EFFECTS OF A PREFERRED VENDOR RELATIONSHIP ON AN ELECTRICAL COMPONENT SUPPLIER AND AN ELECTRICAL CONTRACTOR: A CASE STUDY

Caren A. Crutcher[1], Kenneth D. Walsh[2], James C. Hershauer[3], and Iris D. Tommelein[4]

ABSTRACT

Proven supply chain management techniques hold much promise for the further development of construction as an industry, in terms of gaining efficiencies and streamlining processes. Because construction processes rely so heavily on people working together, examining new ways that participants on a project communicate and form relationships is vital to the advancement of the construction industry.

This paper focuses on a case study that explores the effects of a strategic partnership directly observed in practice. This partnership evolved to support an alliance formed between a major owner/client, a general contractor, a mechanical contractor and an electrical contractor. The partnership is a preferred vendor relationship between the electrical contractor and an electrical component supplier. In this sense, the partnership on which the case focuses is one tier removed from the alliance, from a supply chain perspective.

The implementation of this strategic partnership involved restructuring the process for procuring non-engineered, commodity type electrical components. This restructuring resulted in marked increases in productivity, reduction of inventory, and in efficiencies gained in material handling.

KEY WORDS

Supply chain management, construction supply chain, strategic partnering, inventory management, electrical contractor, distributor.

[1] Graduate Research Assistant, Del E. Webb School of Construction, Arizona State University, Tempe, AZ, USA, 85287-0204, 480-965-3615, FAX: 480-965-1769, caren.crutcher@asu.edu

[2] Associate Professor, Del E. Webb School of Construction, Arizona State University, Tempe, AZ, USA, 85287-0204, 480-965-3615, FAX: 480-965-1769, ken.walsh@asu.edu

[3] Professor, Department of Management, Arizona State University, Tempe, AZ, USA, 85287-4006, james.hershauer@asu.edu

[4] Professor, Civil and Environmental Engineering, University of California at Berkeley, 215-A McLaughlin Hall, Berkeley, CA 94720-1712, USA, 510-643-8678, FAX: 510-643-8919, tommelein@ce.berkeley.edu

INTRODUCTION

This paper presents a case study of the preferred vendor relationship between an electrical contractor and an electrical component supplier (distributor). The focus of the case study is the supply chain for procuring electrical components, consisting of Indianapolis Electric (Indy) as contractor, Kirby Risk (Kirby) as distributor, and Eli Lilly (Lilly) as end customer. Indy largely drove improvements in the supply relationship for Lilly projects. Supplying materials to the job site *when* needed, with little variability in delivery either before or after, has always been a challenge. This case involves reexamining the material procurement process. The intent is to illustrate one method of procurement of low cost, commodity products that resulted in efficiencies realized by all participants in a construction setting; the goal is to highlight the substantial impact this seemingly small relationship has had on the entire supply chain. The potential implications of the formation of similar relationships across other areas of the supply chain must be considered.

The key business issues that drove Indy to move toward a preferred vendor relationship with Kirby were the small markups and excessive chain-of-command/paper trail required by the previous material procurement process. Consequently, after being awarded its first maintenance contract by Lilly in 1995, Indy's goal was to drive inefficiencies out of the system by which projects had historically been completed, in an effort to focus on measurably increasing productivity. As a result, in addition to the internal improvements Indy has experienced, Lilly has experienced enhanced reliability and performance.

The drivers behind the key business issues were several. Primarily, Indy identified a need to eliminate lost labor time spent by workers searching for needed materials and equipment. In a work sampling study, from a sample of 22 projects, O'Brien and Associates (1988) observed that, on average, only 32% of a mechanical/electrical tradesman's day is spent performing fully productive work. By gaining efficiencies in transportation and material handling, both internally on specific job sites and externally in material deliveries to job sites, Indy increased utilization rates from about 20% to about 51%, substantially exceeding the average.

