CILT Level 6 Advanced Professional Diploma

Strategic supply chain management

CASE STUDY

INSTRUCTIONS FOR CANDIDATES

You will be expected to demonstrate your knowledge and understanding of relevant theoretical principles, concepts and techniques; to apply these appropriately to the particular situation described in the case study; and above all, to make sound decisions. You will not gain marks by writing a general essay on the topic.

Please note that all work should be your own. Copying or plagiarism will not be tolerated and could result in no marks being awarded. If quotes or short extracts are used they should be attributed or the source of the information identified.

You should acquaint yourself thoroughly with the case study.

CATERPILLAR CASE

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The case was written in May 2016 and may not reflect the current situation.

Candidates are advised to base their analysis, evaluation and critical review on the situation depicted in the case.

A bibliography can be found at the end of the case study.

Introduction
Caterpillar is a manufacturer of construction and mining equipment, diesel and natural gas engines, industrial gas turbines, and diesel-electric locomotives. The company is also a service provider through Caterpillar Financial Services, Caterpillar Remanufacturing Services and Progress Rail Services. Caterpillar operates in North America, Asia Pacific, Europe, Africa, the Middle East, the Commonwealth of Independent States (CIS), and Latin America.

The company operates through four main business divisions: power systems (engines, turbines and replacement parts across a variety of industries), construction industries (machinery for infrastructure and building construction applications), resource industries (machinery for mining and quarrying applications), and financial products (financing for customers and dealers to purchase and lease Caterpillar equipment).

Caterpillar is headquartered in Illinois, USA and employs 118,000 people. The company recorded revenues of $55,656 million during the fiscal year ended December 2013 (FY2013), a decrease of 15.5% compared to FY2012. The operating profit of the company was $5,628 million during FY2013, a decrease of 34.4% compared to FY2012. The net profit was $3,789 million in FY2013, a decrease of 33.3% compared to FY2012. Caterpillar's products are sold primarily under the brands Caterpillar, CAT, Electro-Motive, FG Wilson, MaK, MWM, Perkins, Progress Rail, SEM and Solar Turbines.[1]

Corporate Vision

Caterpillar's stated vision of the future is where:

- *We are recognised as the leader everywhere we do business.*
- *Our products, services and solutions help our customers succeed.*
- *Our distribution system is a competitive advantage.*
- *Our supply chain is world class.*
- *Our business model drives superior results.*
- *Our people are talented and live Our Values in Action.*
- *Our work today helps our customers create a more sustainable world.*
- *Our financial performance consistently rewards our stockholders.*

[1] Caterpillar Company Profile, Marketline, 20 February 2015

Strategic goals are focused in three areas:

- *Superior Results: We are a solid long-term investment with total shareholder return in the top 25% of the S&P 500.*
- *Best Team: Our people enjoy a safe and inclusive place to work.*
- *Global Leader: Our customers are more successful with us than with our competitors.*[2]

The Supply Chain

Caterpillar's machines are distributed principally through a worldwide network of dealers, 48 located in the USA and 130 located outside the USA, serving 182 countries and operating 3,454 retail outlets, including 1,202 dealing with rentals. Additionally, some of Caterpillar's subsidiaries operate their own dealer networks: Perkins Engines Company has 100 distributors located in 180 countries, Caterpillar Northern Ireland Limited has 264 distributors located in 145 countries, and the MaK brand has 19 distributors located in 130 countries.[3]

Caterpillar sets tight standards for its dealer network and collaborates with it extensively to ensure that customer expectations are met. The dealers are responsible for not only selling machines to the end customer, but also for servicing machines that have been sold. To support dealer service operations, Caterpillar operates a large service parts business that warehouses and distributes components to dealers and customers. Caterpillar customers demand quick service to ensure that, if their equipment needs repair, they are able to get back into service as quickly as possible. As a result, Caterpillar's parts business maintains a large inventory to ensure high service levels to the field.

Because of global demand, Caterpillar produces its products in facilities distributed around the world. The company's general strategy with regard to machine production is to produce its products on the continent where they are to be sold. However, some of its larger and more specialised products are produced in a single location because of the level of capital investment required.

Caterpillar is partially vertically integrated. Internally the company generally produces components that it feels contributes to the competitive edge of its products. Outside of these areas the company relies on an extensive base of suppliers to support production. Given that the company's products are designed to be high-quality durable goods, components are required to meet stringent specifications for performance and construction. The number of suppliers capable of producing these components is, therefore, limited, which means that components are often sourced from a country different from where the product is produced. Given these limitations, it is understandable that some of the components that Caterpillar sources are in limited supply.[4]

Supply Chain Management

Supply chain management is recognised as strategically important in Caterpillar. Jim Owens, the former chairman and CEO of the company, stated in 2011: "*In our industry the competitor that's best at managing the supply chain is probably going be the most successful competitor over time. It's a condition of success*." [5]

[2] caterpillar.com, April 2015
[3] Caterpillar Company Profile, Marketline, 20 February 2015
[4] Rowan, Brandon, Study of the Role of Strategically Managed Inventory In the Caterpillar Supply Chain, MIT Sloan School of Management, 11 May 2012
[5] Malik, Yogesh; Niemeyer, Alex; and Ruwadif, Brian, Building the Supply Chain of the Future McKinsey Quarterly, January 2011

Rapid Response Supply Chain

In an effort to exploit anticipated growth in the small construction industry, Caterpillar made the decision to introduce a new product line of compact construction equipment (such as small excavators and loaders), the P2000, starting in 1999. According to Rau, Scheller-Wolf & Tayur (1998), P2000 represented not only a new product line, but also a new business strategy for Caterpillar's construction equipment division. Caterpillar's traditional product line consisted of large, low-volume, high-margin, customised machines (costing $500,000 or more), while the new P2000 family encompassed smaller, medium- to high-volume, standardised products (selling for as little as $20,000 per machine).

