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Harnischfeger Industries

Portal Cranes

Harnischfeger Industries, based in Milwaukee, Wisconsin, was a major manufacturer of papermaking, mining, and material handling equipment. Harnischfeger's Material Handling Equipment Division was the leading supplier of portal cranes in North America. Portal cranes were used for moving logs in the woodyards of forest products companies, such as pulp and paper manufacturers. In 1990 sales of portal cranes were approximately $15 million in North America, or about 4 percent of the U.S. industrial material handling equipment market.

Since joining Harnischfeger in 1988, Bob Hale, Vice President of the Material Handling Equipment Division, had sought out growth opportunities in the mature material handling equipment business. He had stepped up the Division's after-sales service activities, an effort which won the Division a 1991 Business-to-Business Product Award from *Sales & Marketing Management* magazine. (Other winners included The Gap and The Walt Disney Company.) Hale had also targeted portal cranes as a growth opportunity but recently had become concerned about increasing competition from Kranco, a crane manufacturer based in Houston, Texas. Hale decided to meet with Gary Otto, National Sales Manager for Harnischfeger Portal Crane Products and Services, to develop a strategy for improving their company's position in the portal crane market.

Portal Cranes

Portal cranes were specialized cranes used in woodyards at pulp and paper mills, sawmills, and veneer and plywood mills. A portal crane was used to unload logs from arriving trucks or railcars, to add logs to a stockpile, and to reclaim logs from the stockpile for further processing. Portal cranes were large structures, with spans of up to 300 feet, and could operate on runways over 2,000 feet long. A portal crane could unload a truck carrying 30 tons (about 10 "cords") of treelength wood in a single "bite" and could handle up to 25 trucks per hour. **Exhibit 1** depicts a portal crane in operation.

Exhibit 2 identifies the major components of a "straight-track" portal crane. The gantry was the main structural member used to span the width of the storage area. It travelled on parallel rails laid on either side of the crane runway. The gantry was made up of two A-frame leg assemblies and a girder running at right angles to the rails. Logs were lifted and lowered using a hoist and grapple attached to a trolley which travelled along the girder. The crane was operated from a trolley-

Professor Adam Brandenburger and Ph.D. candidate Gus Stuart prepared this case as the basis for class discussion rather than to illustrate either effective or ineffective handling of an administrative situation.

mounted or fixed-position cab, which commanded a broad view of the woodyard. Most portal cranes were electrically driven, with power fed by a motorized cable reel.

Although straight-track portal cranes were the most commonly used, "rotator" and "log boom" portal cranes could also be found in woodyards. These latter two types of crane serviced circular, rather than rectangular, storage areas. Rotators typically had smaller log storage capabilities than did straight-track cranes, but were otherwise similar in design. Log booms were designed for lifting lighter loads and could also service only smaller storage areas.

The purchase prices of straight-tracks, rotators, and log booms were about $2 million, $1.5 million, and $1 million, respectively. The typical financing package offered to a buyer specified that 10 percent of the total sum due be paid on placement of an order, 40 percent be paid during manufacturing, 40 percent be paid at the time of shipment, and 10 percent be paid after acceptance. The working life of a crane was about twenty years, and the manufacturer typically offered a one- or two-year warranty. A portal crane required regular maintenance and service over the course of its lifetime.

Portal cranes were similar in design and engineering to overhead cranes. Overheads were used for moving heavy loads in factories; they operated on a fixed overhead runway structure above the working area. Overheads were a very mature business and were viewed as a commodity product. After-market support was less critical for overheads than for portal cranes since typically several overheads served a given working area, reducing the wear on any one crane and affording backups in the case of breakdown. Total U.S. sales of overheads were about $170 million in 1990, or about 45 percent of the U.S. industrial material handling equipment market.

Buyers

Portal cranes were bought by forest products companies for use in their woodyards. Forest products companies manufactured pulp, paper, paperboard, and wood products. Pulp was an intermediate product in making paper and paperboard. Paperboard was a heavy grade of paper used to make a wide variety of packaging materials, such as containers, boxes, and cartons. Wood products included lumber, veneer, plywood, and many other processed wood forms.

Total sales of the North American forest products industry were $135 billion in 1990, of which the top ten companies accounted for $71.8 billion (see **Table 1**). Concentration differed by industry sector, with market pulp being the most concentrated sector, paper second, and wood products the least concentrated. Competition in the pulp and paper sectors was largely cost driven; market pulp, in particular, was a commodity product.

Table 1 Sales of Top 10 North American Forest Products Companies, 1990 ($ Billions)

Company	Sales
International Paper	13.0
Georgia-Pacific	12.7
Weyerhaeuser	9.0
Kimberly-Clark	6.4
Stone Container	5.8
James River	5.4
Scott Paper	5.4
Champion International	5.1
Mead	4.8
Boise Cascade	4.2

Source: Pulp & Paper 1992 North American Factbook

Forest products companies engaged in forest management, mill operations, and sales and distribution activities. Companies procured timber in the marketplace or from their own timberlands. Pulp mills turned timber into pulp to be sold on the market. Vertically integrated paper mills turned timber into pulp and pulp into paper on site. Sawmills produced rough or finished lumber, while plywood and veneer mills cut timber into thin sheets suitable for various building applications. Pulp and paper mills ran 24 hours a day and much effort went into avoiding downtime. Interruptions to operations were less serious in the case of sawmills and plywood and veneer mills. Annual production of a mill might be about $100 million, although there was considerable variation around this figure.