In 1996, Indy realized that the best overall solution to achieve its goals was to form a preferred vendor relationship with Kirby. While specific data on the number of suppliers previously used and the percentage of business done with each supplier was not available from Indy, it was revealed that Kirby was previously the largest supplier to Indy. For this reason, the focus shall be on improvements made in the relationship between Indy and Kirby. Indy partnered with Kirby primarily based on its need for a local supplier capable of providing timely support for Lilly projects. Kirby was selected based on criteria including ease of ordering, timeliness and ease of deliveries, guarantee of compliance to Lilly's strict Good Manufacturing Practices, ease of returns, and pre-negotiated pricing terms. The partnership, effective since 1996, is based on a verbal agreement only. Because each party has the right to terminate the partnership for any reason, at any time, Indy and Kirby meet quarterly to discuss areas of concern and improvement.

This paper is based on an extensive literature review as applied to the case study, with a focus on strategic partnering and inventory management. In order to quantify the immediate results of the preferred vendor relationship, process maps and metrics of the "before" and

"after" states of the electrical component procurement process are presented and discussed, highlighting the observed improvements, measured by both time and cost. The "before" process map is based on anecdotal evidence gained through interviews with Indy and Kirby. The "after" process map resulted from two days of direct observation of the process from both Indy and Kirby perspectives. The results of the partnership are presented and discussed. Finally, areas of improvement are optimization are presented and discussed.

OVERVIEW

STRATEGIC PARTNERSHIPS/ALLIANCES

An overall goal in examining the supply chain must be to align the goals of the producers and consumers of the product or service. A key factor that can affect this alignment is the frequently temporal nature of supply chains in construction, as recognized by Emiliani (2000) and Koskela (1993). A means of aligning goals is through the formation of a partnership or an alliance. Key to the partnership is communication of priorities and methods, as Forker et al. (1999) note that the most apparent rift between supplier and customer actions results from differences in perception.

Because one goal of both producers and consumers should be to minimize waste by forming a value chain for the end customer, "companies which are seeking to participate in these chains on a global basis now have to decide whether to risk the potential costs of independence, or to share the potential rewards… through alliances" (Cox, 1997, p. 221). Relationships established with suppliers contribute to the team approach over the individual approach. These relationships should ultimately facilitate the countless handoffs from one trade to another that occur within a project. In order to effectively lean the entire supply chain, efforts in supplier development have proven beneficial in studies undertaken by Hines (1994) and Hahn et al. (1990).

For the purposes of this study, partnerships will be considered as having the same basic goals and structure as alliances. An alliance is defined as "a long-term relationship where participants cooperate and willingly modify their business practices to improve joint performance" (Whipple and Frankel, 2000, p. 22). According to Simchi-Levi et al. (2000), reasons for forming strategic alliances may include adding value to products, improving market access, strengthening operations, adding technological strength, enhancing strategic growth, enhancing organizational skills and building financial strength. Day (1995) and Wilson (1995) agree that no matter what the reason for forming an alliance, to be successful, the arrangement must mutually benefit all members and accomplish specific goals.

INVENTORY MANAGEMENT

Methods of inventory management have emerged in response to identifiable problems that originally plagued the retail industry: the amount of retail space required, the amount of inventory, including safety stock, that must be kept on hand, the obsolescence of inventory and the logistical nightmare of return products. "As a general rule, the party who is most able and in the best position to manage the supply relationship most efficiently should be the party who controls the supply chain" (Blatherwick 1998).

Benefits realized through inventory management methods in general include improvements in customer service levels, and thereby customer retention, and reductions of demand uncertainty, reliance on forecasting, inventory requirements and costs (Williams 2000). With the exception of reduced demand uncertainty, these are all benefits which Indy, Kirby, and ultimately Lilly share. The implementation of the basic theories of inventory management requires collaboration, reduction of redundancies, a rigid implementation framework, and continuous improvement.

To address demand uncertainty, the "bullwhip effect" refers to the tendency towards variability of inventory levels throughout different stages of a supply chain, despite seemingly constant customer demand. The well known "beer game" (Forrester 1961, Sterman 1989) illustrates this effect as variability is introduced into a supply chain. This reaction to variability reinforces the importance of striving for improvements across the supply chain as a whole, rather than focusing too strongly on one specific link. To parallel the bullwhip effect, it is the intent of the authors that by exploring the drivers behind the reduced variability achieved within the Indy-Kirby partnership, the broader implications and positive effects on the entire supply chain will be considered.