Furthermore, while Caterpillar was a well-known leader in the heavy equipment business with few large competitors, the compact product segment had many entrenched market leaders such as BobCat (trademark of the Melroe Manufacturing Company), Deere & Co., and Case Corp. Adding to the interest surrounding the P2000 launch were workforce difficulties at Caterpillar (six years of disputes and strikes over pay and conditions) and the Asian financial crisis, both of which increased the uncertainty of future profitability and demand.

Before embarking on this new product introduction a careful analysis of the supply chain design was required; Caterpillar knew that it needed a network which could maximise profits while also capturing market share and providing flexibility. Caterpillar also recognised that the P2000 family would not fit well in the current supply chain. A two-year study was undertaken which considered the volume of forecast demand, cost parameters and routeing restrictions.

Caterpillar's new product line consisted of several models of three different machines (a skid-steer loader (SSL), a compact wheel loader (CWL), and a mini-hydraulic excavator (MHE), as well as some forty work tools (including items such as buckets, fork-sets and grapples). The work tools, which were designed for use with one or more particular machines, could be sold as attachments to competitor's machines as well as those produced by Caterpillar. Therefore, these provided a means to enter the market independent of P2000 machine sales.

The P2000 products were to be sourced, manufactured, and assembled in approximately twenty locations throughout North America and Europe. Key production centres for machines were Sanford, USA and Leicester, England, with specific machines assigned to each production centre. Work tools came from locations in the UK, the USA, Mexico, Sweden, Germany and Finland, with each work tool having a single source of supply.

In North America, P2000 products were to be sold through a network of 190 Caterpillar dealers serving 58 districts in the United States and Canada. Caterpillar provided demand forecasts, by dealer district, for all of the machines and work tools, as well as customer patience data gathered through surveys of the dealers. These surveys were an effort to understand the behaviour of customers forced to wait for delivery of an item, and hence measure the cost of such delays through customer attrition. They implied that customers renege at a rate which depends on how long they have been waiting, thus establishing a relationship between the level of service and lost sales.

Caterpillar also furnished cost and logistical data, including source costs, source capacities, minimum order sizes, holding-cost rates at the different locations, handling costs, as well as shipping times and rates for different combinations of transportation modes. The nodes in the distribution network were completely specified for machines. A set of potential trans-shipment locations (intermediary nodes between the source and the dealer) had been determined for work tools. In the initial analysis, Caterpillar stated that work tools and machines would not share trans-shipment nodes. This requirement was relaxed later on, when shipment of machines and work tools could be done either separately or together, at varying capacities and rates.

Caterpillar's focus on the supply chain configuration was motivated by specific concerns: the international nature of the P2000 supply chain, coupled with the considerable weight of the equipment, created the potential for both lead times and shipping costs to be large. Caterpillar made a conscious decision not to compete on price; rather, in keeping with its core philosophy, quality and service were targeted as areas in which the company would distinguish its products. Long lead times were thus a particular concern. The dealer surveys reinforced this concern, by implying that Caterpillar's future products would be highly substitutable with those of the competition. Caterpillar thus believed it crucial that it should capture a very high percentage of customer demand for Caterpillar products as soon as it materialised, and not force potential customers to wait for delivery.

By establishing a reputation for product availability, Caterpillar felt that it would not only generate demand for its products, but also possibly be able to satisfy demands for competitors' products, if these competitors failed to keep sufficient quantities of products in stock. It therefore became important not simply to find the minimum cost channel for a product in the supply chain, but to also provide an additional channel for expedited delivery to the dealer, probably at a higher cost, should inventory levels drop precipitously. Caterpillar did not want to underestimate the value of quickly getting inventory to dealers, and hence to new customers. A rapid response supply chain was therefore configured.[6]

Supply Chain Segmentation

Shunko et al (2014) explain how, in 2010, Caterpillar unveiled a dramatic new strategy for pricing and marketing its BHL series of small backhoe loaders, one of the most popular products within its Building Construction Products (BCP) division. This new strategy has radically changed how BCP markets and sells its small machines, focusing the bulk of Caterpillar's customers on a few popular models.

Previously, BCP offered customers an almost unlimited variety of products, built-to-order, priced according to an itemised price list. This maintained very high customer satisfaction, but greatly complicated BCP's supply chain and service operations. With such broad demand, dealers had to hold large amounts of inventory to give a representation of the many possible choices. Moreover, Caterpillar had to maintain documentation and provide service for an extremely heterogeneous group of machines, driving up its costs. Finally, as demand was fragmented across thousands of configurations, forecasting was problematic, leading to frustration among Caterpillar's supply base.

Caterpillar's BCP division saw great potential for a rationalisation of its BHL product line. But there were three crucial questions that needed to be answered before such a new strategy could be devised and implemented:

1. How would customers react to a product line reduction? Answering this question required an understanding of how customers value different machines.

2. How much could be saved by rationalising the BHL product lines? Answering this question required an understanding of the cost of complexity.

The answers to these two questions could help Caterpillar answer the ultimate question:

3. How should the new BHL product line be configured? Specifically, which machines should be offered and at what prices?

[6] Rau, Uday; Scheller-Wolf, Alan; Tayur, Sridar, Development of a Rapid Response Supply Chain at Caterpillar, Carnegie Mellon University, July 1998

To answer the first question, BCP's extensive dealer network was leveraged to gain an understanding of the segmentation, preference patterns, and price sensitivities of BCP's customer base. This dealer knowledge was combined with the entire line's sales history over the previous two years to construct a detailed analytical model of customer preferences and substitution. This produced a model of how BCP's customers would react to changes in the product line.

To answer the second question, a detailed model was built to estimate the total direct and indirect costs of complexity, using an extensive empirical analysis of Caterpillar's cost data, as well as surveys with Caterpillar engineering and marketing experts. This model captured both variety-based costs (driven by the number of options offered) and attribute-based costs (driven by specific complex options) against the benefits of product diversity, from manufacturing to spare parts to sales effort.

The customer and cost models were then combined to evaluate different product lines against randomised demand patterns and market scenarios. This step determined the right product mix for the line, offering customers broad choice while also controlling the costs of complexity.