Demand for pulp and paper followed the general level of economic activity while that for wood products was tied to activity in the construction sector. Recently, forest products companies had been investing in new and upgraded equipment following two downturns at the beginnings of the 1980s, although few entirely new mills were expected to be built. The industry was being increasingly affected by environmental concerns. Environmental groups had succeeded in restricting the harvesting of timber on Federal lands, especially in the Pacific Northwest. Industry participants were concerned that they might face future restriction of cutting rights and cutting practices on their privately owned land. Recycling of forest products was also growing. At present, about 25 percent of all recoverable paper was recycled, a figure that was expected to rise substantially in the 1990s.

Large forest products companies had multiple mill sites where portal cranes could be employed. It was thought that the total number of potential sites for portal cranes in North America might reach 600 at the most. Of these, about 75 percent would be at pulp and paper mills, 15 percent at sawmills, and the remainder at veneer and plywood mills. Most pulp and paper mills were located in areas of "softwood" (pine, for example) in the Southeastern, Central, and Northeastern U.S. and in Eastern and Central Canada. Sawmills and plywood and veneer mills were concentrated in areas of "hardwood" (oak, for example) on the Pacific coast of the U.S. and Canada.

Historically, about three-quarters of portal crane sales had been directly to end-users with the remainder going via woodyard engineering firms, which were companies specializing in the design of new woodyards and in major woodyard reconfigurations. Sometimes a woodyard engineering firm would not only supervise the installation of a new system, but also take responsibility for proving it over an initial 6-month period. Recently, there had been a move towards the woodyard engineering firm actually operating a new or redesigned woodyard under a 10-year contract. The leading woodyard engineering firms were two Finnish companies, Kone Wood and Rauma-Repola, which between them held about 80 percent of the market worldwide. A number of smaller woodyard engineering firms also operated in the North American market.

A major woodyard reconfiguration, such as took place if a woodyard switched over from "shortwood" to "longwood" (see below), might cost from $30 million to $50 million. A changeover to a new woodyard system might take place over an 18-month period and had to be carefully planned and implemented to allow the mill to keep operating during this time.

Portal cranes had been used in a limited number of applications beyond the forest products industry, in steel, concrete, and scrap yards. Most of these applications were, however, too small to warrant use of a portal crane. Opportunities for export of portal cranes beyond North America were also limited, in part due to differing equipment requirements.

Log Handling Techniques

With material, labor, and energy costs rising, forest products companies engaged in a continuous search for more efficient log handling techniques. A number of different techniques were in use at mills, with regional and local differences such as wood species, topography, climate, and

transport network affecting each mill's choice. Often, a single mill employed more than one log handling technique in an attempt to optimize its operations.

The major log handling techniques available to a mill were "shortwood" delivery and processing, "longwood" delivery and shortwood processing, and longwood delivery and processing. Paper and pulp mills had the extra option of "chip" delivery. The term "shortwood" referred to 4-foot to 8-foot logs, "longwood" referred to 50-foot to 60-foot treelength logs, while chips were 1-inch square wood pieces. **Exhibit 3** summarizes the various log handling techniques.

Each technique began with the felling of trees. In the case of shortwood and longwood, the trees were delimbed and (if appropriate) cut into shorter logs, prior to transportation. With in-woods chipping, felled trees were fed through delimbing-debarking and chipping machines on "landings" near the felling operations. In-woods chipping was also suited to the production of "whole-tree" chips, which was gaining popularity in areas of high wood cost. Similar in concept to in-woods chipping were "satellite" chip mills, which were fixed facilities dedicated to processing logs into chips prior to transportation to the woodyard.

Transportation of all three forms of timber—shortwood, longwood, or chips—to the woodyard took place via trucks or railcars. Typically, the trucks were owned by independent haulers who might service a number of mills in a given area. Most rail transportation took place over common-carrier tracks.

Transportation of timber as shortwood had been the traditional method, but recently there had been a shift towards longwood and chip delivery to woodyards. Representative delivered prices for shortwood and longwood were $33 per cord and $30 per cord respectively, reflecting lower upstream handling costs for longwood. (A typical woodyard might have an annual volume of 200,000 cords.) Changing over to longwood delivery did necessitate a one-time reconfiguration of trucks and railcars.

In-woods chipping operations and satellite chip mills had also been gaining popularity in recent years. Transportation of chips had two main advantages over transportation of logs. First, moving chips was more cost effective than moving logs because logs could not be loaded as tightly as chips and included waste product such as bark. (Transportation costs were becoming increasingly important as depletion of woodlands near mills meant that timber had to moved over greater distances.) Second, transporting chips in enclosed trucks was safer than transporting logs, which required open trucks with overhangs. In many states, open log trucks were banned from public roads after dusk, a restriction that did not apply to chips. The main drawback of in-woods or satellite chipping was the resulting chip quality which did not always compare with that obtainable from woodyard chipping.

Once timber arrived at the woodyard of a pulp or paper mill, there was again a number of different routes it might take. Shortwood was unloaded from the trucks or railcars, and was either inventoried or went directly into debarking and chipping machines. The resulting chips were sent to storage silos and then the pulping lines.

Arriving longwood was treated in one of two ways depending on whether the woodyard was configured to process shortwood or longwood. In the first case, longwood went—either directly or via the longwood inventory—to a "slasher," where it was cut into shortwood before being moved to the shortwood inventory or shortwood debarking and chipping machines. In the second case, the slashing step was eliminated and logs went—again, either directly or via the longwood inventory—into treelength debarking and chipping machines. Treelength debarking and chipping were said to produce higher quality chips with less wood loss (since slashing was eliminated) and lower labor and maintenance costs (slashers required heavy maintenance). Treelength processing seemed to give

better results for softwood than for hardwood. Existing woodyards were being retrofitted to take advantage of the newer treelength technology.