Inventory management methods are differentiated according to the level of responsibility the supplier assumes over controlling inventory. These methods can range from general inventory management, as seen in this case, to full-blown VMI. Blatherwick (1998) states: "suppliers with greater concentration and knowledge of a smaller number of products, should be able to forecast and manage the flow of those products through to the end consumer." Thus is the core of Vendor Managed Inventory (VMI), which places the control into the hands of the supplier.

The primary goal of VMI is the optimization of the supply chain as a whole, through the reduction of the total system cost. Kirby is managing inventory for Indy both by holding inventory so that Indy receives materials just-in-time (JIT) and by quickly turning orders around. Through this new management process, gains in efficiency have been realized for the distributor, contractor, and end customer. Cooke's (1998) acknowledgement of the emerging trend that is more "collaborative replenishment movement" and less VMI, accurately assesses the current preferred vendor partnership between Indy and Kirby. Through the partnership, Indy and Kirby have taken a step in the direction of VMI.

PROCUREMENT PROCESS

PREVIOUS PROCUREMENT PROCESS

Figure 1 maps the procurement process that Indy used prior to forming the partnership with Kirby. The process involved the following basic steps:

1. Indy electrical foreman created a bill of materials in the field for a specific project.
2. The foreman then either sent someone to retrieve parts from Lilly's central storage area, or sent the list to Indy's central purchasing area. The main problems that arose out of this system were foremen taking each other's parts and too many laborers walking around searching for parts. Further, because Lilly has sprawling campuses, deliveries might go to many different places across the site. In using multiple

suppliers, the driver would usually deliver to the location of his last delivery. The result was lacking consistency and timeliness of deliveries, and wasted man-hours.

3. Indy's purchasing group placed the order per one of three methods: either pulled materials directly from stock, sent the order to a distributor, or competitively bid.
4. An Indy electrician would then retrieve the materials from the central receiving area and transport them to the job site, where materials were often stored indefinitely.
5. The invoicing process between Indy and multiple distributors was tedious and slow at best. Although it takes approximately the same amount of time for Indy to receive final payment under the new system, efficiency has increased through automation, resulting in a reduction in the overhead required to process invoices and payments.

CURRENT MATERIAL PROCUREMENT PROCESS

Figure 2 maps the new streamlined process, under which orders are now faxed directly to Kirby. Kirby will routinely notify Indy if next-day delivery is not possible. Indy and Kirby will then negotiate whether or not Kirby will source the item from another supplier, in which case Indy pays the additional mark-up to Kirby. All communication occurs at the field level, eliminating two previously required procurement employees at Indy's headquarters.

The basic steps of the revised procurement system are:

1. The foreman creates the bill of materials for a work order then faxes the order to Indy's main office. An Indy Superintendent immediately reviews the order to determine if parts are on hand at the Indy office due to overstock from another project. The order is revised if necessary, then faxed to Kirby.
2. Kirby logs the order and, usually within one-hour, sends Indy an order confirmation via fax for verification, associating a price with each item and assigning an order number. As Kirby sends this fax, the materials are either already being pulled from stock to prepare the order or have been sourced from one of Kirby's 41 branch locations. Kirby's SAP system enables aggregation across all locations; trucks from each branch converge nightly on the hub in Indianapolis to cross-dock goods.
3. The Superintendent receives the order confirmation from Kirby, then transfers the price and the order number assigned by Kirby to the original order. The order now officially becomes a Purchase Order. The Superintendent compares Kirby's Order Confirmation to the original order placed by Indy. If a discrepancy is discovered, Kirby is notified immediately by phone to resolve the issue prior to shipment.
4. Material is delivered to the specified Lilly dock, where a Lilly employee signs for the package and notifies the Indy foreman via a radio.
5. Within two hours, the foreman retrieves the delivery, verifies the items against the original order and transports them to the immediate work area.
6. Kirby automatically invoices Indy every two weeks. When the invoice for the materials arrives at Indy's main office, it is matched to the original order. Indy's invoicing department matches a copy of the packing slip sent to the office by the foreman with the invoice, then prepares an invoice for Lilly. Lilly is sent a master invoice, a support invoice and a copy of the work order with all backup attached.

