The net savings to the military base from using the Tornado to reprocess 60,000 gallons of fuel was about $200,000 after the base paid the service contractor that operated the Tornado. This doesn't include savings from externalities that don't show up "on the books." The following analysis looks at both recorded savings and those that go unrecorded but benefit society. Using the full cost accounting analysis, here are the savings associated with using the Tornado rather than competing processes.

Usual Costs

Personnel: Many tank cleaning jobs require a minimum of four to five people to clean the tank: one safety person, one supervisor, and two to three personnel in the tank, cleaning it. The Tornado needs only two people to clean the tank, a savings of at least two personnel per job.

Fuel Savings: Because the Tornado returns fuel to the tank cleaner than new, the Army installation avoided replacing 60,000 gallons of fuel at approximately $3 per gallon, for a total of $180,000 savings.

Hidden Costs

Insurance Rates: Service providers using the Tornado should have lower insurance premiums since there's less risk for the employees. One regional tank cleaning company paid $30,000 per year for both pollution insurance and general operations. One-third was to cover the possibility of a pollution "event."

Regulatory Costs: Because the Tornado recycles on-site with minimal waste, the military installation avoided significant paperwork requirements under hazardous waste laws.

Hazardous Waste Disposal Fees: The tank sludge and contaminated oil would be disposed of as hazardous waste if a competitor had been used to clean the tanks. One oil company spokesperson stated that this is approximately $2 per gallon.

Liability Costs

Reduction of Potential Contingencies, Fines, and Penalties: Use of the Tornado significantly reduces the liability to the military base (and tank cleaning company) from personnel risk and transporting hazardous materials to an off-site disposal/recycling facility.

Less Tangible Costs

Value of Improved Image: Customers using the Tornado cleaning and recycling system stand to gain significantly in image with the public from using such a system. The marketing value can be long term.

Environmental Focused Costs

Any reduction of fuel disposal positively impacts the environment over time. If companies "recycle a gallon/save a gallon" in large numbers, this could result in significant savings in environmental, health, and social costs, including water and soil contamination, air pollution, climate change, military costs, and government subsidy costs. Specifically, the Tornado helps reduce

New Fuel Purchases: Reducing production of new JP-8

Table 2: Customer Cost Savings Calculation Grid

Fuel Savings:	
A. Cost of fuel	$0.00
B. Used fuel collected in gallons	0
C. Fuel savings	$0.00

Waste Fluid Disposal Savings:	
D. Cost of fluid disposal	$0.00
E. Used fluid disposed	0
F. Cost of fluid disposed	$0.00

Management Savings:	
G. Monthly cost of waste fluid management	
H. Total cost	

Monthly	Annual
A × B	×12 = C
D × E	×12 = F
G	×12 = H
C+F+H	= I
	Return on Investment

*For each of four 10,000-gallon tanks, 567 gallons were lost and disposed of as sludge. Four tanks with 567 gallons of sludge were disposed of: = 567 × 4 = 2,268 gallons.

**The charge for cleaning four 10,000-gallon tanks was $6,400.

***The annual cost of insurance was $30,000, which included a $10,000 premium to protect the vendor from a pollution "event." The remaining $20,000 is the general insurance premium for remaining operations.

****Costs to dispose of fuel range from $0.50 per gallon to $3.00 per gallon. If the lower disposal cost per gallon is used in this analysis, the savings would drop to $128,448 annually and $891,167 for the 10-year period. At the high disposal price per gallon, the savings increase to $196,488 annually and $1,369,053 for the 10-year period.

Consumer Cost Savings Example, using data from a local oil company:

Fuel Savings:	
A. Cost of fuel/gallon	$2.50
B. Used fuel collected in gallons*	2,268
C. Fuel savings	$5,670.00

Waste Fluid Disposal Savings:	
D. Cost of fluid disposal****	$2.00
E. Used fluid disposed in gallons*	2,268
F. Cost of fluid disposed	$4,536.00

Management Savings:	
G. Monthly cost of waste fluid management**	$6,400
H. Total cost	$76,800

Monthly	Annual
A × B × 12 = C	$68,040
D × E × 12 = F	$54,432
G × 12 = H	$76,800
C + F + H = I	$199,272

Annual operating savings from using Tornado	$199,272
Annual insurance savings from using Tornado***	$10,000
Total annual insurance and fuel/hazardous waste savings	$209,272
Minus annual operating cost of Tornado	$40,000
Total annual savings	$169,272
Life of Tornado	10 years
Annuity factor for 7% interest rate for 10 years	7.0236
Present value of future cost savings	$1,188,899
Purchase price of Tornado	$16,000
Purchase price of competitor's product	$5,000
Net savings (loss) from purchase of Tornado	$1,177,899

Table 3: Savings Breakdown

Vendor Savings	
A. Reduced personnel per job	2
B. Monthly wage per person	$4,000
C. Total wages saved	$8,000

Waste Disposal Savings	
D. Tanker rate per hour	$150
E. Hours per month	40
F. Tanker cost per month	$6,000
G. Insurance savings per month	$833
H. Total monthly savings	$14,833
I. Annual savings	$178,000
Minus annual operating cost of Tornado	$40,000
Total annual savings	$138,000
Life of Tornado	10 years
Annuity factor for 7% interest rate for 10 years	7.0236
Present value of future cost savings	$969,257
Purchase price of Tornado	$16,000
Purchase price of competitor's product	$5,000
Net savings (loss) from purchase of Tornado	$958,257

fuel can reduce infrastructure costs and pollution.

Transportation Costs: This particular military base might transport contaminated fuel anywhere from 30 to 45 miles away.

Infrastructure for Recycling Fuels: The marginal cost to society of adding 60,000 gallons to an existing system that may process as much as 12 million to 13 million gallons per year is minimal. Yet if all of those 12 million to 13 million gallons were processed on-site, the infrastructure for transporting, cleaning, and recycling would be eliminated—with significant environmental benefit.

Carbon Footprint: Fuel and transportation savings translate into lower carbon dioxide emissions.

The military recorded cost savings of approximately $300,000, which includes the $2 per gallon disposal fees plus $3 per gallon for replacing the fuel. The primary cost of this work was the $50,000 paid to the service company that operated the Tornado. Additional savings were realized through the externality savings.

Finding the Total Cost

Taking the analysis further to help market the Tornado to service companies, Thomas created a cost savings calculator for customers (see Table 2). The consumer is saving funds by using a vendor with a Tornado cleaning system. The vendor is saving:

- The extra costs of vendor insurance for potential tank explosions,
- The cost of two personnel per use, and
- The cost to hire a tanker to haul the sludge to the approved disposal site.

See Table 3 for a breakdown.

Again, savings increase when considering the social/externality costs saved by using the Tornado instead of a competitor's less environmentally beneficial tank cleaning process.

Using the techniques described above, accountants can add significant value to their companies' bottom lines by calculating possible life-cycle savings from using products and/or services that have the lowest life-cycle cost, not just the lowest purchase price. When selling a product or service based on the lowest life-cycle cost, it's important that all the benefits are presented clearly so the customer can make a fully informed decision.

Finally, neither the seller nor the consumer can overlook the value of externalities in the marketing process. Knowing the cost of the externalities benefits both in arriving at a correct buy/sell decision for a particular product or service. Although it's difficult to put a value on not having contaminated fluids transported on the highways, this does have value, and this value must be calculated in all purchases. **SF**

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