The outcome of the project was implemented as a new 'lane' strategy, offering machines within three different lanes: Lane 1, the Express Lane, featuring four built-to-stock configuration choices at an expected lead time of a few days; Lane 2, the Standard Lane, featuring 120 predetermined configurations, built-to-order at an expected lead time of a few weeks; and Lane 3, the A-La-Carte Lane, consisting of customised built-to-order machines with an expected lead time of a few months.

Caterpillar committed to a phased roll-out of the project, publishing both an (old) a-la-carte price list and a (new) Lane price list in 2010, and transitioned to a single lane price list in 2011. The Lane 1 configurations were immediately able to capture a significant portion of demand, contributing to a reduction in warranty costs in the order of 10%. Caterpillar has continued expanding and refining the BHL lane strategy. For example, it has now reduced the Lane 1 configurations to just two. In addition, Caterpillar has applied the 'cost of complexity analysis' to other divisions within the firm, helping to guide extensions of the lane approach, a fundamental strategic change for the entire organisation.[7]

Supply Chain Integration

Rowan (2012) explains how, at the start of 2012, Caterpillar embarked on a company-wide effort to implement a new supply chain strategy. The new strategy, dubbed the 'Integrated Supply Chain (ISC) Strategy', was designed to move the supply chain from a series of processes that were standardised and executed in silos, to an integrated set of processes that are optimised for the entire company. The ISC is part of Caterpillar's continuing emphasis on improving the efficiency of its operations to support increasing demand for its products.

The ISC strategy was developed after extensive evaluation of Caterpillar's current supply chain capabilities and process implementation. One of those processes governed the use of Strategically Managed Inventory (SMI). SMI is an inventory management and replenishment model designed to streamline the company's supply chain by optimally placing strategic inventory buffers. The primary goals of SMI are: (i) improving overall supply chain efficiency and flexibility by increasing material availability at the point of use (POU); (ii) aiding the transition to a pull supply chain; and (iii) improving material flow. SMI is closely related in form and function with the concepts of vendor managed inventory (VMI) and collaborative planning, forecasting and replenishment (CPFR).

[7] Shunko, Masha; Yunes, Tallys; Fenu, Giulio; Scheller-Wolf, Alan; Tardif, Valerie; Tayur, Sridhar, Restructuring the Backhoe Loader Product Line at Caterpillar: A New Lane Strategy, Working Paper, www.miami.edu, 10 September 2014

Before SMI was introduced, Caterpillar assumed ownership of material at the supplier's location and transported it to its POU. This arrangement created a situation in which there was a good deal of material in transit, which tied up a large amount of working capital, especially in the case of material sourced from other countries. Inventory pools were held at multiple stages of the supply chain: at the supplier (prior to shipment), in Caterpillar warehouses, and at the POU. The situation was exaggerated when multiple Caterpillar facilities used a single supplier, because the inventory pools were typically not consolidated. Replenishment was typically orchestrated through the use of MRP systems and purchase orders. Decisions were made in a decentralised manner; both the supplier and Caterpillar made their own production plans and decisions with limited information sharing.

Caterpillar sought to engage suppliers in the new SMI process in order to streamline the current state and drive additional efficiencies into the supply chain. Suppliers were given responsibility for transporting material to a central point close to Caterpillar's production. Caterpillar can then pull material for production from this central inventory pool. Suppliers typically own the inventory until it is pulled from the central pool. It is at this point that Caterpillar pays for the inventory according to terms established with the supplier. Under SMI all production that uses a common component can pull from the central pool, virtually eliminating the need to maintain large buffer inventories at each facility. The central stock can be located in a regional supplier warehouse or in a segregated area of a Caterpillar facility. In exchange for providing this service, suppliers typically charge an additional per-unit fee to cover their increased costs.

Caterpillar creates central demand forecasts to ensure that suppliers are aware of how much material is needed and when it is required in the plant. The active sharing of POU consumption information allows suppliers to adjust production and shipments according to actual material usage. The additional communication between the two parties allows for exceptions and shifts in production to be addressed more quickly. This leads to more flexibility in the supply chain and a better working relationship between Caterpillar and its suppliers. The transition from MRP and purchase order-based replenishment, combined with a more complete inventory picture, allows suppliers to reduce production costs through better production planning. Under SMI, central planning and coordination is used to ensure that supply chains operate more efficiently, thereby reducing overall inventory, reducing Caterpillar's working capital, and helping to strengthen relationships with suppliers.[8]

Global Sourcing Decisions

A new line of dual-purpose equipment, the 'exoloader', was designed by Caterpillar in 2012 that functionally combined two existing products: (i) excavators (rapid, medium-volume digging capability); and (ii) loaders (high-mobility, large-volume lifting capability). Company executives believed that the exoloader would prove especially attractive to potential customers in emerging markets with limited resources who needed the functionality provided by Caterpillar's excavator and loader machines within one piece of equipment.

A study was undertaken by West & Waymire (2012) to identify the best global source location for production of the exoloader. The aim of the study was to provide global exoloader production capacity, create a new market niche and improve enterprise profitability. Factors that were considered were the sales opportunities in emerging markets, local labour costs, logistics costs across hemispheres, additional supply chain costs, and investment costs.

At the time, excavator production was centred in two locations: Akashi, Japan and Aurora, USA. The plants produced products for five excavator product lines: mini, small, medium, and large excavators plus an ultra-high demolition (UHD) line. Loader production utilised facilities in Aurora, as well as Belgium, Brazil and China. As part of North American loader production, the Aurora plant also produced components for various loader product lines. There was a fully integrated global sourcing supply chain, with Caterpillar managing relationships with three types of suppliers: (i) raw material suppliers; (ii) external suppliers (external to Caterpillar); and (iii) internal suppliers (Caterpillar divisions that provide key component parts).

