TAUBER INSTITUTE
FOR GLOBAL OPERATIONS
UNIVERSITY OF MICHIGAN

WDI PUBLISHING

case W90C84
December 8, 2010

Grainger: Re-Engineering an International Supply Chain

Historically, Grainger had been a US-centric business. However, between 2000 and 2010, its focus expanded significantly and Grainger was in the process of establishing a world-class global supply chain. In 2009, a strategic initiative was created to re-engineer the Grainger global supply chain. The initiative paired a team of three graduate students from the University of Michigan with an internal team of supply chain leaders and subject-matter experts focused on taking both time and cost out of the global supply chain and creating a more robust global infrastructure. The student team proposed two primary supply chain re-engineering options, and the company had to make a decision about which, if either, of those options to pursue.

Company Background

Grainger, with 2008 sales of $6.9 billion, was a leading broad-line supplier of facilities maintenance products serving businesses and institutions in the United States, Canada, Mexico, China, Panama, and other countries. Through a highly integrated network including more than 600 branches, 18 distribution centers and multiple Web sites, Grainger's employees helped their nearly 2 million customers, as the company's motto touted, to "get it done." Details of Grainger's business profile are provided in **Exhibit 1**.

When a customer needed one of the products that Grainger sold, the customer often needed it right away. A Grainger box carried more than just the products that came inside it, since Grainger differentiated itself from its competition in many ways. The company prided itself on outstanding customer service, easy ways for customers to do business, and high levels of inventory availability. Grainger offered almost 900,000 products, from safety supplies to pumps and motors to electrical supplies and fasteners—products that helped keep customers' businesses running. Whether a valve broke on a water pipe, an electrical fuse blew, causing lights to go out in a hospital, or a drill bit broke off during a job, these issues had to be resolved quickly. Customers also depended on Grainger for everyday supplies such as air filters and cleaning supplies. Just offering customers a wide range of products, however, was not enough. Grainger provided 24/7 customer service, a network of local branches, a team of dedicated sellers who understood their customers' businesses, easy online ordering, and same- and next-day delivery.

Published by WDI Publishing, a division of the William Davidson Institute (WDI) at the University of Michigan.

 Gary Scalzitti from Grainger and Amitabh Sinha, Assistant Professor at the University of Michigan's Ross School of Business, developed this case. Acknowledgements go to Sung Hwan Cho, Lisa VanLanduyt and Aditya Vedantam, whose internal report from a Tauber Institute for Global Operations project contributed to the case.

Customers relied on Grainger to help them save time and money by consolidating their purchases of maintenance, repair, and operating supplies.

In the late 2000s, Grainger was growing in terms of revenue, product offerings, and geographical reach. (**Exhibit 2** provides financial details for the years 2006 through 2008.) At the corporate level, Grainger's strategic growth objectives were as follows:

1. Grow market share by being the indispensable partner to those who keep workplaces safe, efficient, and functioning. Operationally, this placed the focus on:
   - Product breadth and high availability
   - Being easy to do business with
   - Leveraging regional and global scale for cost and service advantage
2. Enhance gross profit through expansion of private label products which are sourced globally.
   - Grainger sourced products from manufacturers around the globe under various private labels. Grainger sourced products from 21 countries in 2008, and those products carried gross margins that were about 60 percent higher than the company average. As of the end of 2008, the company globally sourced 22,000 stock keeping units (SKUs), which represented about 8 percent of company sales. In 2008, the company continued to expand and grow all of its private label products to 24 percent of overall sales. Brands such as Dayton® motors met customers' needs while improving Grainger's margins.
3. Grow international share through expansion across Latin America and Asia.

Grainger US and Grainger Global Sourcing Supply

Grainger United States (GUS) operated through a highly integrated network of over 400 branches, 14 distribution centers, and multiple Web sites in order to serve customers in the United States. In 2008, Grainger's US business served some 1.7 million customers, who primarily represented industrial, commercial, and government maintenance departments. The MRO (maintenance, repair, and operations) market size in the US was estimated to be $125 billion, of which Grainger's market share in 2008 was approximately 5 percent. (For the purpose of this case, only nine of the GUS distribution centers are to be considered.)

