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STRATEGIC ERP
EXTENSION AND USE

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At its most basic level, vendor managed inventory (VMI) is an inventory replenishment program in which the supplier makes the inventory replenishment decisions for the customer. The supplier monitors the customer’s inventory levels and replenishes the inventory when necessary, based on prespecified inventory- and service-level targets. The customer benefits from higher product availability and lower inventory costs. The supplier benefits from lower overall costs (especially through reduction of the “bullwhip” effect), marketplace differentiation, and increased customer retention and sales due to the value-added services it provides. The supplier can be a manufacturer or distributor. The customer is any organization one tier downstream from the supplier, such as a manufacturer, distributor, retailer, or end user.

In the traditional customer-managed approach to inventory replenishment (called “retailer managed inventory” in some industries), the customer independently makes inventory reorder decisions and initiates the purchase order. The supplier’s role is limited to communicating pricing and product availability and the actual provision of the goods.

With VMI, the supplier relies on real-time inventory status information or periodic snapshots of the customer’s inventory status (e.g., daily inventory level counts). Inventory status and other relevant information is typically made available by the customer to the supplier via electronic communication from the customer’s ERP, point-of-sale (POS) systems, or other electronic information systems to the supplier’s inventory planning and management systems. Manual systems, although less common, exist as well. The supplier and customer pair in a VMI program is referred to as a “partnership.”

There are two essential aspects that make VMI different from traditional approaches. First, there is information sharing (or information visibility) that extends well beyond the data required for simple order placement. Second, there is collaboration between the two parties. VMI programs typically require up-front, joint decision making about inventory level targets, reorder points, replenishment frequency, and other inventory policy agreements to guide the implementation. In constructing these agreements, the supplier considers prior customer usage histories and forecasts. The information sharing and collaboration require a notable level of trust between the parties. That is particularly true for the customer who must divulge proprietary information and relinquish tactical ordering decisions to the supplier.

The term VMI is often confusing in practice. VMI goes by many names, including supplier managed inventory, automatic replenishment programs, and continuous replenishment. In the consumer retail arena (e.g., apparel), VMI is called efficient consumer response and quick response. Also confusing is that VMI is, in a sense, a misnomer because it implies no involvement by the customer. The customer is involved, but with up-front planning rather than with tactical inventory management. Accordingly, the alternative terms comanaged inventory and supplier-assisted inventory replenishment are used by some companies.

Variations in Form

VMI programs differ considerably in practice, and those differences can be categorized into three dimensions: collaborative intensity, technology intensity, and program complexity (see Figure 8.1).

First, the level of collaborative intensity of VMI programs varies based on the extent of joint planning and management and on what information is shared. By definition, VMI requires information sharing. However, the amount of information sharing can vary (e.g., length of the time-horizon of the historical product usage data shared with the supplier, amount of the customer’s downstream demand or forecast data shared with the supplier, and granularity of the shared data). VMI programs vary
Value Extensions Beyond the Enterprise

In the words of Jacobs and Bendoly (2003), VMI is a management “concept,” while ERP is a “system” by which VMI can be achieved. (For discussions of ERP system capabilities written for the business manager, see Jacobs and Whybark [2000] and Davenport [2000].)

Third, the complexity of a VMI program differs based on the location of the given supplier-customer interface in the extended supply chain. In addition to company size and global (versus domestic) factors, program complexity can be influenced by characteristics such as the number of partners, product variety (number of SKUs), product flow volumes and velocity, and distribution options. For example, VMI programs for B2B situations tend to differ from VMI programs for B2C situations in that there are fewer customers but a greater degree of industry-specific communication standards. Some partnerships are characterized by high-volume flows of a few unique inventory items, while others involve transfer of thousands of SKUs, not all in large volumes. Some suppliers service only a few select customers, while others service hundreds of branches for a given customer. Partnerships vary in replenishment frequency from long-cycle periodicity to practically continuous replenishment. In general, replenishment frequency tends to be greater in VMI situations than in non-VMI situations because of the cost-benefit tradeoffs. Partnerships also vary in the diversity of transportation modes used to transmit inventory from supplier to customer. For example, a single VMI partnership may employ different modes at different times for different SKUs.