Finally, arriving chips from in-woods chipping operations or satellite chip mills went straight to storage silos and from there to the pulping lines.

The woodyard operations of sawmills and veneer and plywood mills were similar to those for pulp and paper mills. One distinction was that arriving logs were spread out on "scale" decks and separated according to size and species prior to being fed to the debarking machines. From there debarked logs passed through lathes to be fashioned into wood products.

Mobile log stackers, which were diesel electric vehicles somewhat akin to giant forklifts, had traditionally been used to move logs in woodyards. A mobile log stacker cost about $250,000 and had a four-year life. The leading manufacturer of mobile log stackers was Marathon LeTourneau, a diversified manufacturing and engineering firm based in Longview, Texas. The company had 50 years of experience in the forest products industry and operated a service network covering the U.S. and Canada to support its installed base of more than 1,000 machines in operation.

Starting in 1977, portal cranes had begun to substitute for mobile log stackers in unloading trucks and railcars, stockpiling the arriving logs, and reclaiming logs from the stockpile for further processing. It was estimated that, as far these operations were concerned, one portal crane could replace up to four mobile log stackers if timber arrived as longwood. The ratio was considerably less favorable if timber arrived as shortwood. Likewise, if a woodyard received timber as longwood but processed it as shortwood, mobile log stackers were still required to manage the shortwood inventory. For engineering reasons, mobile log stackers could not always unload longwood from railcars. For some woodyards wishing to receive longwood by rail, a portal crane was therefore essential.

Because they eliminated the need for paved roadways and also stacked to much greater heights, portal cranes could stockpile up to five times as much wood as could mobile log stackers. Storage volume was especially important in the Northern U.S. and Canada, where log delivery stopped during the mud season (March and April). Portal cranes also offered certain environmental advantages. The hydraulic action of mobile log stackers could cause disturbances to the water table. Portal cranes, on the other hand, ran on railway-type tracks with the load shared by multiple wheel assemblies ("bogies"); ground damage was thereby reduced. Elimination of diesel fumes was a further environmental benefit associated with use of portal cranes.

The main operating costs associated with mobile log stackers and portal cranes were labor, energy, equipment maintenance, parts, and log breakage. **Table 2** provides representative data on operating costs.

Table 2 Estimated Annual Operating Costs ($ 000s)

	One Mobile Log Stacker	Straight-track Portal Crane
Labor	60	60
Energy	20	20
Equipment Maintenance	30	45
Parts	20	25
Log Breakage	50	40

Source: Industry data

Annual maintenance of the paved roadways needed for operation of mobile log stackers was estimated at $100,000; upkeep of a crane runway was about $20,000 annually.

Marketing

Portal crane manufacturers sought to reach potential customers through advertising in woodyard operations publications and at woodyard users' conferences such as those sponsored by the Portal Crane Users Committee, a group of forest products companies that met to compare experiences in operating portal cranes. Manufacturers' sales representatives spent a good deal of time with potential customers, assessing their particular site and operating characteristics and explaining the benefits of portal cranes. A representative then prepared a proposal detailing projected cost savings for presentation to the customer's corporate engineering department. Often, the potential user responded by soliciting bids from competing crane manufacturers in an attempt to obtain favorable terms. Also, selling a portal crane to a particular company was not, in itself, thought to offer any significant advantage in securing future orders from that company.

Manufacturing

The design of a portal crane was modular, which allowed the manufacturer to make cranes to meet customers' particular requirements. Specialty components, such as grapples and operator cabs, were purchased from outside suppliers. The most critical components of a portal crane for reliability and durability were the controls, motors, brakes, and wheels. A manufacturer could choose to function as a pure assembly operation, and purchase standard versions of these components as well from outside suppliers such as General Electric and Westinghouse. Alternatively, a manufacturer could try to achieve greater reliability and durability by designing and building critical components in-house, although doing so was believed to place the manufacturer at a cost disadvantage. **Table 3** gives an approximate breakdown of total costs for a portal crane containing a high proportion of in-house components.

Table 3 Estimated Costs as a Percentage of Sales Price

Materials	45%
Labor	10%
Purchased Items[(1)]	5%
Engineering	5%
Selling and Administrative Expenses	10%
Indirect Costs	20%

[(1)]Grapple, operator cab, etc.
Source: Industry data

The time from securing an order for a portal crane to shipping was about 12 months. Cranes were shipped, disassembled, via railroad and truck to the customer's site. Freight costs amounted to about $50,000. Building of the crane runway was usually subcontracted to a fabricator located close to the job site. The cost of preparing the runway varied from about $250,000 to $500,000 depending on the terrain. The crane manufacturer was responsible for setting up and testing the crane and for providing on-site training of the customer's operator personnel. Set-up, testing, and training might cost the customer about $250,000 and were high margin activities for manufacturers.

Industry History

Portal cranes had been introduced into woodyards in Scandinavia around 1965 but low lifting capacities and the use of slings rather than grapples for log handling had limited their usefulness. In 1969, Heede International, a Canadian company based in Vancouver, British Columbia, obtained a license from a West German portal crane manufacturer and proceeded to design larger, faster, cranes to suit the Canadian and U.S. markets. The first portal crane for the

North American forest products industry was introduced in 1977, with the installation of a portal crane in Plymouth, North Carolina, for the Weyerhaeuser Company. Between 1977 and 1982, Heede built and installed 17 portal cranes in North America. In 1982, Heede was acquired by Harnischfeger, which subsequently relocated production to the United States. Through 1984, Harnischfeger had installed, or secured orders for, an additional 16 portal cranes for the North American forest products industry.