Additionally, Grainger operated internationally. In North America, Acklands-Grainger (AGI) was Canada's largest broad-line supplier of industrial, safety, and fastener products. The company served approximately 43,000 customers across Canada through 154 branches and five distribution centers. The MRO market size in Canada was estimated to be $13 billion, of which Grainger's market share in 2008 was approximately 6 percent. Grainger also operated in Mexico, as Grainger, S.A. de C.V. In 2008, the company served approximately 35,000 customers through 22 branches, a distribution center, a Spanish-language catalog, and grainger.com.mx. The MRO market size in Mexico was estimated to be $12 billion, of which Grainger's market share in 2008 was approximately 1 percent. International expansion in other parts of the world was of sustained interest at Grainger, with much of the revenue growth over the next decade expected to come from outside North America.

Many products sold by Grainger were nationally branded products (e.g. General Electric, 3M, Bosch), which were purchased from the respective vendors and made available to end customers via Grainger's distribution network. Increasingly, Grainger had also been selling its private label products, because these offered an opportunity for increased profit margins and they met customers' growing needs for low cost, high quality products.

Until 1997, both nationally branded and private label products in the GUS catalog were sourced exclusively domestically. In 1997, the Grainger Global Sourcing (GGS) business unit was formed to develop an international, lower-cost supplier base for private-label items offered through the GUS catalog. Although GGS was a division of Grainger, its sole purpose was to act as a supplier to GUS. GGS was the largest supplier to GUS, and GGS-sourced private label products made up approximately half of GUS's total private label sales. GGS offered 22,000 private label SKUs (products) in 10 of the 17 GUS catalog categories.

GGS sourced products from over 300 suppliers in 21 countries including China, Taiwan, Mexico, Indonesia, India, and South Korea. Seventy-one percent of these suppliers were in China. All products sourced by GGS were shipped to and processed in a single distribution center (DC) in Kansas City, Missouri. GUS placed orders with GGS for its products. GGS shipped products to the nine GUS DCs daily based on these orders. Thus, the GGS network in the US consisted of a single distribution center in Kansas City supplying the nine GUS distribution centers as its customers.

Although Grainger sourced from manufacturers around the world, China and Taiwan comprised approximately 80% of all globally sourced products.

Current State of the Grainger Global Sourcing Supply Chain

This section describes the status of GGS and identifies the key levers with respect to this product flow.

GGS China/Taiwan to US Supply Chain

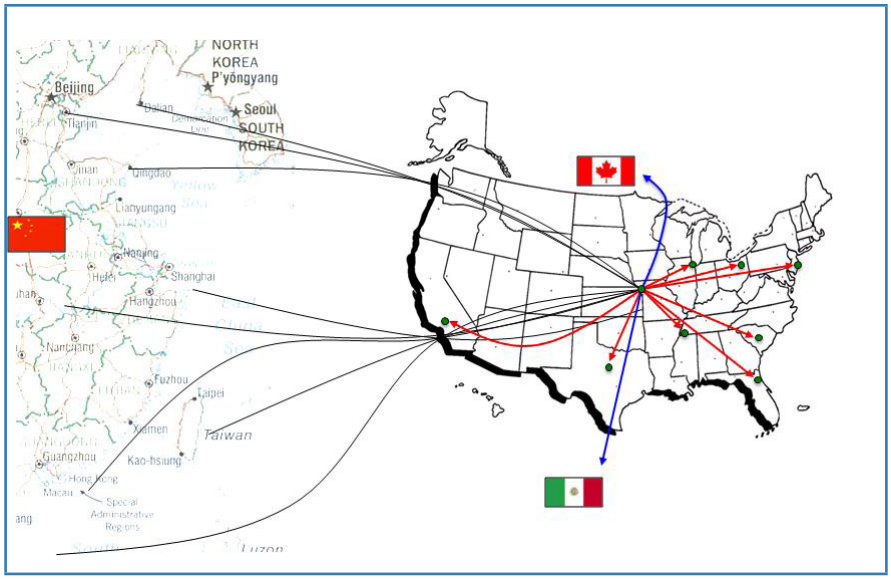
Product Flow

Figure 1 outlines the flow of products from China and Taiwan to the GGS DC and out to the nine domestic customers and some international customers.

GGS had over 300 suppliers in China and Taiwan (71% of its entire supplier base and 80% of the volume). Because Grainger's specifications for its products were unique, there was, in many cases, only one supplier for a product line, and GGS had to work with that supplier to develop new manufacturing programs specifically for GGS. For example, GGS could have found a supplier that produced a limited line of quality work gloves but did not produce the breadth or variety that Grainger required. GGS would work with the supplier to create specifications and manufacturing recommendations for the complete line. The unique specifications and variety in the product line often resulted in high minimum order quantities (MOQs) because the supplier incurred setup costs to switch the manufacturing lines to GGS products. High MOQs, in turn, sometimes led to excess GGS inventory of slow-moving items, which were stocked for completeness rather than for true demand.