What VMI Is Not

VMI commonly uses EDI, but is not synonymous with EDI. EDI stands for “electronic data interchange” and involves the use of standardized electronic formats for B2B transactions such as order placement, order confirmation, and invoicing. By the early 1990s, many Fortune 500 firms had implemented custom software applications to transmit high volumes of orders and other documents electronically using EDI standards developed by industry groups or powerful buyers such as automobile manufacturers or large retailers like Kmart and Wal-Mart. VMI programs, due to their high level of transactions, also commonly use EDI standards for information exchange. However, VMI transactions can be communicated via document attachments to e-mail systems, Web-based forms (with or without XML),
File Transfer Protocol (FTP), and other electronic and telecommunication mechanisms. Small companies can also outsource their EDI requirements to value-added network providers (VANs).

VMI should not be confused with consignment inventory. In consignment situations, the supplier’s inventory resides on the customer’s premises. The customer owns the inventory and owes payment on it only when the customer draws on that inventory. In some consignment programs, the supplier actually physically manages the inventory at the customer’s site (called an “in-plant store”). Customers enter into consignment agreements to obtain increased service (inventory is available without delay) and lower costs (inventory is not owned until used). Suppliers enter into consignment agreements primarily to provide service-based competitive differentiation. The supplier off-loads inventory storage costs (e.g., secured physical space) to the customer but faces issues regarding timing of ownership, which in turn influences payment cash flows.

In general, consignment requires more human intervention and manual effort for the business transactions than VMI. However, VMI and consignment are not mutually exclusive. In many cases, both are used simultaneously on the same inventory items. VMI addresses decision making and timing of inventory replenishment, while consignment addresses timing of ownership. A concept related to consignment is that of bonded inventory or reserved product, in which the supplier prioritizes and segregates safety stock as a reserve inventory for select customers. This provides high confidence about product availability to key customers. Like consignment, reserve inventories may or may not be used with VMI.

Many VMI programs employ a demand-pull logic, including kanban order quantities, to guide the timing and quantity of inventory replenishment. The pull logic is central to the just-in-time (JIT) philosophy and has become common in the automotive industry, among others. But JIT and VMI are not the same thing. A JIT delivery (JITD) program need not have vendor managed inventories, and a VMI program need not be based on a pull logic. The JIT and VMI concepts are separate, but often used together, and as such parallel the VMI and consignment inventory situation.

A typical VMI partnership is limited to two-party situations: a supplier and a customer. In contrast, collaborative forecasting, planning, and replenishment (CFPR) involves many players in an extended supply chain who provide information such as historical product usage and forecasts to all the players in that supply chain. Multiparty collaboration based on this data can lead to effective global decision making and optimization of the extended supply chain rather than simple optimization of a given supplier-customer partnership in the supply chain. CFPR clearly involves a more complex set of players, but the individual supplier-customer partnership dyads in VMI are often deeper and stronger than links between two partners in a CFPR (multiparty) program.

Case Study: NIBCO’s VMI Program

The following case study illustrates the strategic motivation, implementation process, and performance outcomes for a new VMI program leveraging an ERP platform (Brown, Tatikonda, and Vessey, 2003).

The Company

NIBCO Incorporated is a worldwide provider of flow-control products, including valves, fittings, supports, seismic bracing, and struts used in applications for potable water, chemical and gas processing, and drain waste. Markets include residential construction, commercial construction (hotels, hospitals, and office buildings), and irrigation and environmental systems. In 2003, NIBCO had over $400 million in sales revenues, with 12 plants and four distribution centers worldwide. This privately held company was founded in 1904, is headquartered in Indiana, and employs over 2,900 people.

NIBCO manufactures more than 20,000 different stock-keeping units (SKUs). Its plastic products include valves and fittings made by injection molding of plastics resins. Its metal products include pipe fittings, valves, and other pipe products made of copper, bronze, iron, and steel that are cast, machined, and assembled. Two-thirds of NIBCO’s sales are in commodity markets; their customers include large wholesalers such as F. W. Webb, large (“big box”) retailers such as Home Depot, hardware cooperatives such as Ace Hardware, and many smaller customers. All tolled, NIBCO has approximately 9,000 customers.