The period 1985 to 1990 saw intensifying competition in the portal crane market. Following the entry in 1987 of Kranco, profit margins on portal cranes had fallen sharply. Kranco had secured its first portal crane contract by underbidding Harnischfeger by $300,000, to which Harnischfeger had responded with a lawsuit contending patent infringement and use of proprietary designs. Kranco had continued to compete aggressively on price and delivery schedule and had secured a number of sales, notably with woodyard engineering firms. In return, Harnischfeger had begun discounting the prices of its own cranes. Recent winning bids were thought to be at or near cost.

Competitors

A total of five companies secured orders for portal cranes between 1985 and 1990. **Table 4** lists sales by company and year. Only two companies, Harnischfeger and Kranco, sold a complete range of portal cranes, including straight-tracks, rotators, and log booms. A third, Ederer, offered straight- tracks and rotators. Manitowoc had sold one straight-track and Kone Cranes one rotator. **Exhibit 4** presents information on sales of cranes by geographic region.

Table 4 Sales of Portal Cranes in North America

Company	Year						Total
	1985	1986	1987	1988	1989	1990	
Harnischfeger	2	4	8	3	4	4	25
Kranco	—	—	3	2	5	3	13
Ederer	1	—	—	—	—	—	1
Manitowoc	—	1	—	—	—	—	1
Kone Cranes	—	—	—	1	—	—	1
Total	3	5	11	6	9	7	41

Source: Industry data

Three of the competitors in the portal crane market, Harnischfeger, Kranco, and Kone Cranes, also met in the overhead crane market. Their shares of the U.S. overhead crane market were about 30, 20, and 10 percent, respectively. (Another notable player in the U.S. overhead crane market was Mannes-mann Demag, a highly regarded German crane manufacturer with a number of overseas operations.)

Profiles of each of the competitors in the portal crane market are given below.

Kranco, Inc. Based in Houston, Texas, Kranco was a rapidly growing company with fiscal 1989 sales of $40 million and net income of $470,000. The company manufactured overhead and portal cranes, as well as other material handling equipment. Kranco had a non-unionized work force of 400 people and possessed modern integrated design and manufacturing facilities at a 300,000 square-foot Houston plant as well as another 100,000 square feet of production space in Cleveland, Ohio.

Founded in Houston in 1956 by a Dutchman (the Dutch for crane is “kraan”), Kranco had started as a small manufacturer of overhead cranes serving industrial needs in the rapidly growing Southwest. In 1980, Kranco became a subsidiary of McCall Industries, a diversified manufacturing holding company. In 1988, an investment group including the Kranco management and employees

gained control of Kranco through a leveraged buyout. The Chief Executive Officer, Executive Vice President, and Vice President of Engineering of Kranco were all former Harnischfeger executives. The CEO had previously served as Vice President of Harnischfeger's Material Handling Equipment Division before leaving Harnischfeger in 1985 to join Kranco. It was believed that Kranco's management team was aiming to take the company public in due course.

Kranco viewed the portal crane market as a growth opportunity and was an aggressive competitor on price and delivery schedule. The company's strategy was to underbid its competitors on a project and then, having secured the order, to challenge its engineering, purchasing, and manufacturing departments to make a profit. Kranco sales people described their cranes as just as good as those of Harnischfeger; after all, they pointed out, three of their managers had previously worked at Harnischfeger and so were in a position to know. One industry participant described Kranco as having a "Let's get Harnischfeger" attitude.

Kranco portal cranes were of a lighter design than those of Harnischfeger and contained a higher proportion of bought-in components. Kranco was expanding its product support group, which currently consisted of about 30 service engineers operating from a number of bases in the U.S. and Canada, by buying up independent service companies in return for Kranco stock. The company provided a range of after-sales services for its cranes, such as installations, preventive maintenance programs, spare parts provision, repairs, and modernizations. Most of Kranco's parts sales were for components made by other equipment manufacturers.

Ederer, Inc. Founded in 1901 and based in Seattle, Washington, Ederer was a custom crane manufacturer. The company made overhead and portal cranes, dockside cranes, cableways (used for rapid transport of concrete at major construction projects), and other equipment. It employed about 80 people. Recently, sales growth at Ederer had stalled, with 1989 sales of $10.5 million unchanged from the previous year.

Ederer had been an early competitor in the portal crane market. Its portal cranes were of a heavy box-girder design rather than the more typical truss-girder design and were built to be especially rugged and durable. The company made its own controls and brakes. Ederer had failed to win an order for a portal crane since 1985, and recently had only been submitting bids when asked. The company had an installed base of 14 cranes, mostly in the Pacific Northwest, and had long-standing relationships with several customers in the region. Ederer offered only limited product support and some of its cranes were rumored to be experiencing operating problems.

The Manitowoc Co., Inc. Manitowoc was a diversified capital goods manufacturer based in Manitowoc, Wisconsin. The company made earth-moving equipment, equipment for the forest products industry, commercial ice cube machines and dispensers, equipment for the offshore petroleum industry, as well as other products. Net income in fiscal 1989 was $21 million on sales of $226 million.

Manitowoc manufactured a wide range of woodyard equipment, including both shortwood and longwood debarking machines, conveyors, infeed and outfeed chutes, bark hoppers, and slasher decks. In its sales literature, the company emphasized the advantages to a buyer of single-source responsibility for, and complete compatibility across, different pieces of woodyard equipment. In 1988, Manitowoc had also begun producing "chain flail" delimbing-debarking machines, designed for in-woods and satellite chipping operations. Currently, there were 30 Manitowoc chain flail delimber-debarkers in use in North America, out of an estimated total of 120 machines in operation. The company had recently upgraded its original chain flail models.