Figure 1

Product Flow: China/Taiwan to US



All contracts with GGS suppliers were Free on Board (FOB) port. The supplier owned the products until they were placed on an ocean vessel and was responsible for all costs incurred to transport finished products to the port. International logistics were coordinated for GGS by a third-party freight forwarder, which managed container transport and ship bookings for all suppliers' cargo. Suppliers whose cargo filled an ocean freight container received a container from the freight forwarder, filled it, and sealed it at the factory (these were factory-direct containers). All cargo was floor-loaded (packed directly on the floor without the use of pallets). The freight forwarder transported the sealed containers to the proper shipping vessel, and they were not opened again until they reached Kansas City. Factory-direct containers represented 89% of all containers shipped to GGS from China and Taiwan. Suppliers whose cargo did not fill an ocean freight container delivered their cargo to one of the freight forwarder's five consolidation centers. The freight forwarder built containers by combining one supplier's products with products from other small GGS suppliers. GGS products were never combined with non-GGS cargo. These consolidated containers represented 11% of all containers that were shipped to GGS from China and Taiwan.

GGS cargo was transported in four container sizes, measured by their length in feet: 20′, 40′, 40′ high cube, and 45′. The relative proportion of each container size used by GGS in 2008 is listed in **Table 1** below. It should be noted that all numbers in the case and in the exhibits are artificial and illustrative, and should not be considered primary data.

Table 1
GGS Container Mix in 2008

Container Size	Proportion of Factory-Direct Containers	Proportion of Consolidated Containers
20′	21%	27%
40′	50%	60%
40′ High Cube	28%	11%
45′	3%	3%

It was most cost-effective to use 40′ or 40′ high cube containers rather than 20′ containers because they had a significantly lower cost per cubic meter (cbm) of cargo. The cost of a 20′ container was 80% of the cost of a 40′ container, resulting in a 165% cost per cubic meter premium for a 20′ container over a 40′ container. GGS's consolidated containers skewed toward the smaller sizes, primarily due to the limited volume of cargo that was consolidated (only 11%) and the dispersion of consolidation centers. The freight forwarder operated five consolidation centers in China, and cargo was sent to the nearest one. GGS placed a minimum container utilization requirement and a dwell time limit on all containers. Containers had to be at least 83% full by either weight or volume, and cargo could not wait more than seven days in the consolidation center for additional cargo to arrive. As a result, on average, all containers were utilized to 85%, and consolidated cargo was shipped in smaller containers than was factory-direct cargo.

Both factory-direct and consolidated containers from China and Taiwan flowed primarily through five major ports (Shanghai, Ningbo, Yantian, Qingdao, and Kaohsiung). This flow represented approximately 80% of all GGS purchases in 2008. The distribution of this volume is shown in **Table 2**.

Table 2

Proportion of GGS Shipments Passing Through Ports in China and Taiwan in 2008

Port Center	Volume Percentage
Shanghai/Ningbo (China)	36%
Yantian/Hong Kong (China)	33%
Kaohsiung (Taiwan)	9%
Qingdao (China)	5%

All containers entered the US at either the Seattle, Washington, port (40% of containers) or the Los Angeles, California, port (60% of containers). For the future, it was proposed that all containers would enter exclusively through ports in California. From there, the containers were transported to Kansas City by rail, and then transferred to the Kansas City DC by truck. In Kansas City, GGS utilized an offsite storage facility because it had reached capacity in the DC building itself. At the DC, the containers were unloaded. Representative items from every SKU in the container were processed through a quality assurance check before the products were stocked in the storage racks. Any SKU whose items did not pass the quality check were quarantined. These products were reworked (corrected) by the GGS warehouse staff when possible or sent back to the supplier for correction. In 2008, 3% of all SKU's inspected required rework.

When GUS placed an order with GGS, the order was processed and picking/packing instructions were generated. Some products required additional assembly. To improve the efficiency of ocean transport, products that would be too bulky if shipped fully assembled (such as hand carts with wheels) were shipped in a partially assembled state. When these products were ordered by GUS, GGS performed final assembly before shipping the products to GUS. All items in the order were then packed on pallets and loaded onto 53′ trucks. In 2008, 73% of shipments were to GUS DCs that were either south or east of Kansas City. Nineteen percent went to the GUS Kansas City DC, where products were simply shifted from the GGS side to the GUS side of the warehouse. The remaining eight percent was sent to the west coast. By 2012, the west coast volume was expected to be 18%. That meant that fully 18% of GGS outbound shipments would be transported into Kansas City and back to the west coast.