By the end of the 1990s, NIBCO had become the information technology leader in its industry. By early 1998, it had successfully executed a “big-bang” implementation of all major ERP (SAP R/3) modules across its
plants, distribution centers, and headquarters (Brown and Vessey, 2002). This initial implementation was viewed as an opportunity to begin redefining the company's supply chain processes. A new director-level position for supply chain systems was created to oversee continuous improvement projects, as well as to focus on e-commerce initiatives with customers and suppliers. By the end of 2001, the company had completed two version upgrades, which provided enhanced supply chain capabilities.

**Origins of the VMI Program**

NIBCO's VMI program builds on the enabling capabilities provided by its ERP system, as well as the knowledge gained by its IT and business personnel about the capabilities of this type of packaged enterprise software. NIBCO's VMI program was envisioned as part of a multichannel e-commerce approach to customer interaction (including electronic catalogs, Web-based ordering, EDI, and other order-entry mechanisms for non-VMI customers), all supported by its ERP infrastructure.

NIBCO viewed its ongoing investments in enterprise systems as a means to not only remain viable but also increase its competitiveness and ensure significant growth in its commodity business. Three strategic thrusts help describe the motivation for VMI program implementation in particular.

1. **Greater customer service.** NIBCO could differentiate itself from competitors in its commodity industry by providing a more substantial, value-added product/service bundle. It was anticipated that this would offer its customers greater availability of products (in terms of fewer stockouts and higher fill rates), faster replenishment, greater order accuracy, and easier order placement and receipt.

2. **Increased efficiency.** The firm could reduce costs through overhead reduction, greater utilization of physical assets, reduced paperwork and administrative costs, and fewer errors, deductions, and returns. The firm could also improve cash flow through faster cash cycles and lower working capital requirements.

3. **Sales growth.** The firm could expand market opportunities. With established customers, NIBCO anticipated increased sales of currently sourced items, addition of new lines, and customer conversion to sole sourcing from NIBCO. VMI partners would be true strategic partners, with a deeper, longer-term, and more stable partnership than typical trading relationships. Customer retention and growth would accrue through increased customer loyalty and nontrivial switching costs. New customers would be attracted by the value-added product/service bundle that NIBCO could provide and competitors could not.

NIBCO's first VMI customer was a leading wholesaler whose president challenged all current and potential suppliers of copper parts in the late 1990s to provide a VMI capability. The supplier with the successful proposal would become the sole-source provider of its copper products (hundreds of SKUs). NIBCO, which at the time sourced products other than copper to this customer, prepared a detailed proposal and captured the contract. NIBCO first developed a manual process and then a fully automated replenishment process driven by its ERP system. When the customer's president made the challenge, his firm's distribution centers were near capacity. One immediate benefit of the VMI partnership was that the customer was able to delay growing its distribution centers.

Since that first customer, NIBCO has developed a deep competency in VMI, serving a number of strategic wholesale customers who enter into sole-sourcing agreements with NIBCO for high-moving commodity products. NIBCO has developed a business model to identify potential VMI customers based on sales levels and the attractiveness of a sole-sourcing arrangement to both parties. A targeted customer is typically EDI-capable and has a central distribution center, which in turn services multiple branches.

**Partner Engagement Process**

The partnership development proceeds in steps, which we describe here and illustrate in the flowchart in Figure 8.2. The initial goal is to achieve buy-in from a potential VMI partner to move forward with a trial VMI partnership. NIBCO’s marketing team makes an initial presentation to the customer, explaining the VMI concept and informing them of the types of improvements that NIBCO’s established VMI customers have achieved. If the customer shows interest and approves, then NIBCO conducts a statistical analysis to model the customer’s purchase landscape and
determine specific potential benefits for the customer. The customer’s last 24-month consumption history and sales activity data are analyzed in conjunction with customer inventory data, growth forecasts, and seasonality effects so that NIBCO can develop a VMI proposal. Based on the customer’s own critical business metrics (e.g., inventory turns and gross margin return on inventory investment), improvement projections are made and presented to the customer.