[8] Rowan, Brandon, Study of the Role of Strategically Managed Inventory In the Caterpillar Supply Chain, MIT Sloan School of Management, 11 May 2012

Steel plates represent the dominant raw material used in exoloader production. Typical shipments consist of approximately 5 to 20 plates that collectively weigh more than 20 tons (plate weight depends on plate thickness). External suppliers provide highly engineered components, like circuit boards. To maintain the highest levels of quality control, internal suppliers provide machine-critical components such as engines and transmissions.

The planned production process for the exoloader consists of seven general steps from cutting/prepping raw materials for production, to assembly and inspection. A key aspect of the supply chain involves the logistics of bringing the right materials and labour to the right place at the right time to make the right products. Logistics costs associated with the exoloader could make or break product line profitability.

Ultimately, logistics questions within the supply chain centred on which of the following two alternatives would prove to be less costly:

1. North American production: Incur the higher costs associated with shipping finished exoloaders to customers/dealers in the emerging Asian and South American markets and reduce the costs associated with acquiring and coordinating the raw materials and component parts used in production; or

2. Asian production: Incur the higher costs associated with acquiring and coordinating the raw materials and component parts used in production and reduce the costs associated with shipping finished exoloaders.

Moreover, the steps in the production process require a highly trained workforce. The decision to build a new production facility in Asia would pose questions relating to worker training costs and cultural differences.

By introducing the exoloader, Caterpillar was creating a new market niche. There was significant competition, however, from existing makers of excavators and loaders, which placed significant downward pressure on projected operating margins. The study therefore focused on reducing the overall production and delivery costs throughout the supply chain.

A variety of options was considered, but two offered the greatest potential:

The first option involved expanding and refocusing an existing production facility to accommodate the new exoloader production volumes. A facility in Japan was considered, but the location was essentially land-locked and offered little if any potential for expansion. An alternative involved the Aurora production facility. The team believed that the Aurora location could be reconfigured to handle effectively exoloader production. However, questions remained concerning the potentially lengthy delivery times required to meet product demand in Caterpillar's growth markets.

The second option focused on building a new production facility in China. Under this scenario, exoloader delivery times would be reduced in Asian markets, but there were concerns about delivery times to South America. Moreover, questions emerged concerning how to best coordinate the delivery of raw materials and component parts from global suppliers to a Chinese facility.

Ultimately, Caterpillar must stand behind its products regardless of where production occurs. The study team had concerns about overall costs and production quality given the extensive coordination of activities required throughout the supply chain.[9]

[9] West, Timothy; Waymire Tammy, Caterpillar Inc: The Impact of Decision Biases and Risk on Capital Budgeting, www.ssrn.com, 20 August 2012

Supply Chain Logistics

Ed O'Neil is the Head of Logistics at Caterpillar, with responsibilities that include the design, procurement, and overall running and efficiency of the firm's logistics operations and networks worldwide. Inbound, this involves moving material and components around globally within Caterpillar's vast network of suppliers and manufacturing sites. Outbound, Caterpillar's finished products must be delivered safely, cost-effectively, and on time to its dealers around the world.

"*I love the way our products look,"* O'Neil explains in an article posted on the DHL website in 2013. *"But in my world it's about moving a lot of big, ugly iron. Our largest tonnage is on the outbound side with break-bulk and railroad shipments. For example, when we ship our largest mining truck out of the North American facility across the world to places such as Indonesia or Australia, it weighs the equivalent of two fully-fuelled 747 jumbo jets*."

If the sheer bulk and weight of products and components in the engineering and manufacturing sector present enormous logistical challenges, so too does the complexity of the supply chain. "*The main challenge in the industry is how to achieve the right balance in a company's sourcing, manufacturing, and distribution strategy. We're always striving to improve product cost structure through reduced supply chain variability, minimum transit inventories, achieving higher velocity and, above all, by creating a high degree of visibility in our shipments*."

Achieving this visibility, O'Neil says, is crucial. DHL, a global logistics provider, handles over 400 inbound and outbound air shipments every day on behalf of Caterpillar. Then there are land and sea shipments worldwide. "*We employ advanced global materials management software for EDI, which allows us globally to track and book material with high accuracy in our network. Regionally – in the Americas, Asia, and in Europe – we also deploy 'control towers' over the top of the network*."

Typically, a control tower considers the strategic design of a supply chain. It not only tracks costs but also proactively adapts the supply chain in response to anticipated changes in the market to ensure it meets the company's strategy. It also manages all the operational aspects of the supply chain on a day-to-day basis. The control tower offers a highly effective means of bundling technologies, efficient processes, and people together in a single hub to achieve visibility. Two of Caterpillar's control towers, O'Neil explains, are managed solely by DHL.

Caterpillar has certainly positioned itself as a highly product-driven company. This extends from design and the procurement of material and components through to manufacture of a finished product. "*But there must also be the capability to deliver this product cost-effectively to wherever it needs to go. In my world*," O'Neil continues, "*distance is an enemy. I'm moving material all over the globe, so I need to leverage the best possible cost structure and velocity in terms of effectively consolidating and deconsolidating material. The question is: 'How can I create the big pipes that are flowing globally and fill these as effectively as possible?'"*

Caterpillar has a footprint on six continents and is driving significant growth in South-east Asia, China, India, Australia, and Central and South America. With this rapid expansion, the company finds itself facing a challenge that many others would envy: how to evolve and develop a logistics network to meet the necessary increases in capacity and capability stemming from this growth. "*Expansion means bringing new capabilities and processes into a region*," O'Neil explains. "*This can be done either through strategic partners such as DHL, or by performing the strategic functions within Caterpillar*."

Continuing to develop data and analytics will be one part of the solution. Having talented people in place with a deep understanding of logistics and the industry will be another. "*A challenge in the world economy is making sure we have the best people to support where we're going*." While expansion inevitably brings new challenges, Caterpillar sees the journey ahead and understands how critical it is to be well positioned in terms of technologies, partners, processes, and people.[10]

[10] Making Tracks with Caterpillar, www.dhl.com, April 2013

Logistics in the Middle East

In Dubai, Caterpillar Logistics operates a product distribution centre (PDC) for finished products (machines). The PDC concept involves a distribution strategy that has been developed to increase the velocity of product through the supply chain and therefore improve delivery time to the dealers. Essentially, the PDC provides high levels of sustained service and short availability.