A very small percentage of GGS products was purchased by the Canada, Mexico, and China Grainger divisions. The quantities were often limited due to the relative sizes of the MOQs compared to the existing demand for these products within these other business units. However, when there was need for these GGS

products in the other business units, the products first came to Kansas City, as described above, and were re-exported to the Canada, Mexico, and China divisions from there. Further, Grainger also had newer divisions and joint ventures in India, South Korea, and Japan, which had no access to the GGS products at all.

Lead Time

In aggregate, the GGS products flowed from the time the order was placed with the GGS supplier to the time the product was stocked in the Kansas City DC. GGS order-to-stock lead time was approximately three months. **Exhibit 3** and **Figures 2 and 3** are schematic drawings of this aggregate lead time broken down by phase. (Note that there is a difference in lead time between products that are consolidated and products that are shipped factory-direct. This difference is due to the potential for additional dwell time at the consolidation center.)

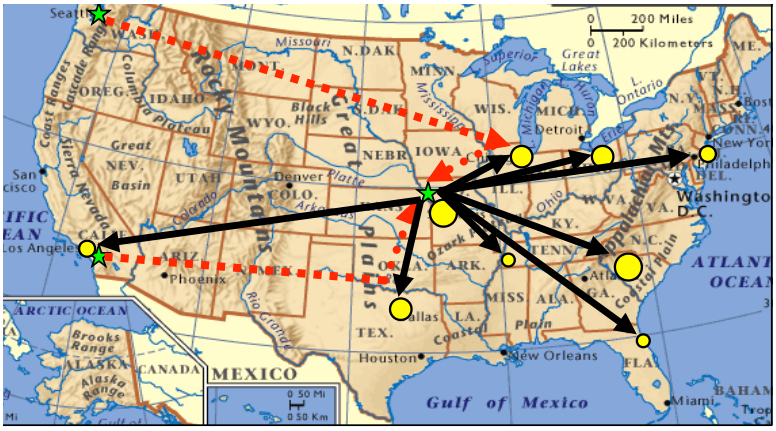
Figure 2

Lead Time Breakdown in China and Taiwan

	Order	Manufacture	Consol	Ocean
LT (consol)	4 d	57 d	7 d	14 d
LT (direct)	4 d	57 d	0 d	14 d

Figure 3

GGS Operating Expense and Lead Time Breakdown in the US



	Rail	Transfer	Stock	PO to Ship	Ship to GUS
Lead Time	7 d	2 d	2 d	3 d	**3 d**

Operating Expense and Overall Metrics

For this discussion, the supply chain operating expense is made up of all expenses to transport products from China and Taiwan to the GGS DC, process them, and transport them to the nine GUS DCs. GGS measured the efficiency of its supply chain by viewing the operating expense as a percent of the cost of goods sold (COGS), as well as by overall inventory position and service level. These metrics for the GGS supply chain in 2008 are listed in **Table 3**.

Table 3
GGS Supply Chain Overall Metrics in 2008

Category	Current State
Operating Expense	
Expense	$28.3 M
Operating Expense as % of COGS	14.3%
Lead Time	
GGS Order to Stock	90 days
GUS In-Transit	1-6 days
GUS In-Transit Distance (avg.)	776 miles
Service Level	
Mature Items	96%
New Items	84%
Other	
Container Utilization	85%
Average Inventory Position	$85 M

Summary

With respect to Grainger's global distribution and operational efficiency goals, the company experienced the following issues:

- Most suppliers were following their own procedures, or "doing their own thing." They were loading containers with only their products and sending them directly to Kansas City. GGS did not have control of the products until they reached its DC in the US.
- All GUS DCs were served from a single GGS DC in Kansas City. The distance traveled to many of these DCs was long, and products going to the west coast actually traveled over the same route twice (on the inbound trip to Kansas City and again on the outbound trip to the west coast GUS DC).
- GGS's ability to sell its products to Grainger's international divisions in a cost-effective or lead-time-efficient manner was limited due to transfer pricing, incremental processing costs, and time associated with bringing the products all the way into the US, then exporting them back out to those divisions.