If there is customer buy-in, NIBCO and the customer then discuss and finalize execution details, including which SKUs will be affected; inventory maximums, minimums, and reorder point levels; the frequency of the replenishment cycle (weekly, biweekly, or monthly); the number of customer locations; and the improvement metrics to be tracked. These inventory policy decisions can differ for each SKU. Although NIBCO may sell thousands of SKUs to a given customer, its preference is to manage only the high-volume items via VMI and to replenish low-volume items through traditional means instead. Essentially, a Pareto analysis is conducted to trade off transactional volume complexity with “bang for the buck” in terms of which SKUs are best served by a VMI plan (often 300 to 600 SKUs).

The partners agree to a long-term, stable-rate pricing plan and a single-source relationship for the SKUs of interest. Single sourcing is essential to NIBCO to ensure data completeness and validity in terms of product usage rates, on-hand levels, and inventory level projections. Customers do typically identify a second source, but only as a contingency for emergency situations.

**Partner Implementation Process**

NIBCO works in parallel with the customer’s resources to analyze the customer data, perform EDI testing, agree to item selection and pricing terms, and gain final approval to establish the VMI relationship. NIBCO’s supply chain systems manager is responsible for the VMI program and establishes and coordinates the partnership core team. This VMI team typically consists of an inventory analyst, an EDI/information systems specialist, and the appropriate sales or account representative from NIBCO. From the customer’s side, there are three types of team participants: the purchasing manager, at least one EDI person from the customer’s IT group, and a

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**FIGURE 8.2 Typical VMI Partnership Process**

- **START**
- **PARTNER IDENTIFICATION (via business model)**
- **VIABLE PARTNER?**
  - **MARKETING PRESENTATION TO POTENTIAL CUSTOMER**
    - **PARTNER SHOWS INTEREST?**
      - **DATA COLLECTION, ANALYSIS AND DETAILED PROPOSAL**
      - **PARTNER APPROVES PROPOSAL?**
        - **PILOT PROJECT**
        - **BOTH PARTIES SATISFIED AND APPROVE FORMAL AGREEMENT**
          - **FULL-SCALE VMI PROGRAM IMPLEMENTATION**
          - **“GO-LIVE” (regular daily transactions for all SKUs)**
          - **PERIODIC PERFORMANCE REVIEW AND INVENTORY POLICY REVISION**
            - **EXIT**

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Value Extensions Beyond the Enterprise

NIBCO’s VMI approach is an automated, computer-to-computer process that utilizes its ERP system as the underlying platform and relies heavily on EDI transactions. The pilot project with each customer therefore includes testing of system-to-system EDI transactions between customer and supplier for selected SKUs. Trial runs of the inventory replenishment cycle are conducted. In the full implementation, the customer’s inventory system must submit EDI transactions to NIBCO each day for each SKU. As such, there is a significant external transaction volume that must be handled by the ERP system, and a streamlined, reliable EDI communication process is essential. Part and product references (e.g., names, part numbers, or product codes) that differ between NIBCO and the customer are translated as part of the EDI interface or via cross-references embedded in the SAP modules (such as those for Universal Product Codes [UPCs]). Other product catalog information is also electronically referenced as necessary to accommodate a specific customer’s product name and labeling needs.

Four EDI transactions are employed (see Figure 8.3). Each day, the customer system sends the product activity (EDI transaction number 852) for each SKU, which indicates, among other things, on-hand levels. NIBCO’s system then determines whether replenishment is necessary. If so, an internal (or reverse) purchase order is generated and a purchase order acknowledgment (EDI 855) is sent to the customer to indicate that an order has been placed. Later, when the order is ready to be shipped, NIBCO sends an advance ship notice (EDI 856), which indicates the order’s contents and arrival time. An electronic invoice (EDI 810) is also sent. The customer then makes payment via electronic funds transfer (EFT)—hence the financial aspects are fully electronic as well. For most customers, the physical inventory replenishment consists of a weekly truckload from NIBCO containing many SKUs.

Regular weekly conference calls are held with the customer during the initial implementation. After implementation, the NIBCO core team typically stays on the project for three to four weeks to monitor issues on a weekly basis. Then, on a quarterly basis, NIBCO communicates to customers the benefits that have been delivered, considers any relevant new forecast information, and makes inventory policy adjustments as needed.