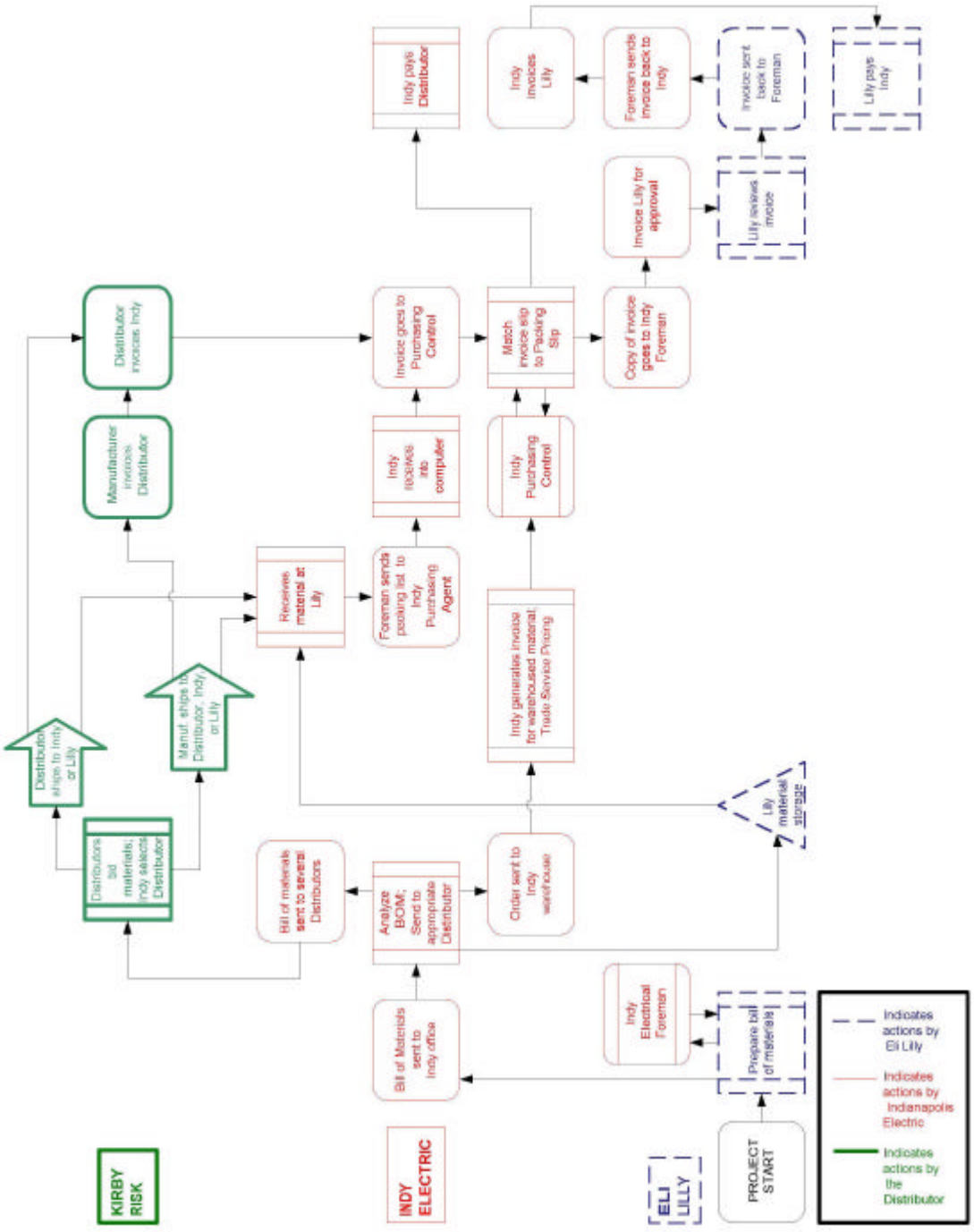

Figure 1: Previous Material Procurement Process,

Prior to Preferred Vendor Relationship

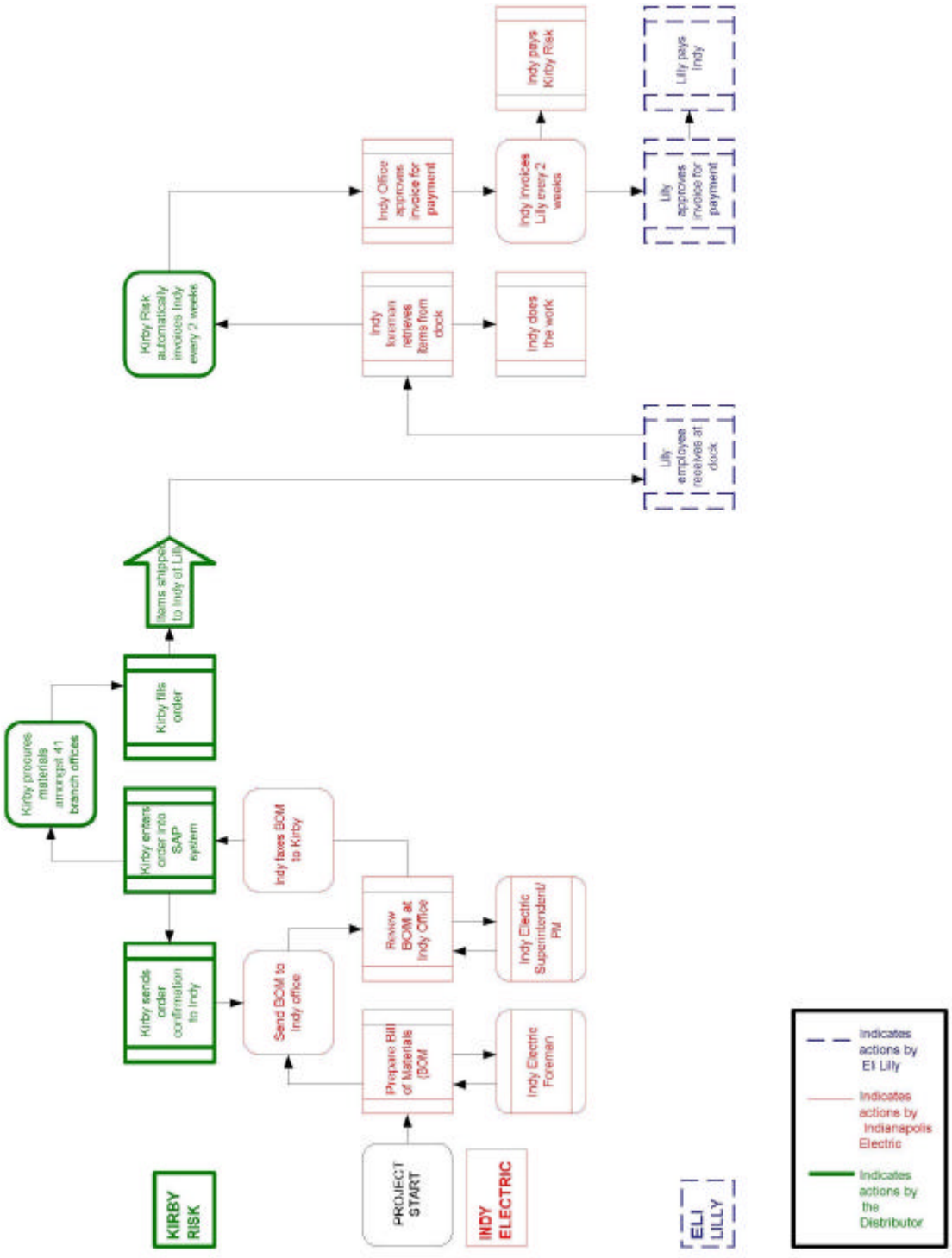

Figure 2: Revised Procurement Process,

between Indy (Contractor) and Kirby (Distributor)

ADVANTAGES OF PARTNERSHIP

Through the preferred partnership, Indy now relies on Kirby as a sole source supplier to complete work for Lilly, in contrast to the multiple suppliers that Indy used previously. Mutual goals of the preferred partnership between Indy and Kirby follow.