Network Optimization

As Grainger looked toward its future and considered the company's strategic growth objectives, it became clear that a major redesign of the GGS supply chain was needed. Furthermore, this redesign would create a rare opportunity to fix some of the inefficiencies that existed in the supply chain's current state.

When the team of students arrived at Grainger in May 2009, they quickly realized that a project of this scope and magnitude offered many levers that could be worked to meet Grainger's strategic growth objectives as well as eliminate inefficiencies. After significant brainstorming with the executive team and domain specialists within Grainger, the team converged on three alternatives that appeared to be most promising. The three alternatives are described below.

1. **Increased consolidation in China:** As mentioned earlier, most of the containers coming from China were "factory-direct" in that the suppliers manufactured and shipped the containers straight from their facilities to Kansas City. Given that there were over 300 such suppliers, some sending just a handful of containers per year, Grainger suspected that there was an opportunity for significant savings by consolidation in China.

   Specifically, it was proposed that Grainger operate consolidation centers in China at the same port locations used in the existing network: Shanghai-Ningbo, Yantian, Kaohsiung, and Qingdao. Suppliers would then send their products only to their assigned consolidation centers. Grainger (or a third party operating on behalf of Grainger) would take ownership of the products at the consolidation centers and consolidate the products from different suppliers as well as for different destinations. These consolidated containers would then be shipped overseas under Grainger's existing shipping arrangements.

   This re-engineering offered significant opportunities for cost reduction. Transportation costs could decrease in two ways. First, there would be more efficient use of container space. Second, consolidation would allow for a reduction in the number of 20′ containers used, which were highly cost-inefficient. Because each manufacturer would not need to wait to fill a full container by itself, the average order size would also decrease, which would reduce inventory costs. Also, non-US Grainger businesses, which typically have lower volumes, could now be served directly from the consolidation centers in quantities consistent with their sales volumes.

   However, opening consolidation centers in China carried significant risks, and it would represent a major new presence in China by Grainger. Although the consolidation decision had many components, it was felt that a pilot study would demonstrably generate enough savings to justify consolidation. As a pilot study, the team was advised to consider opening a consolidation center at Yantian. At the time, Yantian shipped out approximately 62,700 cbm of material annually, using a mix of 40′ and 20′ containers as described in **Exhibit 4**. A reasonable target would be to assume that 85% of the material would be consolidated, and a container utilization level of 96% would be achievable on consolidation. Of course, consolidation would enable reducing the use of the inefficient 20′ containers; for the pilot study, it was believed that if 85% of the material were consolidated, then the remaining 15% of unconsolidated material would all be from high-volume suppliers who would use only 40′ containers. All other relevant data are provided in **Exhibit 5**. Can the consolidation investment in Yantian be justified?

2. **More primary DCs in the US:** A large quantity of GGS products came from Asia, with the majority entering the US via the port of Los Angeles. Grainger already had a GUS DC at LA, but this DC received products from Kansas City and distributed them to the stores in its operating area. Would it be possible to set up a new primary import DC operated by GGS in addition to a GUS DC serving the southwestern US? In this scenario, some of the containers coming from Asia would be offloaded at the port of entry and directed to the new primary import DC for distribution in the western United States, while the remainder would be routed to Kansas City.

A similar change could be made in the East Coast, by converting the DC at Greenville, SC, into an import warehouse operated by GGS as well. Containers would arrive from Asia to Greenville and would then be dispatched from Greenville to the four GUS DCs serving the East Coast: Greenville, Jacksonville, New Jersey and Cleveland. Any goods not destined for these four DCs would be sent to Kansas City for further distribution and processing.

Although creating these two primary DCs offered substantial savings in transportation costs, there were several other activities that would need to be examined carefully so that there would be no net increase in costs. The Kansas City DC, being the only primary DC for the entire country, allowed for maximum pooling of demand uncertainty, thus allowing for very low levels of safety stock to be maintained. If more primary DCs were opened in the US, would the safety stocks that needed to be maintained at each of the primary DCs result in an overall increase in inventory costs? Were there other ways to mitigate this possible inventory cost increase?

Additionally, the Kansas City DC performed other activities on the goods once they were unpacked from the containers. These included quality assurance, assembly, and kitting. Opening more primary DCs would mean these activities would have to be replicated at the other primary DCs, potentially increasing labor and equipment costs.