NIBCO and its customers rigorously collect and assess VMI partnership performance data. For NIBCO and its customers, the actual benefits in terms of the overall VMI program and individual partnerships have been quite compelling. The proposed improvement levels for all VMI customers have been realized or exceeded. Relative to pre-VMI benchmarks, the customers have approximately doubled their inventory turns and reduced their inventory dollar value by one-third to one-half. These results are in line with customer benefits reported for VMI programs by other companies (IOMA Group, 2003). All in all, NIBCO’s VMI customers have seen notable benefits.

NIBCO’s VMI team has honed its organizational processes and information systems so that a new VMI partnership can be established within a period as soon as two to three weeks after customer buy-in is achieved. This relatively short time frame for fully implementing a VMI partnership is due to NIBCO’s competency in VMI program management and partnership execution.

NIBCO’s Next Steps

NIBCO was the first company in its industry to leverage its ERP infrastructure to offer VMI. Four years later, some of NIBCO’s competitors tried to implement a comprehensive VMI program but did not succeed. Although VMI customers represent a small percentage of NIBCO’s total customer base, they provide a large percentage of its sales. Overall, NIBCO is a stronger company with closer relationships to key customers as a result of its VMI program.
By 2003, NIBCO was moving forward with VMI-related activities on several fronts. First, it continues to seek additional customers for its VMI program. Second, it has applied the VMI concept "in reverse" by engaging in supplier-facing partnerships in which a supplier monitors and manages NIBCO's raw materials inventories for high-moving items. This supplier-NIBCO interface exhibits significantly lower program complexity (see Figure 8.1) because far fewer SKUs are involved than for a typical NIBCO-customer interface. NIBCO, this time as the customer, has achieved the expected VMI benefits and seeks to expand VMI to more key suppliers. This e-procurement effort further leverages the ERP system capabilities already in place. Third, NIBCO is working with industry trade organizations to help create a common, industry-wide database of parts and to help set and enhance a variety of industry-wide electronic communication standards.

The benefits of VMI have also begun to spread among NIBCO's partners. The first customer who engaged in a VMI partnership with NIBCO has since developed numerous VMI relationships with its own customers and promotes its VMI-based value-added services as a differentiator in its marketplace. NIBCO's first VMI supplier has expanded its customer-facing VMI relationships with other customers after using the NIBCO partnership as a pilot project.

**Measuring VMI Performance**

**Partnership-Level Measures**

As in all complex business processes, the benefits of VMI programs and partnerships are multidimensional (Tatikonda and Montoya-Weiss, 2001). Some benefits accrue to both the supplier and customer, while others are supplier or customer specific. Here we focus on the benefits that are, for the most part, measurable and applicable across many VMI contexts. The supplier benefits from:

1. *Improved customer service and increased customer satisfaction.*
   This is measured by greater product availability, higher fill rates (order, line, and piece) and on-time delivery, shorter delivery lead times, greater order accuracy, and order process error reduction.

2. *Greater efficiency and cost and time savings.* These effects are measured by a reduction in demand volatility (particularly through significant reductions in the “bullwhip” effect), which in turn leads to more stable production and distribution capacity requirements; reduced inventory levels (in pieces and total dollar value), increased inventory turns, and reduced inventory space requirements; reduced overhead, administrative, and transactional costs (through the replacement of manual processes with automated ones and through prenegotiated agreements) and associated error avoidance; working capital reductions due to lower inventory levels (without reduced sales); and shorter cash-to-cash cycles (due to faster inventory flows, electronic funds transfer, and even shortened payment terms in some cases).

3. *Strengthened business relationships.* This is observed through initiation of strategic partnerships with established customers and attraction of new customers who seek the differentiated product/service bundle.

The customer benefits as well from effects similar to the first two benefits listed in (1) and (2) above. From the customer's perspective, it is not volatility of demand that is reduced, but rather a reduction in supply uncertainty. Inventory savings and inventory turns increases are likely to be more pronounced for customers than for suppliers. The customer gains administrative efficiencies by reducing procurement personnel, overhead, and errors. In addition, the customer, through its own greater product availability, provides increased service levels (higher fill rates) and other differentiating aspects to its own customers, in turn leading to some of the beneficial effects listed in the last bullet above.