Caterpillar machines held at the Dubai PDC are imported from various countries. Machines are then exported from the PDC by road and ocean to Middle East and East Africa destinations. The PDC location in Dubai was chosen due to its strategic hub location as well as its very good port facilities.

In an effort to improve service, capture cost reduction and to develop a long-term, competitive supply base, Caterpillar launched a tendering exercise in 2009 for a service provider to manage its United Arab Emirates (UAE) and Gulf Cooperation Council (GCC) regional clearance, forwarding and distribution activities. The scope included customs brokerage into and out of Dubai, freight forwarding and road transportation.

Al Futtaim Logistics was chosen by Caterpillar after a detailed vetting procedure, which reviewed the following key criteria:

- Demonstrated capabilities
- Business philosophy of continuous improvement
- Well established relevant transport experience, in the UAE and region
- Solid infrastructure base
- Strategic location
- Broad supply chain experience
- Competitive pricing model

"*We are happy to have been chosen by Caterpillar for these services and shall make sure that we provide first quality services*," stated Tom Nauwelaerts, Head of Logistics for Al Futtaim in Dubai. "*We are looking forward to further optimising clearance, forwarding and distribution activities with Al Futtaim in a mutually beneficial business partnership*," said Michelle Wahrenburg, Caterpillar's General Manager for Transportation in Europe, Africa, Middle East, and CIS.[11]

Logistics in the UK and Ireland

Finning UK & Ireland (part of Finning International Inc.) is a Caterpillar dealer with 28 branches and 800 field engineers throughout the UK and Ireland. In 2014 a brand new national distribution centre (NDC) was set up to replace an earlier in-house operation based at five separate locations. The new centre, which is run by CEVA Logistics (part of CEVA Holdings LLC), houses all of Finning's engines stock, plus 60,000 separate product lines, all of which are required for next day delivery.

CEVA designed the purpose-built £8m facility, and is providing 33 staff to operate it over extended business hours six days per week. Under the contract, CEVA has committed to next-day delivery of all orders, for an expected overall traffic of some 10,000 items per week. The building itself, situated on the Lakeside Estate at Cannock, UK, covers 120,000 sq ft and incorporates wide-aisle and cantilever racking, floor-level storage and a two-tier mezzanine floor accommodating 90% of stock keeping units (SKUs). On the environmental front, it features energy-saving lighting, a biodiversity area and the first electric car charging points in the company. To facilitate business continuity, the NDC boasts a fire protection system incorporating 9.5km of pipe work and over 3,000 sprinkler heads covering each level of racking.

[11] Logistics Case Study: Caterpillar Middle East, www.arabiansupplychain.com, 19 April 2010

In preparation for the opening of the new distribution centre, CEVA successfully consolidated the stock from the five existing Finning parts operations into the new facility within five weeks, while maintaining full operational capability; the new centre was fully functional on time and on budget. Parts Operations Manager for Finning UK and Ireland, Steve Smith, said: "T*he opening of this new distribution centre follows five months of hard work by my team and CEVA. The transfer of approximately two millions parts items from numerous storage locations, into one central facility was achieved, whilst of course retaining the level of service that our customers expect during the transition. This significant investment not only meets the needs of today, but also factors in plenty of capacity for our future growth plans*."

CEVA's Industrial Components Accounts Director, Kevin Leigh, added: "*We are delighted to have been chosen as Finning's partner in this venture. The new operation managed by CEVA will enable Finning to provide its customers with operational excellence and class-leading service, while it will enjoy improved inventory management and efficiency. Service levels and KPIs are already showing an improving trend*."[12]

Logistics in the USA

In 2014 Neovia Logistics (an independent company that was formerly Caterpillar's logistics division) implemented a container cross-docking (CCD) operation as part of Caterpillar's global hub and spoke network. The 170,000 square-foot operation in Savannah, Georgia is located less than two miles from the Port of Savannah. "*Savannah is known worldwide as a premier logistics and distribution hub*," said Trip Tollison, President of the Savannah Economic Development Authority. "*Companies like Neovia Logistics further add to the reputation that the Port of Savannah is a leading port to import and export goods*."

For the new Savannah operation, Neovia partnered with Coastal Logistics Group, a local logistics provider specialising in manufacturing support services. "*Shipping to more than 190 countries, Neovia Logistics delivers a nimble, cutting-edge approach to supply chain management*," said Curtis Foltz, Executive Director of the Georgia Port Authority. "*Their state-of-the-art solutions mesh perfectly with the Port of Savannah's speed, efficiency and its global reach delivered through 38 weekly container ship services*."[13]

Transportation

At Caterpillar the question of what customers want and what they will pay influences the transportation mode choices it makes on a product by product basis. Tom France, Caterpillar's Director of Global Transportation, makes the point that engineering $400-500 out of a product is almost impossible but, in a global supply chain with heavy equipment products, achieving this with a lower-cost transportation mode is quite possible. "*Transportation can be a huge lever in lowering product costs. It is just a matter of working with customers on the price/delivery trade-offs*."

At Caterpillar the ability to utilise lower cost transportation modes has been facilitated by technology. The company built a control tower, using a visibility solution from GT Nexus, to achieve end-to-end visibility. This tool allows it to measure not just one carrier's performance, but also the variability associated with different carriers' performance. What this means is that a carrier that delivers a number of shipments five days early or late has higher variability than a carrier that consistently delivers within a day or two of the scheduled arrival time, even if on average its on-time performance is the same. Lower variability translates into a lower need to carry inventory.

Caterpillar also uses a number of air and ocean trans-shipment hubs. These hubs give it better scale on a lane. With scale, Caterpillar becomes a more important customer that can pre-book ocean capacity with no dwell times. In the air mode, it ships hub-to-hub to maximise cube. Caterpillar worked on the visibility solution first, then put the hubs in place.