Reduce Non-Value Adding Activities

Due primarily to a lack of planning, Indy laborers used to waste time searching for or moving materials. For these reasons, Indy chose to focus on increasing productivity not by more closely monitoring its employees or reducing the workforce, but by simply removing any potential barriers to work. While not strictly based on the Last Planner technique (Ballard 1994), there are obvious similarities to this approach. The goal is to pre-plan to an extent to insure laborers are always supplied with both tools and materials to complete the task at hand. Each Indy foreman completes look-ahead planning of 1-2 weeks, generally to identify any custom or long lead items.

Indy has attacked the productivity issues head-on, both by implementing look-ahead planning, and by empowering all project foremen to place material orders themselves, exponentially increasing the control that individual foremen have over their projects. In addition, each laborer is made aware of what others will be doing that day, so that logistically two workers receiving directives from different foremen will not be scheduled to work on identical tasks or in identical areas simultaneously. A qualitative effect of these planning meetings on the company as a whole involves a change in morale change. When workers are allowed to see the "big picture," instead of just being assigned to isolated tasks, the attitude of the group appears to change for the better. These meetings serve to allow workers to collaborate and to address any concerns they have about the project.

As a result of the partnership, Kirby now delivers 70% of orders within two days. A total of 98% of orders are filled within five days.

Assure only Lilly Approved Materials are Supplied

Lilly uses a pre-selected pool of 26 contractors, all of whom are familiar with and remain accountable for adhering to the strict Good Manufacturing Practices guidelines that are followed on all projects. This is in sharp contrast to the multiple contractors that Lilly used previously, and the tedious and time-consuming approval and education process it was forced to impose on each new bidder.

Implement JIT Deliveries

One of Indy's primary goals is to maintain virtually no inventory. Indy currently holds approximately $20,000 in inventory at any one time, to support the projected $20M of Lilly work to be completed in 2001. By comparison, this $20,000 represents less inventory than was held to support the $1M for Lilly prior to the formation of the alliance and the partnership with Kirby. The inventory consists of overstock, pending returns, and a small stock of basic electrical components, such as fittings and supports, needed on every project. These items are typically ordered by the box, such that minimal overstock is inevitable. Furthermore, by relinquishing the powers of ordering materials to the job foreman, the

materials arrive on site when needed, consequently reducing the requirements for costly and cumbersome lay-down area at every job site.

The partnership has enabled Indy to place orders closer to the time when items are actually required on site, making substantial strides toward JIT. However, there still exists an average buffer of two days from the time items are ordered until the delivery of items to the site. The fact that Kirby is holding substantial quantities of inventory precludes true JIT from occurring. This area of potential optimization will be further discussed.

Reduce Internal Overhead Costs

In 2000, Indy did $30M in volume, $15M of which was for Lilly. The projections for 2001 are $40M, including $20M for Lilly, with no increases in inventory or overhead from the previous year. By transferring ordering responsibilities to foremen, Indy has alleviated the need for several full-time employees to manage the procurement process.

Reduce Total Cost to Lilly

By being consistent in the materials used, Indy can use any overstock on the next job. Overstock is typically comprised of small, bulk-order items such as fittings. Additionally, Lilly is keeping its long-term maintenance costs to a minimum as workers have only a handful of product types to maintain. As an unwritten part of the alliance contract, Indy works with Lilly to value engineer projects prior to beginning the actual work, which provides hard-to-quantify added value for Lilly.

