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# SUSTAINABLY DRIVEN SUPPLY CHAINS

THE DRIVE TO GO “GREEN” HIT supply chains like a thunderclap in July 2009. That’s when Wal-Mart announced that its suppliers would have to improve sustainability in their supply chains. One corporation, which we’ll call the ABC Company, had Wal-Mart as a key customer when the announcement was made. A study of this large, multinational consumer goods company demonstrates how to create a more cost-effective supply chain by being more sustainable.

ABC Company committed to integrate its supply chain sustainability goals with its productivity goals to improve both operating and sustainability metrics. The project involved a comprehensive approach that included electricity, utilities, water and logistics. This approach helped ABC Company reduce its carbon footprint by 10,000 metric tons a year, saving more than \$2 million in annual operating costs. This article, however, deals only with the logistics portion as it applies to the movement of materials to and from the plant (external) and within the plant (internal).

The supplier learned lessons on how to initiate a process to use sustainable manufacturing practices as a strategy to reduce costs in the supply chain. The lessons include the necessity of finding an executive champion; building organizational support; embedding a systems approach; aligning sustainability metrics with key supply chain performance indicators; and quantifying supply chain savings and sustainability opportunities with data analyses.

## Past is not present

Executives traditionally believed that making manufacturing operations more sustainable would put them at a competitive disadvantage because of additional operating and equipment costs. Back then, executives treated the need to become more sustainable as a corporate social responsibility issue divorced from business objectives.


The Wal-Mart 2009 announcement changed the game. Its executives were operating under the belief that being an efficient and profitable business

and being a good steward of the environment were consistent goals. The Wal-Mart sustainability index focuses on four areas: energy and climate, material efficiency, natural resources, and people and community.

As a key customer, the retailing behemoth’s sustainability criteria accelerated ABC’s efforts to initiate a companywide project to establish a sustainability baseline. The facility used in this case study was chosen as the pilot location for ABC.

ABC used its baseline sustainability assessment to model innovative ways that sustainability improvements could cut supply chain costs. The assessment focus areas were derived from Wal-Mart’s sustainability criteria. For ABC, the criteria included electricity audit, energy (compressed air, steam and retort), material usage (solid waste and water) and transportation and logistics (supply chain).

By the end of the pilot study, the overall assessment identified more than 10,000 metric tons of carbon footprint reduction annually with a return on



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investment of 10 times. Of this, more than 50 percent came from the supply chain improvements.

## En route to savings

A key first step is to identify an executive to champion, lead and accept the investment risks. Sustainability needs executive level commitment. Therefore, it takes a courageous leader to challenge the skeptics, push the facility and expend resources to find more sustainable business operations. In this example, the plant manager became the executive champion. The vice president of manufacturing supported the project with the caveat that the plant manager had to meet his cost performance numbers. This ensured that any sustainability initiatives were tied to cost savings.

The plant manager formed a cross-functional team. It was important to create an early victory to win over skeptics. The early efforts of collecting baseline information and sharing it with the team led to some surprising findings. An example was the magnitude of transportation wasted on high-volume raw materials from across the country and the world. This cost reduction opportunity caused the plant controller, who was a skeptic, to become an avid supporter after the first milestone meeting. Showing such measurable possibilities early on gets the team believing in the mission.

The sustainability drive required an embedded systems approach to identify synergies across the processes when streamlining. The most important aspect of the assessment was keeping the big

picture in mind. The assessment looked at sustainability opportunities plantwide, and transportation and logistics were major focus areas. Figure 1 demonstrates how the plantwide effort was divided into various elements.

The entire chain of raw materials — from supplier through external storage, transportation to the plant, and movement within the plant until the materials were distributed as finished goods — was defined and analyzed as a complete system. Focusing too much on individual supply chain components could have resulted in suboptimizing the overall objective.