In 1986, Manitowoc had built a $3 million straight-track portal crane for Scott Paper. Although regarded as being well designed and of high quality, the crane had proved very costly to

manufacture and Manitowoc was thought to have lost up to $500,000 on the project. The company had bid again on a portal crane project in 1987 but had lost out to Kranco.

Kone Corporation Kone (pronounced "ko'nay") was a leading Finnish-based machinery company with 1989 sales of FM7.1 billion (US $1.8 billion) and net income of FM526 million (US $132 million). Kone, established in 1910, had various subsidiaries in Finland and around the world. The two major business divisions were Kone Elevators and Kone Cranes. Kone Elevators, which manufactured passenger and freight elevators, escalators, and autowalks, was the world's third largest elevator manufacturer. The division accounted for 66 percent of total company sales in 1989. Kone Cranes, which accounted for 17 percent of total company sales in 1989, was regarded as the worldwide leader in crane products. Another division, Kone Wood, which accounted for 7 percent of total company sales in 1989, manufactured complete woodyard systems for the forest products industry, including shortwood and longwood debarking machines, chipping machines, and chip storage systems. Kone Wood had 50 years experience in the forest products industry and had built turnkey woodyards around the world. The company had particular expertise in designing woodyard systems that could operate in Arctic climates.

After Western Europe, North America was Kone's largest market. Management of Kone in North America was decentralized, with management compensation tied to local performance. Recently, Kone had been showing a growing interest in the North American market. Kone Cranes, which currently employed about 80 service engineers in the U.S., was buying up independent crane servicing companies with a view to being able to service other manufacturers' cranes. Kone Wood was active in the North American forest products industry and had been involved in around 20 woodyard projects in North America since 1984.

In 1988, Kone Wood had commissioned Kone Cranes to manufacture a portal crane as part of a woodyard system that Kone Wood was supplying to Stone Container Corporation. The project had lost money because of wheel and runway problems caused by an excessively heavy crane design. Kone Wood had subsequently returned to buying portal cranes from outside manufacturers.

Harnischfeger Industries

Harnischfeger Industries had fiscal 1990 sales of $1.76 billion and net income of $73.1 million. The company, based in Milwaukee, Wisconsin, consisted of three business groups: the Systems Group, the Paper Group, and the Heavy Equipment Group, the last made up of the Mining Equipment Division and the Material Handling Equipment Division. **Exhibits 5** and **6** summarize Harnischfeger's recent financial performance.

The Systems Group consisted of Harnischfeger Engineers and Syscon Corporation. Harnischfeger Engineers was an engineering services company engaged in the design and installation of automated material handling systems for industry. Syscon Corporation was a Washington, D.C., company that developed computer software systems for military applications. The Paper Group consisted of Beloit Corporation, a leading manufacturer of papermaking machinery and systems. Worldwide, approximately 1,100 papermaking machines were Beloit products, giving Harnischfeger the largest installed base of paper machines in the world. As paper mills had begun to demand higher efficiency and quality from existing equipment, Harnischfeger had been able to capture a significant share of the rebuild market. Harnischfeger's Mining Equipment Division was a major manufacturer of surface mining equipment. Seven out of every ten electric mining shovels in use around the world were Harnischfeger products; the company expected replacement and repair parts to generate an increasing share of the Mining Equipment Division's revenues. Finally, the Material Handling Equipment Division was a leading producer of industrial material handling equipment, including cranes, hoists, and components and parts.

Founded in 1884 by Chicago-born pattern maker Alonzo Pawling and German immigrant Henry Harnischfeger as a small machine and pattern shop, the company had grown to become a major force in the heavy-machinery business until running into serious trouble in the early 1980s. By 1982 the company was in technical default and fast running out of cash. The immediate causes of the crisis were the U.S. recession and a drop in oil prices, which hit the company's exports of construction equipment to the Middle East. Henry Harnischfeger, grandson of the founder and chairman and chief executive officer, brought in William W. Goessel as chief operating officer to try to save the company.

By instituting tight financial controls and cutting the work force from 6,900 to 3,800, Goessel managed to bring the company through its immediate cash crisis.[1] In 1986, Harnischfeger acquired Beloit Corporation, a Wisconsin-based papermaking machinery manufacturer which was Goessel's old employer, for $175 million. Seven months later, Harnischfeger sold a 20 percent stake in Beloit to Mitsubishi Heavy Industries for $60 million, thereby valuing Beloit at $300 million. Also in 1986, Harnischfeger spent $92 million to buy Syscon Corporation. In 1988, Century II, Inc., a company formed by a group of former Harnischfeger executives, acquired almost all the assets and liabilities of Harnischfeger's discontinued Construction Equipment Division. By 1990, the Paper Group and the Systems Group together accounted for 76 percent of total sales and 77 percent of total operating income of Harnischfeger Industries.

Material Handling Equipment Division Harnischfeger's Material Handling Equipment Division was organized into five groups (see **Exhibit 7** for an organization chart). The crane group manufactured standard and engineered overhead cranes, a new low-cost, quick-delivery overhead called the Pacesetter, portal cranes, and crane components. The specialized equipment group made standard and engineered hoists, electrical products, and government products such as equipment for locks and dams. The parts group and the ProCare service group were the highest margin operations, responsible for crane installations, preventive maintenance, spare parts provision, repairs, and modernizations. Finally, the Phoenix group was a new endeavor, devoted to buying up shuttered down cranes and rebuilding and then reselling them to the lower end market.