Early benefits are, in part, dependent on the customer's initial inventory condition. The timing of benefits for some customers is slower as excess inventories (typically hedging or "just-in-case" inventories) acquired pre-VMI are worked off. There is a large, but one-time, inventory level reduction. During this time, the supplier typically faces reduced sales (similarly a one-time event).

A recent study found that VMI suppliers enjoyed an average inventory reduction of 35% and an average inventory turns increase of 53%. Companies also reported faster replenishment lead times, increased fill rates, and increased sales (Asgekar and Suleski, 2003).
Other Relevant Measures

There are also benefits at the program level (that is, the supplier firm's overall portfolio of VMI partnerships). For example, the supplier gains deeper insight into its customers' actual needs, particularly through visibility into actual customer consumption levels. This makes it possible for the supplier to consider and prioritize the needs of all VMI partners. The supplier can make priority allocation decisions rather than treating all customer orders as equally important. This approach optimizes the supplier's asset utilization and increases customer service.

Admittedly, it is difficult to parse out benefits that accrue solely due to the VMI aspects of the partnership (that is, vendor decision making regarding the timing and quantity of replenishment) because there are commingled factors in many VMI programs. These factors would themselves alone logically lead to some benefits. Such factors include electronic communication methods (e.g., increased speed and decreased transaction costs due to EDI and EFT), the “demand-pull” philosophy of inventory replenishment (versus the traditional “forecast push” approach, which tends to lead to higher inventory levels), and strategic partnership aspects (including long-term, stable-price contracts and sole-sourcing relationships).

Other measures could be listed as well because different industry contexts call for different objectives. For example, noncommodity and retail VMI situations have some benefits that are distinct from those in commodity situations. In the case of noncommodity products, part innovation by the supplier and joint product innovation between supplier and customer are benefits that could arise from VMI partnerships. Both partners benefit from less costly and simpler transitions (“changeovers”) when established parts are replaced with new ones (due to upgrades, engineering changes, etc.). Other measures appropriate for some situations include part quality, return on (information) technology investment, and the customer's performance measures (that is, the second-tier customer's fill rates, inventory turns, and overall satisfaction).

Strategic Implications for Organizational Capabilities and Competitive Competencies

The first strategic implication is that an effective VMI program can significantly differentiate the supplier firm from its competitors and, as such, can be an essential competitive competency. The differentiated, value-added product/service bundle provided by VMI can achieve greater customer loyalty and retention, increased sales to established and new customers, longer trading relationships, and increased switching costs for customers. These aspects, combined with the internal efficiency gains of VMI, allow supplier firms to offer lower prices, provide better service, and invest for the future.

A critical question then is how lasting this marketplace differentiation might be. Competitors may join the VMI bandwagon, customers may become more sophisticated in partner selection or their willingness to share information may wane as time progresses, and emerging technologies may result in greater interface richness at ever lower costs. As shown in the NIBCO case, there is a potential for a first-mover effect. A key aspect of NIBCO’s VMI program was a sole-sourcing agreement in which new and established customers, once they were entered into a VMI program, became long-term strategic partners. Furthermore, installing and maintaining an effective VMI program is no simple matter. Although software to facilitate VMI programs and consulting services abound, there is no black-box solution. Large-scale VMI program operation requires not only a robust information technology infrastructure in terms of hardware, integrated software modules, network communications, and training, but also highly knowledgeable VMI management personnel with the ability to quite effectively engage partners and maintain individual VMI partnership relationships. Therefore, in addition to the technological capabilities, key management process skills must be obtained.

Despite the benefits afforded by standard ERP platforms, there is a significant setup cost and learning curve to all this, so there is a differentiation capability that appears difficult to imitate in the short term.

A second, related strategic implication is that the ability to support, plan, and execute both an overall VMI program and individual VMI partnerships is a fundamental, valuable organizational capability that is, in turn, a competitive competence. The ability to rapidly implement a partnership and smoothly execute, with low coordination costs, both the VMI partnerships and the VMI program as a whole is valuable. Having the technology and analytical skills in place to measure VMI performance, both proven and projected, for established and potential customers is valuable as well.
The essential aspects of VMI competence can be grouped into two areas, partnership development and program infrastructure. Partnership development consists of skills in the following areas:

- identifying promising customer partners
- persuading potential customers to buy-in to the VMI concept and the supplier's specific program
- helping the customer overcome technological and political hurdles, gain internal consensus, and develop trust with the supplier