RESULTS

QUANTITATIVE RESULTS: METRICS

Table 1 summarizes the efficiencies gained through the revised procurement process:

	Indy's Previous Process	Indy's Revised Process
Order Process	6 days	2 days
Receive Supplier Invoice	14 days	7 days
Indy Processing Invoice	30 days	14 days
Lilly Processing Invoice	40 days	40 days
TOTAL	**90 days**	**63 days**

Table 1: Procurement Process Metrics and Values

In 1997, Lilly formed the Central Indiana Alliance (CIA) with Indy (Electrical Contractor), BMW (Mechanical Contractor) and F.A. Wilhelm (General Contractor). Each alliance contractor is available to Lilly under reimbursable, cost-plus contract for Maintenance Projects of less than $1M and Small Projects ranging from $1M to $5M, without bidding each project. Lilly has renewed the contract each year due to measurable annual gains in efficiency achieved by each alliance member.

The CIA Year End Report (Messick 1999) describes the success: "The savings documented for 1998 were $6.32M. Our goal was $5.5M (which represents more than 10% of the total volume of work). The savings are generated by an improved safety record,

reduced rates/markups, streamlined business processes, eliminating redundancy, decreased design costs, value engineering, constructability reviews, etc."

Table 2 summarizes Lilly's projected savings for 1999. Actual results were not available for comparison. Total projected savings for 1999 were $5.81M. This analysis only includes items directly resulting from Indy's procurement efforts; the balance of the savings is attributable to the other alliance contractors

Reduce/consolidate contractor office and storage area	$71,000
Delete onsite trucks of displaced contractors	$33,000
Streamlined invoicing procedure (no sign-offs)	$218,000
Reduction of non-value added work by Indy employees	$700,000
Increased productivity of Indy employees	$1,050,000
More efficient utilization of Lilly Personnel	$350,000
Reduced fee structure for Alliance Contractors	$786,000
Procurement of material through Lilly Alliances	$55,000
A/E Savings	$624,000
TOTAL SAVINGS	**$3,887,000**

Table 2: Projected Savings for 1999, Resulting from Indy's Reduction of Redundant Services

QUALITATIVE RESULTS: WIN-WIN-WIN

Three key changes occurred almost simultaneously as a result of Lilly's issuance of a maintenance contract to Indy in 1995 and the subsequent formation of the Alliance in 1997:

1. The *process of placing orders* was refined by Indy and implemented at all Lilly sites.
2. Kirby's *material list was standardized* in the form of a catalog that was created by Indy and distributed to all foremen.
3. The *delivery of orders* to Lilly sites was significantly transformed by the following efforts, which occurred gradually through the continuous improvement process:
   - Twice per day deliveries by Kirby to Lilly sites. The foreman's name, job number and purchase order number were added to each order, for ease in tracking.
   - The Kirby delivery drivers were equipped with radios to enable them to notify the foremen of deliveries. This improvement is of key importance as Lilly has multiple campuses, each one with several delivery docks.
   - Radios and fax machines were provided to all Indy foremen to enhance communication with both the central Indy office and with Kirby.

The long-term effects have been the drastic reduction in inventory held by Indy, the virtual elimination of overhead and equipment maintained by Indy, and the marked productivity increases due to materials now being delivered to specific job sites. Indy has experienced a 600% increase in the volume of business it does with Kirby, from $50K in 1995 to $3M in 2000, resulting in Indy giving less work to alternate suppliers. This increase is due to both Lilly's general volume increase and Indy's streamlined delivery methods.

Decreased costs to Indy have been realized in many forms. By reducing the volume of inventory being held, Indy has decreased the number of storage trailers required. In addition, since Indy employees no longer leave the jobsite to procure materials or to move materials,

Indy now maintains only three company vehicles, fewer than before. The repetition of similar project types (i.e., renovation of existing office or lab space) enables Indy to estimate material demands accurately when a new project begins. Finally, Kirby currently acts as a buffer for Indy's variable demand by holding inventory. By consolidating buffers at this a single point, Indy has realized bottom-line savings.

As the customer, Lilly reports having projects completed on time and closer to budget than before the formation of the alliance. Part of the reason for this is that all prices and mark-ups are pre-negotiated, so that it is easier to make a more accurate cost estimate prior to beginning construction. It is also easier to predict with more accuracy the labor-hours required for projects, since productivity has reached a more consistent level across all projects that Indy completes for Lilly. Twice per day deliveries of materials are predictable and reduce the amount of lay-down area required on each project. Furthermore, Lilly is just beginning to experience long-term benefits such as reduced maintenance costs due to standardization of parts. Lilly no longer has to approve new contractors for each new project.