Cranes were built by a unionized work force in a 1.2 million square-foot manufacturing facility located on the site of Pawling and Harnischfeger's original machine and pattern shop in Milwaukee. Nearby plants manufactured electric components and hoists. Engineering work for cranes, as well as the purchasing of raw materials such as steel, was shared across product lines. The same "wear" parts (i.e., motors, brakes, and wheels) were used in all Harnischfeger cranes. Harnischfeger prided itself on the quality of its engineering. Its portal cranes, which contained the highest proportion of in-house components in the industry, were designed with a particular view to reliability and durability. The company's "make not buy" philosophy extended not only to the controls, motors, brakes, and wheels of a portal crane, but even to the cabinets that housed the controls.

Harnischfeger's complete line of cranes, bearing the widely recognized brand name P&H, was marketed by a direct sales force which included nine regional sales managers covering the United States and Canada. There was also a dedicated sales force, consisting of Gary Otto and four assistants, assigned specifically to the portal crane market.

With more than 40,000 of its overhead cranes in operation, the Material Handling Equipment Division generated a significant proportion of its income from crane maintenance and spare parts provision. The ProCare service group, consisting of about 30 people, was responsible for servicing

[1]For more information on Harnischfeger's corporate recovery plan, see "Harnischfeger Corporation," Harvard Business School Case Services (186-160), 1986.

the division's entire line of cranes. ProCare offered what was generally agreed to be the most comprehensive after-sales service in the crane industry, including turnkey installation, on- and off-site training programs for customers' operator personnel, and 24-hour emergency crane repair service. The parts group supplied only genuine P&H parts to its customers and maintained the largest stock of crane parts in North America.