The supply chain was divided into internal and external material movement. Internal was defined as all material movement within the walls of the facility

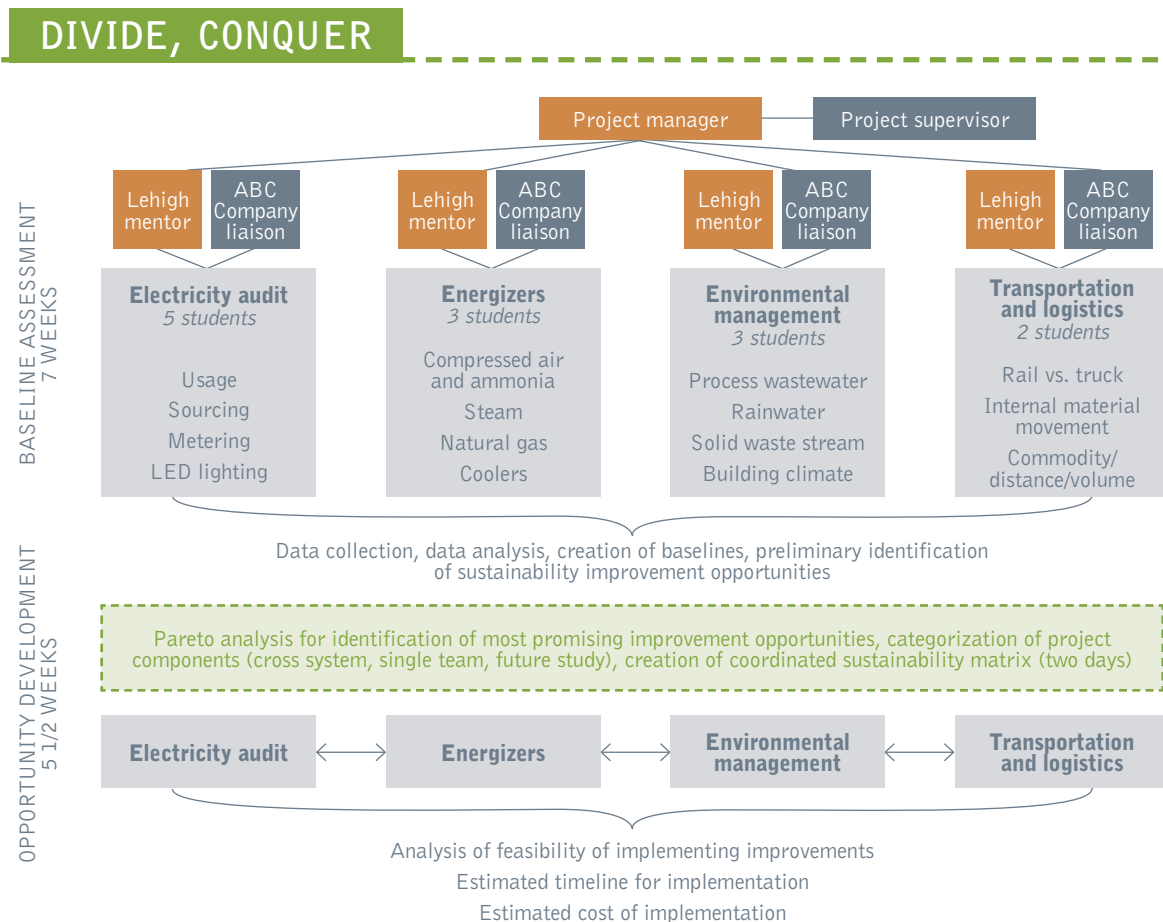


Figure 1. A systems approach helped break down the plantwide sustainability effort into various elements.

— warehousing, material handling, production and distribution. External was defined as all material movement from raw material sourcing, transportation from supplier to plant and all storage of raw material outside of the facility — procurement and transportation.

Many believe that what is measured is improved, and sustainability has many connotations. It is important to quantify key metrics that are clear to the organization and are consistent with other supply chain performance measures. This will support aligning the goals of internal and external stakeholders so they work collaboratively toward improving supply chain sustainability.

The primary goal was to maximize supply chain performance, which included increasing throughput and material availability, reducing operational costs and improving labor efficiency. The sustainability goals were subordinated to the supply chain goals of delivering products on time for customers. This process aligned the supply chain and sustainability goals. Sustainability became doing more with less movement.

The internal and external material movement became the critical indicator of both sustainability and supply chain improvements. Therefore, the efforts focused on understanding all the internal

and external material movements and finding ways to eliminate or minimize the non-value-added steps in the process.

Due to their unique characteristics, the internal and external elements were analyzed separately in parts of the data collection process. However, the final analysis examined all elements of both internal and external supply chains as a whole. Remember, the decisions made on one part could and did impact another. The systems approach also took refrigerated storage, pallet design and stretch wrap into consideration.