[12] CEVA Manages New Finning Parts Distribution Centre, www.cevalogistics.com, 17 November 2014
[13] Neovia Logistics Opens International Cross Dock for Caterpillar Inc. in Savannah, Georgia, www.neovialogistics.com, 17 September 2014

When supply chain professionals think of mode shift they usually think of moving from faster and higher cost modes, like truckload, to a totally different mode such as rail. However, France points out that one can also stay in a mode and achieve the same thing. In Caterpillar's case that meant moving from flying spare parts overnight to using many more three to five day flights where customer expectations were aligned on a lower cost, but slower, delivery.[14]

Supply Chain Technology

Randy Krotowski, Caterpillar's Vice President and Chief Information Officer, joined the company in 2012 after spending nearly 30 years with Chevron. In addition to meeting with people in various positions throughout the company to become familiar with their goals, Krotowski said he also began building relationships with Caterpillar's dealers and customers. With that information, Krotowski put together an IT strategy he says received the "wholehearted" support of Caterpillar's board. He says the strategy has a completion date goal of 2018. In the time between now and then, he says that the company hopes to provide customers with more IT solutions that help them use Caterpillar equipment more productively, while putting more technical information in the hands of dealer technicians while they are in the field.

"*My number one priority is an internal project focusing on the manufacturing supply chain. It is enormous and having a huge effect on Caterpillar. It has to be successful. It will give us a competitive edge, but if it is not successful, it will break the company," says Krotowski. "My second priority is customer-facing technologies. We have to shift our focus; we have to be aware of changes that technology companies are making. Things like cloud development, service-oriented architecture, agile development. We want to be providing our customers with commercial software solutions*." Krotowski also said he wants to see what he can learn from peers and competitors in terms of more seamlessly integrating data sharing.[15]

One example of Caterpillar's utilisation of supply chain technology is the development of a fully integrated EDI solution to manage targeted suppliers, products and parts. Drop-ship and inventory processes were established to optimise product flow and freight logistics to Caterpillar facilities worldwide.

To ensure highly efficient delivery, Group O, a business process outsourcing provider, designed and hosted a web portal that serves to integrate more than 600 global suppliers and manage 3,500 products and parts. The portal provides custom features such as controlled order acknowledgments, compliant electronic advanced shipping notices, pack lists and shipping labels, integrated invoice processing and workflow alerts. Multi-level security and role-based administration is also built into the platform, and Caterpillar leaders receive real-time reports and operational metrics in an easy-to-read dashboard.

By working closely with Caterpillar suppliers, Group O was able to improve on-time delivery in the non-core supplier base from less than 30% to more than 90%. Group O also eliminated shipping compliance issues between suppliers and 32 Caterpillar facilities worldwide. The new solution provides greater visibility, transparency, simplification and standardisation across the supplier network, while at the same time reducing supply chain interruptions through improved documentation and execution.[16]

Another example of supply chain technology application is related to the Caterpillar Ground Transportation Operations Centre-Americas (GTOC-A) in Morton, USA. New freight optimisation software allows the GTOC-A to optimise ground shipping through dynamic load planning that determines optimal transportation modes and consolidates existing transportation movements. Through these simple methods, facilities currently managed by the GTOC-A have seen a 6% to 10% monthly reduction in transportation spend, fewer travel miles through load consolidation, plus improved trailer utilisation costs. These improvements result in fewer trips, lower fuel consumption and fewer CO_2 emissions.[17]

[14] Dell and Caterpillar Reduce Freight Costs with Mode Shift, www.logisticsviewpoints.com, 28 October 2013
[15] Caterpillar CIO Says Priorities Include Improving Supply Chain, Providing Customers with Productivity Boosting IT Solutions, www.equipmentworld.com, 03 Sep 2013
[16] Case Study: Caterpillar Web Based O-Sourcing Solution Challenge, www.groupo.com, April 2015
[17] Caterpillar Cuts CO_2 Emissions in Supply Chain through Sustainable Progress, www, 3blmedia.com, 8 July 2014

Supply Chain Sustainability

Caterpillar has been producing a sustainability report since 2005 and has been named on the Dow Jones Sustainability Index for 12 years running. However, Tim Lindsey, Global Director of Sustainable Development, sees the company's strong sustainability culture as its key strength.

Lindsey's team is small. Currently, they are three people responsible for supply chain issues, some manufacturing, and Caterpillar's dealership network, as well as helping customers (the source of the company's biggest environmental footprint) with sustainability issues. It is a lot of responsibility for a small team, but Lindsey thinks that's how it should be. *"It is not appropriate to have a huge sustainability department," he says. "More can be accomplished having a culture of sustainability. It's a lot like quality and safety too. Everyone is responsible. I want to move sustainability forward to that point. We are not there yet but a couple of years down the road we will be*."

Where the company is ahead of the pack is in its mentoring relationship with customers. As Lindsey points out, Caterpillar has had some strong technology breakthroughs in the last few years that have helped customers. In addition, Caterpillar has a 'job sites solution program' which is popular at quarries and mining operations. Lindsey and his colleagues assist, for example, in training operators and rebuilding engines and, in doing so, help improve fuel efficiency of operations by 30%. Lindsey feels this type of value-added customer relationship is the future.

Remanufacturing is also a big part of Caterpillar's business, something it has been doing for 40 years. By remanufacturing products, the company is able to preserve 85% of the embedded energy that goes into making products and extend their lives. In 2011 remanufacturing allowed Caterpillar to save 170 million pounds of materials and 400 million kilowatt-hours of electricity while avoiding 180 million pounds of greenhouse gases.

Caterpillar is not going it alone in the sustainability world. The company has a solid partnership with Waste Management, where 73 power plants across the country are powered by Caterpillar equipment, primarily using biofuels. Furthermore, Caterpillar recently teamed up with the World Resources Institute on a four-year plan to create global sustainable cities.[18]

One example of sustainability in action is the achievement of a zero-waste goal in two of Caterpillar's UK facilities. The Remanufacturing & Components Division for the United Kingdom in Leicester hit the waste management target in 2010 and Cat Logistics in Desford had maintained a 100% recycling rate for a year as of October 2010.