As a pilot study, the team was advised to consider whether opening a new GGS DC in the West Coast (WCDC) could be justified. If a GGS DC were opened in the West Coast, would Los Angeles be the only GUS DC served by it? The Dallas GUS DC was also close enough that it could make sense to supply it from the WCDC as well. **Exhibit 5** displays the demand information at each of the nine GUS DCs, their distances from KC, and a tentative site for the WCDC, while **Exhibit 6** provides a cost breakdown of items that would impact the WCDC opening decision. For this calculation, assume that pipeline inventory costs are ignored, but cycle and safety inventory costs are incurred at the primary DCs. When freight and inventory costs are considered, does it make sense to set up and operate the WCDC?

3. **Retain existing supply chain:** The third alternative was to avoid the major re-engineering activities, because of their risks, and to incrementally improve the processes within the existing supply chain so as to achieve Grainger's objectives. For instance, the relationship with Grainger's suppliers in China could be managed so that they were encouraged to consolidate products on their own, reducing shipping costs.

   Given the significant risks of the two major redesign initiatives, there was significant push-back within Grainger against the major changes. An executive in GGS stated that the current supply chain was, in fact, optimal when all the costs and risks were considered, and the redesign initiatives were being considered only out of a "myopic focus on transportation costs." With the economy going into recession in 2009, fuel and transportation costs were already dropping dramatically, removing some of the impetus for a major redesign.

   As the student team concluded its presentation to the executive steering committee, it came away with conflicting opinions on what to recommend. For each of the three alternatives presented, there were some executives who thought that the idea was great, while others downplayed the benefits and emphasized the risks. The students realized that the only way to get everyone on board (and convince themselves) on an appropriate redesign would be to conduct a thorough quantitative analysis of the scenarios. In the words of the steering committee at Grainger, "Show us the numbers!"

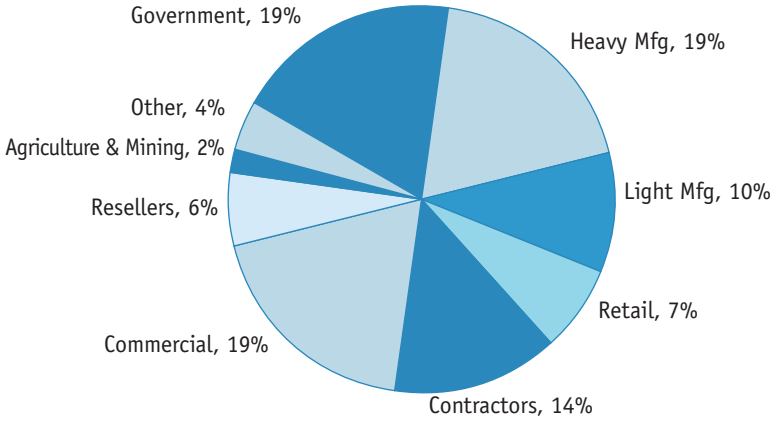
Exhibits

Exhibit 1

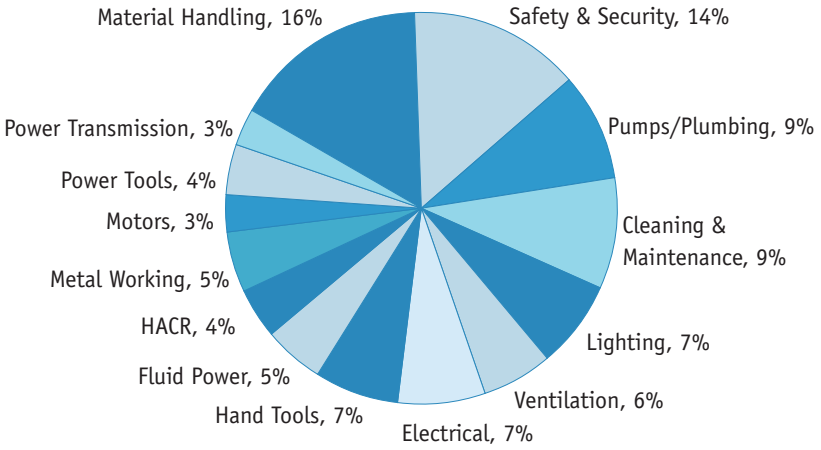
Key Facts about Grainger

2008 sales	$6.9 billion ($1.5 billion via e-commerce)
Employees	18,000
Branches	617
Distribution centers	18
Customers	1.8 million in 153 countries
Products	offered: 900,000
Suppliers	3,000