Many different data sources were used to understand the supply chain components in detail. The sources for external analysis included the ERP system, plant and corporate employee interviews and collaboration with transportation and logistics companies. The internal analysis involved time studies, interviews with forklift drivers and data from warehouse management systems.

### A moving analysis

The primary focus of the external movement analysis was storing and moving raw materials from suppliers to the plant. All incoming raw materials were identified and prioritized by weight. The top few were analyzed further for frequency of receipts, distance from

supplier source, outside storage requirements, mode of transportation (truck, rail and intermodal), related operating costs and environmental impacts. The distance traveled was the primary factor in determining the carbon footprint of the shipment. This provided insight into opportunities and trade-offs when choosing alternate sources and different modes of transportation. Switching from one transportation mode to another could save money and cut carbon costs without compromising service levels.

High-volume materials were identified, and the location of every vendor that supplied them was mapped to visualize the opportunities. Transportation costs were compared to illustrate the cost differences. Figure 2 compares the transportation costs between truck and rail delivery for selected raw materials. The results indicate that shipping by rail was consistently cheaper, except for Raw Material No. 1.

The internal analysis primarily focused on forklift movement. Even though they are powered by electrically charged batteries, forklifts have a substantial impact on emissions. The forklift movement in the distribution center was divided into order selecting (loading), truck receiving (unloading) and line receiving. The process of loading was

## WHAT'S CHEAPER

RAW MATERIAL	LOCATION	STORAGE LOCATION	WEIGHT	TRUCK LOADS	MILES	CARBON FOOTPRINT (CO2 LBS.)	TRUCK COST	ESTIMATED RAIL COST
Raw material 1	Vermont	Direct	3,317,260	94	330	63	\$77,550	\$452,289
Raw material 2	Wisconsin	Wisconsin	22,793,750	625	1,000	2,272	\$987,500	\$912,500
Raw material 3	South Dakota	Direct	918,697	26	1,313	93	\$73,736	\$49,841
Raw material 4	California	Missouri	1,791,744	20	2,900	15	\$102,080	\$84,680
Raw material 5	California	Missouri	819,394	22	2,900	130	\$112,288	\$93,148
Raw material 6	Wisconsin	Missouri	1,415,318	38	1,780	138	\$132,574	\$98,754
Raw material 7	South Dakota	Missouri	1,154,601	31	1,780	110	\$117,180	\$79,205
							<b>\$1,602,908</b>	<b>\$1,770,417</b>

Figure 2. For most raw materials, shipping via rail was less expensive than shipping via truck.

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divided into running, trailer preparation, wrapping and stationary times for the forklifts. The stationary time is related to the forklift, not operator movement. Time studies of the loading process identified various non-value-added activities, including time wasted while the pallets were being wrapped. The time for each activity and the total number of pallets in each truckload determined an average time per pallet.

The ideal time for each operation was estimated by minimizing the non-value-added activities and comparing them to the actual times. The comparison identified opportunities to reduce the time the forklift spent on unnecessary activities.

### The “hows” of sustainability

The project’s internal and external analysis yielded several opportunities to improve the supply chain and make it more sustainable.

**Shift modes of transport (rail or intermodal vs. truck).** Several raw

materials are transported from long distances on trucks. Rail solutions have a high initial setup cost but low operational costs. Rail cars can store up to four truckloads of material and have a lower carbon footprint than trucks. However, truck shipments are predictable and, at first, cheaper to set up. Often these trade-offs can be managed.

**Alternate sourcing.** Several raw materials were sourced from across the country due to unit price and availability. In some cases, using nearby vendors could reduce the distance traveled and the risk of running out of production materials. But alternate sourcing is a strategic decision that should be considered carefully lest it negatively affect other facilities in the manufacturing network.

**Evaluate on-site or closer storage locations:** Some key raw materials were stored in central locations for use in multiple facilities. These external storage solutions could add costs. And

bad weather could prevent the materials from reaching the plant when needed. This plant had unused on-site storage space that could minimize off-site handling, reduce storage costs and keep the material available.

**Minimize non-value-added time:** The internal movement of forklifts could be made more efficient by addressing unnecessary movement due to distribution center layout, wrapping of pallets and unreliable load plans.