Program infrastructure is the installation of the VMI program that then supports continuous execution of individual partnership activity. Program infrastructure consists of the following components:

- installation and ongoing operation of the essential underlying operational systems (including technology, management processes, and personnel)
- installation and ongoing operation of the VMI-specific systems functionality (including technology, management processes, and personnel)
- development and operation of the VMI performance measurement system (including data analysis and periodic audits or feedback) for partnership and program evaluation and improvement

As noted earlier, all this is not a simple matter, and there are significant installation costs. Still, those who enter into VMI activity earlier than others can go down the learning curve to be ahead of competitors in obtaining the skills for VMI partnership engagement, setup, pilot, and execution.

The third strategic implication is that an ability to effectively conduct a VMI program is, in a sense, a baby step down the path toward more sophisticated interactions with supply chain partners both upstream and downstream and at multiple tiers in the chain. A successful VMI experience confirms the supplier's ability to effectively interface with one customer in a given partnership. That is, there is confidence in the technological infrastructure, the management processes, and the ability to foster trust with a partner. Recall that VMI is more than information sharing: it requires collaboration. This essential ability to interface with another firm is a collaborative competence that can be leveraged in other arenas. For example, if the supplier firm is the focal firm of interest, then the VMI experience can serve to establish interfaces with the supplier's suppliers. VMI involves non-trivial interaction, but that interaction is only on the outer edges of the boundaries of the two firms. VMI experience can serve as a basis for richer and deeper interactions in established partnerships, ranging from two-company integrated inventory-planning systems to collaborative development of new products. And it may help the firm contribute to, and operate in, a multi-tier CFPR-like environment more successfully.

Outlooks for VMI Growth

Overcoming the Barriers

In general, the factors in Table 8.1 appear to be those most commonly associated with implementation of VMI partnerships and with VMI partnership effectiveness. The inverse of these factors can be seen as barriers to VMI implementation and success. Finding ways to reduce or overcome these barriers would allow growth in the number and depth of VMI partnerships. As one example, consider the high "bang for the buck" SKU items. Currently, VMI programs are applied primarily to higher volume SKUs. Should VMI be extended to B and C parts? And if so, then what is required for VMI to be made viable for those items? As a start, the traditional inventory control prioritization of A, B, and C items could be extended into the VMI context. As such, B and C items would be monitored less often by the supplier, perhaps once a month rather than once a day as might be done with A items.

Systems Integration

There are intra-firm and inter-firm technology barriers to seamless electronic VMI operation. Each linkage depicted in Figure 8.4 is a potential technology barrier. Some companies conduct VMI with some manual intervention, and others utilize vendors to perform intermediary roles. Although Internet-based EDI systems provide for standardized communications across different computer platforms, smaller companies that do not have integrated, cross-functional transaction systems (such as those afforded by ERP platforms), as well as firms of any size that do not have VMI functionality well integrated into their enterprise system, face internal integration
Factors associated with VMI partnership implementation and effectiveness

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<th>Characteristics</th>
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<tr>
<td>• Customer has established electronic capabilities (EDI in place)</td>
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<td>• Customer employs centralized inventory planning (even if customer has many branches)</td>
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<tr>
<td>• VMI partner represents a significant percentage of supplier’s sales</td>
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<tr>
<th>Product characteristics</th>
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<tbody>
<tr>
<td>• High-volume, fast-moving items</td>
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<tr>
<td>• High “bang for the buck” items (these SKUs represent a large percentage of the supplier’s sales)</td>
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<tr>
<td>• High product unit accountability (discrete, unitized, countable pieces)</td>
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<tr>
<td>• Highly defined part reference and communication standards for the industry</td>
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<th>Partnership characteristics</th>
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<tbody>
<tr>
<td>• Customer willing to collect and share proprietary information with supplier</td>
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<tr>
<td>• Customer has sufficient personnel and management resources for implementation</td>
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<tr>
<td>• Customer and supplier trust each other</td>
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<tr>
<td>• Potential employee resistance is managed (especially among customer’s purchasing/procurement personnel and supplier’s sales representatives/agents)</td>
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Finally, even with VMI, there is dependence on an intermediate party between the supplier and customer—the logistics entity involved in the actual physical distribution of the goods. The logistics entity may be internal or external to the supplier. Subsequent to VMI implementation, it is common for replenishment deliveries to increase in frequency while replenishment quantities decrease for a given SKU. The increased shipping costs are defrayed through better freight consolidation capabilities that arise through increased visibility into customer requirements. Still, system integration with the shipper can be further developed, and better models and techniques for incorporating the shipper into the VMI process are necessary.