Large, diverse customer base



Broad and deep product portfolio



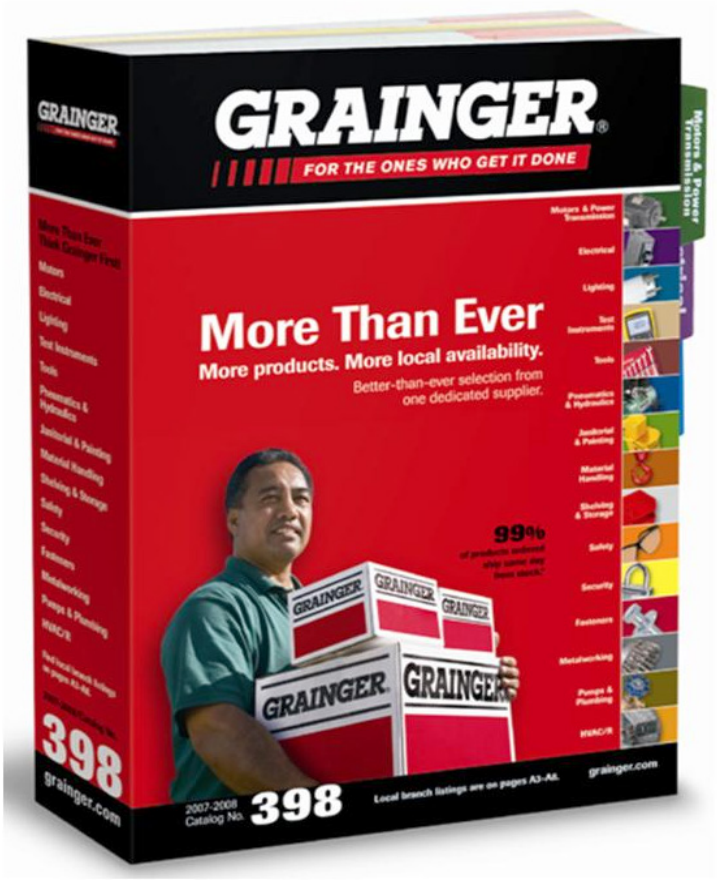


Exhibit 2

Grainger 2006-2008 Financial Summary

W.W. GRAINGER, INC. AND SUBSIDIARIES

HISTORICAL FINANCIAL SUMMARY

		2008	2007	2006
Financial Summary ($000)	Net sales	$6,850,032	$6,418,014	$5,883,654
	Earnings before income taxes and cumulative effect of accounting change	773,218	681,861	603,023
	Income taxes	297,863	261,741	219,624
	Earnings before cumulative effect of accounting change	475,355	420,120	383,399
	Cumulative effect of accounting change	—	—	—
	Net earnings	475,355	420,120	383,399
	Working capital	1,382,375	974,414	1,155,763
	Additions to property, buildings and equipment	182,633	188,867	127,814
	Depreciation and amortization of property, buildings and equipment	112,443	106,839	100,975
	Current assets	2,144,109	1,800,817	1,862,086
	Total assets	3,515,417	3,094,028	3,046,088
	Shareholders' equity	2,033,805	2,098,108	2,177,615
	Cash dividends paid	121,504	113,093	97,896
	Long-term debt (less current maturities)	488,228	4,895	4,895
Per Share ($)	Earnings – basic	6.21	5.10	4.36
	Earnings – diluted	6.04	4.94	4.24
	Cash dividends paid	1.550	1.340	1.110
	Book value	27.20	26.40	25.90
	Year-end stock price	78.84	87.52	69.94
Ratios	Percent of return on average shareholders' equity	23.0	19.7	17.2
	Percent of return on average total capitalization	20.3	19.2	17.2
	Earnings before income taxes and cumulative effect of accounting change as a percent of net sales	11.3	10.6	10.2
	Earnings before cumulative effect of accounting change as a percent of net sales	6.9	6.6	6.5
	Cash dividends paid as a percent of net earnings	25.6	26.9	25.5
	Total debt as a percent of total capitalization	20.7	5.0	0.4
	Current assets as a percent of total assets	61.0	58.2	61.1
	Current assets to current liabilities	2.8	2.2	2.6
	Average inventory turnover – FIFO	2.9	3.1	3.1
	Average inventory turnover – LIFO	4.1	4.3	4.4
Other Data	Average number of shares outstanding – basic	76,579,856	82,403,958	87,838,723
	Average number of shares outstanding – diluted	78,750,328	85,044,963	90,523,774
	Number of employees	18,334	18,036	17,074
	Number of account managers	2,858	2,823	2,699
	Number of branches	617	610	593
	Number of products in the Grainger® catalog	183,000	139,000	115,000

Notes: 2002 net earnings include a charge for the cumulative effect of accounting change of $23,921,000, or $0.26 per share, and special credits of $4,458,000, or $0.05 per share, for gains on sales of investment securities and $1,183,000, or $0.01 per diluted share, for the reduction of the reserves established in 2001.