Through the standardization of materials supplied, Kirby has reduced the number of items to be tracked in inventory. Kirby has increased the volume of maintenance materials it supplies directly to Lilly from $1M to $2M as a result of the name recognition the company has gained through the partnership with Indy. Indy enjoys quick delivery of standard materials ordered from the Kirby "catalog", which was assembled by Indy. However, high variability still exists in the lead times of these items.

Also as a direct result of the partnership, the volume of work that Kirby does with Indy has increased. Due to the close nature of the two companies, Indy tends to rely on Kirby for projects with many other customers. However, Indy maintains the preferred vendor relationship with Kirby only.

CONTINUOUS IMPROVEMENT POSSIBILITIES

Opportunities for improvement within the revised material procurement process are:

- (Step 1) E-procurement by Indy for even more immediate processing and delivery would help to further eliminate redundancy within the procurement system. The turnaround time to produce an order confirmation could be reduced by enabling an Indy foreman to input the material order into a palmtop, and then electronically sending to Kirby. Because most items are ordered out of the catalog assembled by Indy, prices would be automatically associated with the orders when input. This process would make same day deliveries feasible. The possibility of transposing digits of the item number, which could alter the item ordered, would be eliminated.
- (Step 1) Each Indy foreman maintains a small central storage area. Because these areas are within Lilly facilities, the only costs incurred by Indy for these storage areas are the actual costs of the stored inventory. However, 90% of the items stored in these areas are items that Kirby regularly stocks. The current justification for these areas is the sprawling nature of Lilly's campuses. Minimization of these inventories would translate directly to bottom-line savings.
- (Step 3) Eliminate superintendent order review. Indy should not be holding any overstock inventory.

- (Step 7) Kirby could generate an invoice with the markup previously agreed upon between Indy and Lilly, to be sent directly to Lilly.
- Kirby currently does not aggregate materials requirements across projects, which may be an area for Kirby to further explore.

POSSIBLE OPTIMIZATION APPROACHES

Opportunities exist for further optimization of material supply to Lilly job sites:

- An integral part of inventory management is Electronic Data Interchange (EDI), the electronic transfer of data over a network. Through the use of its SAP system, Kirby has the ability to manage inventory through an electronic database, but this ability has not yet been exploited. The introduction of EDI would further streamline the process.
- Bar-coding by Kirby for enhanced inventory management, exploited through SAP.
- Since the establishment of the preferred vendor relationship between Indy and Kirby, Kirby is holding more inventory than before based on the sheer increase in volume; however, Kirby feels that the amount has not increased, when measured as a percentage of volume. The ideal would be for Kirby to receive its inventory just-in-time as well, so that the effects of reduced inventory carrying costs are realized across the entire supply chain. For Kirby to receive items just-in-time, an accurate estimate of demand for products must first be realized. Kirby's education of its vendors to lean the supply chain further will be lengthy, with no immediately measurable results.

CONCLUSIONS

Because of its relationship with Kirby, Indy has changed the way it does business beyond its work for Lilly. Indy's electrical work represents 67% of the total $27M in electrical maintenance/construction projects that Lilly contracted in Indianapolis in 2000. Efficiencies gained by Indy, Kirby and Lilly should encourage them to seek similar gains in other areas, with other allies, whether by growing existing relationships or by forging new ones.

The key outputs of the strategic partnership were the restructured flow of the procurement process and the virtual elimination of traditional bid negotiation by the electrical contractor. These results were made possible by empowering the foreman and changing the chain-of-command that the information flow must follow. Placing inventory management in the hands of the supply chain member who is most adept at that skill allows for economies of scale and facilitates pulling resources from upstream.

The findings of this case study must be kept in the proper context. For this reason, it is important to re-emphasize that this case focused on standardized, commodity-type products. Therefore, similar results may not be expected of drastically different cases involving high cost, long lead, or highly customized components.

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