The Desford site, which provides logistics services to a range of clients and distributes material around the world, had a long-standing recycling programme in place, but expanded it in 2008 in order to achieve the waste management goal. "*We're extremely proud of the results of this project*," said Cat Logistics' Site Services Manager Paul Morris in a statement released just before the new year. "*It's a great thing for the environment but it's also great for our business. We've taken what used to be a cost and turned it into an asset*."

The facility saved $183,984 in a year as a result of its efforts, according to the company. Measures included:

- Adding six waste streams to the 30 that already existed.
- Bundling or baling waste from those streams, which increases weight per volume. The baling has reduced transportation used to move waste off site by 50% overall. The process resulted in an 11-fold improvement in transportation of cardboard. Previously vehicles held two-ton loads when hauling away the material for recycling, but now the vehicles can cart away 22 tons of baled cardboard per load.
- Providing workers with small desktop containers for office rubbish and setting up segregated collection points for various materials to encourage recycling and motivate employees to generate less waste. Before the changes, office garbage went in one large bin that was sent to landfill.

[18] Moving Mountains for Earth's Sake at Caterpillar, www.greenbiz.com, 31 March 2013

The facility in Leicester reached the waste management goal by increasing its recycling rate by as much as 30%. Steps taken include the development of a total waste management system that enabled the facility to maximise revenues from the process, and a programme to recycle rubber hydraulic hoses. The site has saved $15,562 in a year.[19]

Another sustainability example is related to the inbound shipping operations of Caterpillar's North American large mining truck facility. To construct the very large vehicles used in the mining industry, parts are shipped from all over the globe for assembly at Caterpillar's manufacturing facility in Decatur, USA. Historical shipment data was analysed in order to identify areas where shipments could be consolidated. Furthermore, Caterpillar uses steel containers to transport parts, and the company has been working for the past four years to phase out these steel containers and replace them with plastic ones which weigh considerably less. The overall project looks to reduce weight and packaging, improve routeing and scheduling, and create opportunities for streamlining shipping protocols. When combined, the streamlined shipping and packaging efforts could reduce Caterpillar's overall carbon emissions by 340-730 tonnes of CO_2 per year.[20]

Supply Management

Throughout much of the 2000s, Caterpillar enjoyed substantial sales growth, both in the USA and overseas, as the globe saw a rapid construction boom. However, profits did not move upward at anywhere near the pace of Caterpillar's revenue growth. A key part of the problem was seen to be mediocre supply management.

As sales soared, the supply base for parts and other components could not keep up. As a result, Caterpillar had to pay premiums to get suppliers to produce additional volumes, and often resorted to expensive air freight or other forms of expedited logistics services. In an interview with the Wall Street Journal in 2010, Caterpillar CEO, Doug Oberhelman, said that the soaring procurement and logistics costs served as a "lightning bolt" that soon spurred a wide spread revamp in its approach to supply management.

One issue was that the company usually promoted from within. That often left it without an outside perspective and not enough fresh ideas. A talent gap was especially problematic in Caterpillar's busy international operations, where it lacked the time to train new managers. The move to bring in outside supply management talent had started two years before but, in August 2010, Caterpillar hired Frank Crespo as its new chief procurement officer, a title he held previously at Honeywell.[21]

In his new position, Crespo reports to Group President, Steve Wunning, who has responsibility for Resource Industries. Commenting on the appointment, Wunning said: "*We are fortunate to bring Frank on board with Caterpillar, and I know he will build on his proven track record of leadership, supply chain management and low cost country sourcing that will bring Caterpillar's supply chain performance to the next level. He brings an extensive record of driving successful supplier collaboration, which is one of the nine key operating principles embedded in Caterpillar's enterprise strategy*," he added.[22]

Crespo led the charge to bring more 'flexible manufacturing' capabilities to Caterpillar's supply base, so they can ramp up parts production more quickly based on Caterpillar's demand. As the automotive companies have done for years, Caterpillar started working with suppliers so they can become more efficient, sometimes investing in a supplier if it needs financial help.

[19] Caterpillar Achieves 'Zero Waste' Goal at 2 UK Facilities, www.greenbiz.com, 5 January 2011
[20] Caterpillar: Light Weighting and Inbound Consolidation, www.supplychainmit.com, 29 April 2013
[21] Supply Management Effectiveness can Make or Break Bottom Line Results, www.scdigest.com, 15 December 2010
[22] Caterpillar Names Chief Procurement Officer, www.supplychaindigital.com, 01 August 2010

Caterpillar also brought in Heather Robinson, who had spent 16 years at Ford, to help improve supply management at Caterpillar's transmission unit. Robinson brought some new ideas to bear at Caterpillar, including how to manage inventories, where a focusing on being 'lean' sometimes created operating problems and higher costs. "*Inventory is not a bad word*," Robinson told the Journal. "*It has to be purposeful. We have to know why we have it*." Robinson also helped bring the automotive industry concept of 'parts supermarkets' inside some Caterpillar plants, with greater use of bar-coding and new software to automatically trigger the replenishment of parts and supplies to production lines.

Other new hires are also trying to expand the supply chain awareness within Caterpillar. David Bozeman joined Caterpillar at the same time, after a long career at Harley-Davidson, and is now managing a group of factories in the USA and abroad. Bozeman has tried to instil a greater sense of urgency and to get disagreements out in the open so they can be resolved quickly. He wants his factory managers to worry about cash flow, he said, not just manufacturing, so they better support the company's total financial performance.[23]

To improve skills within the purchasing and sourcing team, Crespo has created a specialist training group to help staff understand new processes and more effectively measure their success. Around 70 employees at the company are currently focused on changing the way the procurement division operates.