Exhibit 1 Harnischfeger Industries Portal Crane in Operation

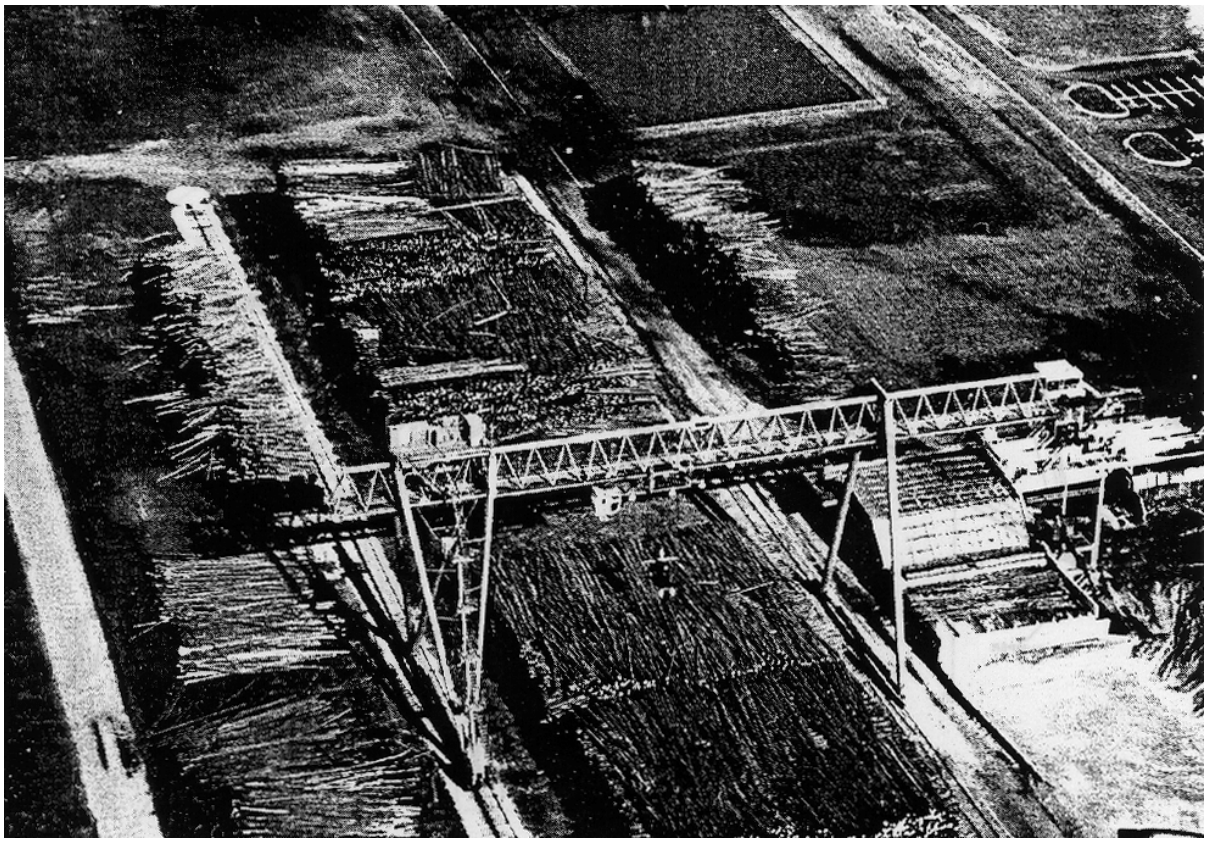

Exhibit 2 Straight-track Portal Crane

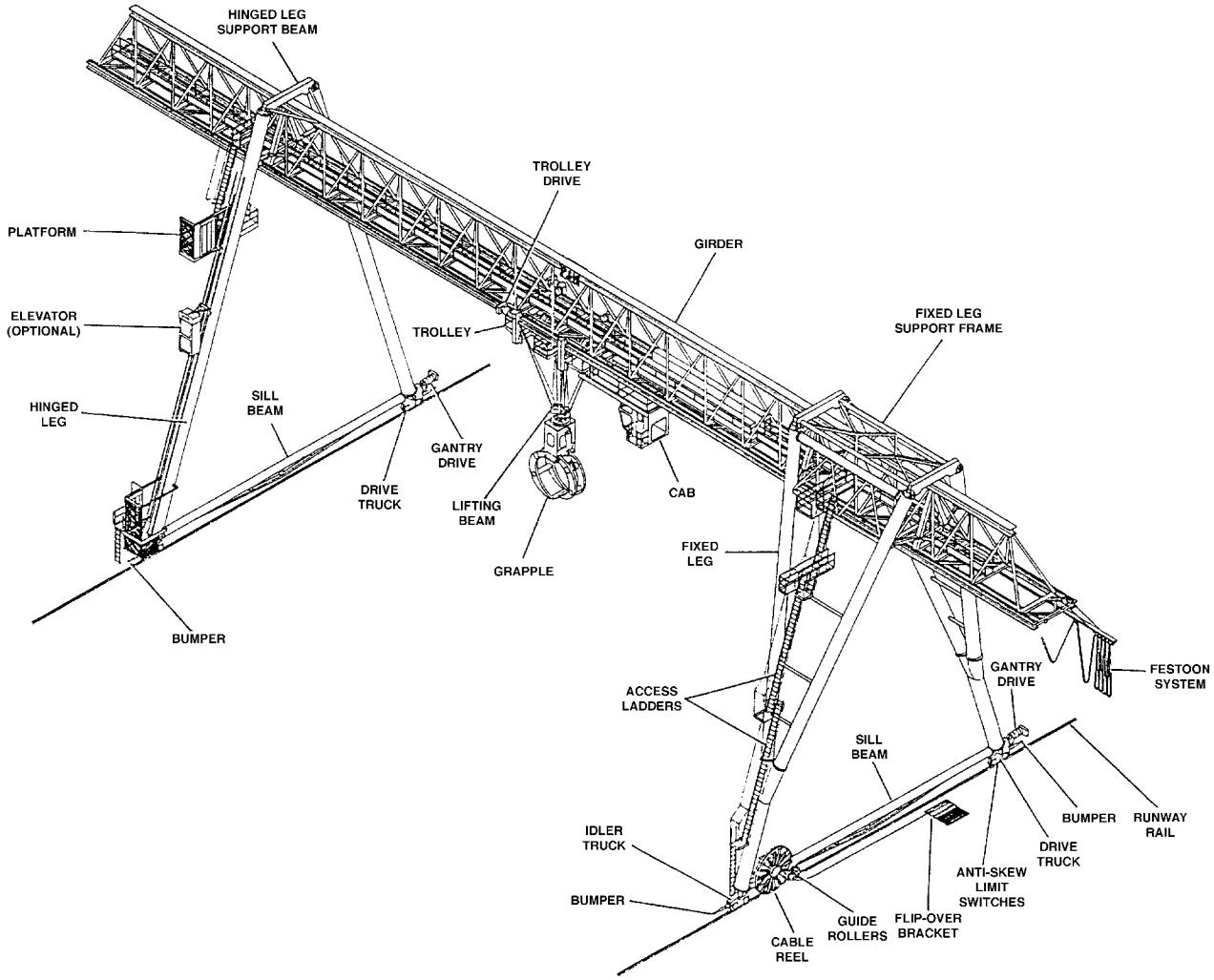

Exhibit 3 Log Handling Techniques

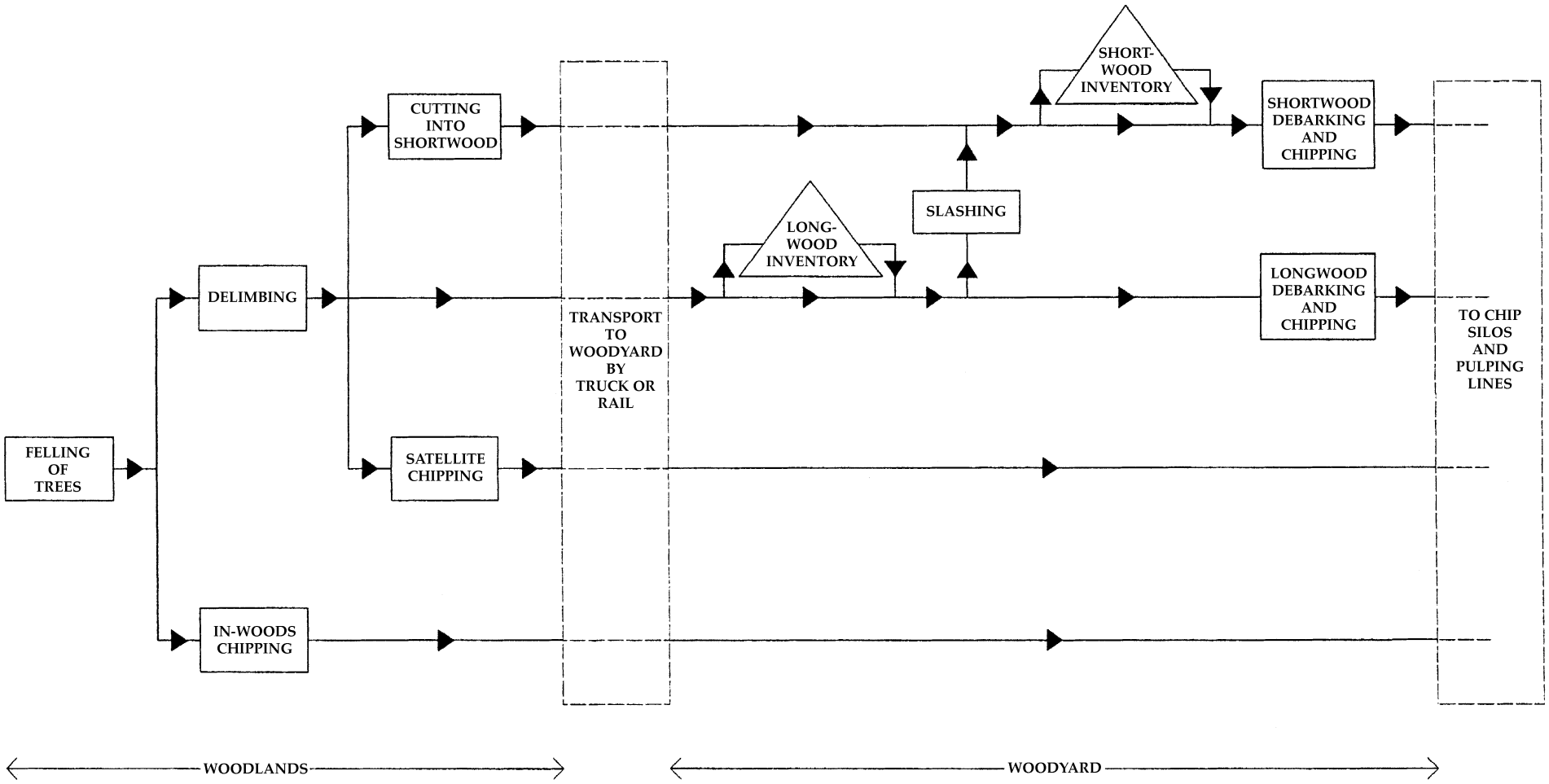

Exhibit 4 Estimated Installed Base of Portal Cranes by Region

Company	Region					
	Southeast	Pacific Northwest	Northeast	Rest of U.S.	Canada	**Total**
Harnischfeger	36	6	3	3	10	58
Kranco	4	1	—	—	8	13
Ederer	3	8	1	1	1	14
Manitowoc	—	—	—	—	1	1
Kone Cranes	1	—	—	—	—	1
Total	44	15	4	4	20	87

Source: Industry data

Exhibit 5 Harnischfeger Industries: Financial Summary ($ millions)

	1983	**1984**	**1985**	**1986**	**1987**	**1988**	**1989**	**1990**
Sales and Other Revenues	220.2	298.9	370.4	727.1	974.1	1208.6	1482.8	1777.0
Cost of Sales	169.8	235.5	302.9	584.8	770.4	956.6	1172.0	1438.1
Product Development, Selling and Administrative Expenses	52.7	40.8	38.2	102.5	160.4	182.6	204.4	215.4
Operating Income	(2.3)	22.6	29.3	39.9	43.3	69.3	106.4	123.5
Interest Income (Expense)	(3.0)	(5.9)	(3.3)	(4.0)	(11.3)	(9.3)	2.4	8.2
Provision for Income Taxes	0.9	(7.8)	(8.5)	(15.7)	(14.4)	(16.8)	(38.1)	(44.8)
Other Deductions	(30.1)	6.2	(1.3)	(18.9)	5.3	(28.8)	(0.1)	(13.9)
Net Income	(34.6)	15.1	16.2	1.3	22.9	14.4	70.6	73.1
Total Assets	415.4	472.7	640.2	966.9	1070.7	1166.7	1370.0	1576.5
Long-term Obligations	152.6	136.4	136.2	168.0	167.9	83.9	120.9	115.2
Shareholders' Equity	109.9	147.4	228.4	212.2	323.4	461.4	513.9	582.6
Current Assets	314.4	349.3	516.3	637.2	661.3	702.4	895.4	1009.7