Performance Measurement Systems

There is a pressing need for better VMI performance measurement capabilities. Industry needs comprehensive, practical models of the strategic and tactical costs and benefits of VMI opportunities, implementation, and execution. Metrics for costs, inventory, and service currently exist, but quantifiable measures of the benefits of strategic partnerships and market growth opportunities brought about by VMI would be especially helpful. Also needed are performance measures that span three or more players in a supply chain (3+ echelons). Current VMI effectiveness measures focus on a single organization (e.g., the customer’s inventory levels) or the customer-supplier dyad (e.g., fill rates). To our knowledge, measures to assess the benefits of linking the supplier to the customer’s customer are not usually captured.

Technological Progress

To some firms, it is simply too costly to purchase, install, and operate VMI software functionality that can be integrated with their existing enterprise systems. However, the availability of dedicated VMI software packages from ERP vendors and other software firms is increasing, and installation is easier and less costly than in the past. XML and other Internet standards for communicating electronic transactions are developing and offer alternative solutions that may be cheaper than EDI in some cases. Together these factors increase the population of firms, especially smaller firms, that can afford to engage in VMI (at least as customers).
A constant challenge is the conversion and synchronization of one firm's part numbers to another's. The development and usage of common industry standards and part databases are accelerating, and industry-wide systems that act as universal translators are coming into play. With this increase in industry-wide standards and systems developed for supply-chain partners, VMI partnership setups should become faster and simpler. For the supplier, this makes it economical to enter into more partnerships. However, the customer gains an advantage as well because switching costs will also go down.

Some firms have the types of parts that lend themselves to automated inventory level monitoring (e.g., through point-of-sale systems). These are typically unitized, discrete-part types of items. Automated monitoring is more challenging for bulk-type items, and currently, sophisticated weighing, volumetric, optical sensor, and other techniques are employed. As technologies progress and their costs fall and with the increasing functionality of bar codes and RFID (radio-frequency identification), the ability to monitor inventories becomes physically easier and less costly. The impact of these technology-based physical unit measurement and tracking systems will be significant going forward and will make VMI feasible for more firms and products.

Conclusions

VMI is clearly a win-win relationship for both customer and supplier. VMI represents an essential, initial step toward the electronically integrated extended supply chain. The firm that moves early to implement customer-facing VMI may be able to lock-in customers. Successful early adopters may also be able to leverage a learning curve advantage. On the other hand, partner implementation costs may be lower for late adopters due to enhanced technological capabilities, facilitated translation of part references, and greater understanding and acceptability of VMI by customers.

Suppliers, particularly those seeking to smooth out their product demand (i.e., mitigate the "bullwhip" effect), have an additional motivation to convince customers to adopt VMI. However, in some industries in which customers have high buyer power (e.g., electronics manufacturing and automobile manufacturing), it is the customers that demand VMI from their suppliers. As less powerful customers become more technologically sophisticated, they may also demand VMI partnerships. In operations strategy terminology (Hill, 1999), the supplier's ability to offer VMI may be an "order winner" characteristic today, but will become an "order qualifier" characteristic in time. What is a competitive advantage today may become a competitive necessity tomorrow. Firms need to assess trends in their industries to anticipate customer demands for VMI as a basic supplier capability.

Furthermore, firms with a robust enterprise system architecture that includes integrated back-office systems and e-commerce capabilities have the technological advantage today for quickly ramping up a large-scale VMI program. The vendors of the first-wave ERP packages of the 1990s now offer supply chain and customer relationship management (CRM) modules to support multichannel interactions with customers and efficient e-procurement programs. We believe the competitive advantage of the ERP adopter rests in how well the company’s enterprise system investments are leveraged to take advantage of its own internal management competencies for multichannel approaches with customers and suppliers.