2001 net earnings include a special charge of $36,650,000, or $0.39 per share, to establish a reserve related to the shutdown of Material Logic.

2000 net earnings include gains on the sales of investment securities of $17,860,000, or $0.19 per share.

Exhibit 3

GGS Supply Chain Activity Detail

Stage	Description
GGS Order Processing	GGS reviews inventory monthly, and places orders with its manufacturers.
Manufacture	Suppliers typically take approximately 57 days to manufacture.
Consolidate	Some suppliers send the product to consolidation centers, where they are consolidated to fill containers. Most suppliers fill up the containers themselves at their facilities, and deliver the packed containers to the port specified by GGS.
Ocean Shipment	GGS's contract with the steamship lines are from the China/ Taiwan port to the door at the Kansas City DC. The rate to ship a container includes each of these shipment legs.
Dray – Port to Rail	
Rail to Kansas City	
Dray – KC Rail to KC DC	
Warehousing	Unload containers. QA-check all SKUs. Rework SKUs that fail QA. Stock keep. The approximate time from order placement to stocking is about 3 months.
GUS Order Processing	Create order picking/packing instructions. Pick items. Assemble items (when required). Pack items on pallets. Load pallets into truck.
GUS Order Shipment	Shipment from GGS to GUS DCs. This expense is paid for by GUS.

Exhibit 4

GGS Operating Expenses Detail – Yantian Consolidation (forecast data for 2012)

Data for consolidation decision		
Item	**Units**	**Value**
Annual volume	cubic meters	190000
Yantian volume	percent	33%
Targeted consolidation	percent	85%
Container utilization after consolidation	percent	96%
Annual fixed cost of running consol	$/year	$75,000
One-time fixed cost of opening consol	$	$250,000
Unit holding cost at Yantian consol	$/cubic meters per year	$5
Unit consolidation material handling cost	$/cubic meters	$1.40

Container size		40′	20′
Container capacity	cubic meters	67	34
Current container volume out of Yantian	containers/year	918	612
Freight, Yantian to US port	$/container	$600	$480

Exhibit 5

GUS Distribution Centers (Forecast data for 2012)

Annual Demand (Cubic Meters)				
Warehouse	**Mean**	**Standard deviation**	**Miles from Kansas City**	**Miles from West Coast**
Kansas City	20900	6270	0	1570
Cleveland	17100	5130	800	2290
New Jersey	24700	7410	1200	2725
Jacksonville	15200	4560	1150	2375
Chicago	22800	6840	520	1980
Greenville	15200	4560	940	2270
Memphis	17100	5130	510	1745
Dallas	22800	6840	500	1390
Los Angeles	34200	10260	1620	50
Total	**190000**			

Exhibit 6

GGS Operating Expenses Detail – US
(Forecast data for 2012)

Data for US Distribution Centers Decision		
Item	**Units**	**Value**
US rail freight	per cbm per mile	$0.0018
US truck freight	per cbm per mile	$0.0220
GGS inventory review period	months	1
GGS lead time	months	3
US holding cost	$/cbm per year	$7.50
Targeted service level	%	98%
One-time fixed cost of WCDC	$	$2,300,000
Annual operating cost of WCDC	$	$350,000
Variable cost at WCDC	per cbm annual throughput	$5.00
Variable cost at KC facility	per cbm annual throughput	$3.00

WILLIAM DAVIDSON INSTITUTE
AT THE UNIVERSITY OF MICHIGAN

Established at the University of Michigan in 1992, the **William Davidson Institute** (WDI) is an independent, non-profit research and educational organization focused on providing private-sector solutions in emerging markets. Through a unique structure that integrates research, field-based collaborations, education/training, publishing, and University of Michigan student opportunities, WDI creates long-term value for academic institutions, partner organizations, and donor agencies active in emerging markets. WDI also provides a forum for academics, policy makers, business leaders, and development experts to enhance their understanding of these economies. WDI is one of the few institutions of higher learning in the United States that is fully dedicated to understanding, testing, and implementing actionable, private-sector business models addressing the challenges and opportunities in emerging markets.