Several recommendations were developed for each opportunity. A cost/benefit analysis showed the payoff and return on investment. For example, although switching most transportation to rail could reduce costs substantially, this was not always feasible because of facility location and current contracts. Other recommendations such as using a returning truck to carry recyclable material could be implemented right away without significant initial investment. The supply chain performance

## LIKE A HAND IN A GLOVE

OBJECTIVE	RECOMMENDATION	POTENTIAL SAVINGS	C02 FOOTPRINT	ACTION REQUIRED
<b>Internal</b>				
Reduce forklift movement		8 additional trucks loaded/day	18 tons/yr.	
	Reduce wrapping time	20 minutes/day/forklift	4.16 tons/yr.	
	Additional stretch wrap machine			Implement
	Better pallet design			Test on line
	Dependable load plans	10 minutes/day	2.17 tons/yr.	Follow-up project
	Improve distribution center layout	60 minutes/day	11.7 tons/yr.	Follow-up project
	Create algorithm for truck dock scheduling			Implement
	On-site storage	\$133,000/yr.		Better availability and less handling with savings
<b>External</b>				
Reducing external movement	Alternate sourcing			Needs strategic sourcing study and corporate involvement
	On-site processing equipment	\$540,000/yr.		Internal investment
Reduce transportation cost	Raw material brought by rail instead of truck	\$650,000/yr.	3,512 tons/yr.	Requires corporate involvement and approval
Reduce energy cost	Rationalizing cooler capacity			

Figure 3. Reducing internal and external movements demonstrates that supply chain improvements and sustainability go together.

and sustainability improvement were calculated for each recommendation. For each feasible recommendation, an implementation plan was developed, as summarized in Figure 3.

## Cashing in

The logistics and “green” improvements could wind up saving ABC \$1.2 million each year. In addition, the company could reduce this facility’s carbon footprint by more than 3,500 metric tons annually. These results were a major part of the assessment project’s overall annual savings of \$2 million and 10,000 metric tons of carbon emissions. In addition, they could save enough time for workers to load an additional eight trucks each day, a 15 percent improvement.

The logistics results demonstrate that supply chain performance, costs and sustainability indices can be improved simultaneously. The recommendations were reviewed by management and currently are in various stages of implementation. Based on the company’s own ROI standards, the return on the sustainability project was estimated to be 10-to-1 without considering grant offsets. With grants, the return doubled.

The case study taught participants several lessons about using sustainable manufacturing as a strategy to reduce supply chain costs and carbon emissions. The key elements for success are as follows:

1. Identify an executive to champion, lead and accept the investment risks.
2. Pilot and build support by ensuring early success.
3. Embed a systems approach to identify synergies across processes when streamlining.
4. Ensure sustainability metrics support existing key performance indicators (KPI) of the supply chain.
5. Quantify the supply chain cost

## RIDING THE RAILS

Supply chain managers are looking at rail to cut their company’s carbon footprint and save money. Railroads can carry a ton of freight two to four times as efficiently as trucks. But in the past, customers have worried about reliability, and rail hasn’t been seen as a sexy investment or solid supply chain alternative.

This is changing, as exemplified by Berkshire Hathaway Chairman Warren E. Buffett’s decision to spend \$26.5 billion to buy the rest of Burlington Northern Santa Fe railroad, reported *Bloomberg Businessweek*.

Since the buyout, dividends have totaled more than \$3 billion. The continuing economic recovery, combined with rail’s fuel efficiency and improved reliability, has Burlington executives buying 200 more locomotives and more transfer facilities. Recent years of capital investment by Burlington Northern and other railroad companies have more trains meeting their schedule.

“People need to know that the trains are going to run on time,” Tompkins Associates logistics consultant Chris Ferrell told *Bloomberg*. “They don’t mind that you’re a day and a half slower; they just want to make sure that you’re a day and a half slower every time.”

Each year, organizations spend about \$300 billion shipping goods between cities. A Burlington Northern executive estimated that rails only get about 13 percent of that business. Rail’s sweet spot is for hauls longer than 750 miles. For example, a company could save \$1,002 and half its carbon emissions by using rail to send a freight container the 2,020 miles from Los Angeles to Chicago, according to Burlington officials.

savings and sustainability opportunities through data collection and analysis. ❖

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