While the procurement division, which employs around 1,300 staff worldwide and spends $25 billion (£15.4 billion), is working from a "solid foundation" Crespo says he wants to help them become more business focused. "*We're really engaged on the objectives and the key challenges that the business may be facing, that they want us to be a part of. We've created this excellence organisation with a mindset of serving the leadership and teams within the division to empower the procurement professional at the desktop*."[24]

Supplier Relationships

In 2011 Caterpillar reached out to approximately 500 key suppliers globally with face-to-face meetings to discuss ways in which they could improve their relationships. As basic as it seems, Caterpillar's communications with key suppliers was sporadic until then, with contact only triggered when major issues arose. Now there are scheduled conference calls or personal meetings each month. The companies pore over forecasts and discuss any potential issues, such as capacity constraints or the need for additional capital investments.

"*Although that process may sound fundamental, a lot of times companies, I found, have been* [communicating] *at too high a level or there's too much assumption in communications, as opposed to digging deeper, going more granular and getting a synchronisation part by part, build-material by build-material, to make sure there's not going to be a disruption or challenge down the road*," Crespo says.[25]

Collaboration is a cultural shift for Caterpillar, whose suppliers in the past have complained about a lack of dialogue, says Stephen Volkmann, an analyst at Jefferies & Co. "*It was, 'Give me what I want when I want it, and the rest is your issue to manage*,'" he said. "*The big change in attitude is from the servant-master relationship to more of a team-type relationship*."

One example of supply chain collaboration is related to Caterpillar's catalytic-converter manufacturer, Tenneco. Rather than simply dictate specifications and choose the cheapest vendor, Caterpillar worked closely with the supplier to design a component that cuts emissions. The Caterpillar team worked with 12 engineers and managers from Tenneco. A mock production line was set up to work out kinks in the manufacturing process. Using the joint design, assembling the component at a Tenneco plant in Nebraska cut Caterpillar's costs on the part by 20%.

[23] Supply Management Effectiveness can Make or Break Bottom Line Results, www.scdigest.com, 15 December 2010
[24] Caterpillar Targets Purchasing Metamorphosis, www.supplymanagement.com, 03 October 2011
[25] Caterpillar and Syngenta Take Supply Chain Leadership to a New Level with a Focus on Collaboration, www.industryweek.com, 14 February 2011

Tenneco's experience building parts that reduce emissions for the automotive industry has benefited Caterpillar, said Mike Render, a Caterpillar product manager. The partners reduced the complexity of the device they worked on. They made two versions of a part used to burn soot in the emission-reduction device for Caterpillar's various machines, compared with the 43 versions made by Caterpillar in 2007 just for truck engines, which it also makes. "*It's a bit like playing a Rubik's cube*," said Render. "*If we do this, what will happen? If we do that, what will happen? They helped with the innovation. Tenneco has given us a model of how collaboration should occur*."

The device that Caterpillar and Tenneco worked on to reduce diesel emissions, as required under federal law, will be used in about 100 Caterpillar models, including various types of excavators, backhoes, wheel loaders, and bulldozers. "*When we come up with what we think is a pretty great technical innovation, the first guys we talk to are the guys at Caterpillar*," says Brent Bauer, a senior vice-president who oversees the project for Tenneco. "*When you have everybody in the same room, there are some magical things that happen. We get great products. We optimise costs and we add speed*."[26]

Another example of collaboration is the case of Tata Steel Europe, the leading supplier of track shoe sections for Caterpillar's off-road construction equipment products. The two companies worked together to improve on existing local supply chains for greater global business efficiency. In the past, longer lead times for replacement track shoes led to greater stock and inventory levels. Tata Steel began looking at ways to reduce lead times and excess stock levels to ensure Caterpillar received replacement parts as and when it needed them. Through a number of key changes to the supply chain, Tata Steel, with the help of Caterpillar, managed to cut lead times to just five weeks.

Peter Gate, Global Account Manager for Caterpillar at Tata Steel, said: "*We are delighted to have been working with Caterpillar on this project and are equally excited about having been able to add value to one of the world's most recognised brands. The track shoe longbar supply chain project shows our commitment to continuously improving not only our product offering, but our service offering to customers too, and we are extremely proud of our association with the project. We are more than just a commodity supplier and we look forward to working on future projects with Caterpillar*."[27]

Many suppliers say that Caterpillar is a tough but fair business partner. However, after riding a global boom in mining, Caterpillar hit a rough patch in 2013 as metals prices sank, and with them orders for mining equipment. According to an article posted on www.chicagobusiness.com in 2013, this led to Caterpillar pressuring its supply chain to cut prices on already thin margins.

At least one suburban Chicago supplier has been put out of business. North Aurora-based Daco told the state that it was permanently shedding 90 employees, thought to be its entire workforce, citing a "lost contract." Daco executives did not respond to requests for comment, but local manufacturers say that Caterpillar dropped the company as an engine parts supplier during 2013. "*Bottom line: If you want to continue to do business with Caterpillar, you'd better run fast*," says Warren Young, CEO of Acme Industries, a machine shop in Elk Grove Village that supplies Caterpillar with components for mining and construction trucks.

Mark Lindemulder, president of Tibor Machine Products in Bridgeview, received a letter from Caterpillar asking him to reduce the price for its hydraulic parts by 8%. He refused. Though Caterpillar accounts for only 11% of Tibor's total sales, cutting the price "*would have significantly hurt our business*," he says. Mr. Lindemulder also notes that his margins average in the single digits. He has yet to receive any kickback from his response, but he admits a small part of him worries that Caterpillar could be looking for alternative suppliers. "*Some requests you just can't meet*," he says.

"*Cat is a challenging and demanding customer*," says Young. "Y*ou'd better be as competitive on pricing as you can be, and you'd better continue to try and figure out a way to take costs out*."[28]

[26] Caterpillar Looks for a Few Close Friends, www.bloomberg.com, 21 October 2010
[27] Tata Steel and Caterpillar Collaboration Brings Supply Chain Gains, www.tatasteeleurope.com, 12 Sep 2011
[28] Is Caterpillar Bullying its Suppliers?, chicagobusiness.com, 07 September 2013

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