Current Liabilities	123.5	117.2	139.8	341.7	373.6	430.5	534.0	644.1

Source: Harnischfeger Industries Annual Reports

Exhibit 6 Harnischfeger Industries: Business Segment Results ($ millions)

	1983	1984	1985	1986	1987	1988	1989	1990
Net Sales								
Systems Group	21.3	22.9	59.5	62.7	194.0[2]	245.0	212.9	235.6
Papermaking Machinery and Systems	—	—	—	345.9[1]	492.0	697.1	898.9	1105.0
Mining Equipment	105.0	169.6	199.4	197.7	173.5	151.7	254.5	303.7
Material Handling Equipment	92.6	102.8	108.4	107.4	98.1	93.7	100.4	117.5
Total	218.9	295.3	367.3	713.7	957.6	1187.5	1466.7	1761.8
Operating Income								
Systems Group	0.2	(0.2)	2.2	(6.2)	15.6[2]	20.9	16.3	11.7
Papermaking Machinery and Systems	—	—	—	41.3[1]	34.6	63.5	86.2	98.3
Mining Equipment	3.9	22.1	31.6	24.5	19.1	10.9	22.8	25.3
Material Handling Equipment	6.8	9.1	5.9	(3.1)	(7.0)	(5.2)	2.7	8.4
Total	10.9	31.0	39.7	56.5	62.3	90.1	128.0	143.7
Identifiable Assets								
Systems Group	n/a	6.0	21.0	18.5	151.7[2]	146.6	147.6	149.1
Papermaking Machinery and Systems	—	—	—	528.6[1]	552.7	649.8	781.0	945.7
Mining Equipment	105.1	118.0	135.3	134.4	127.0	163.6	248.2	295.7
Material Handling Equipment	n/a	89.0	100.3	86.0	74.9	78.2	83.4	96.8
Total	190.0	213.0	256.6	767.5	906.3	1038.2	1260.2	1487.3

(1) Reflects acquisition of Beloit Corporation
(2) Reflects acquisition of Syscon Corporation

Source: Harnischfeger Industries Annual Reports

Exhibit 7 Harnischfeger Industries: Material Handling Equipment Division Organization Chart