

NIBCO: mySAP™ Supply Chain Management

© 2003 by Brown, Tatikonda, Vessey

Kelley School of Business, Indiana University



Carol V. Brown, Ph.D.
Associate Professor
Kelley School of Business
Indiana University
Bloomington, IN 47405-1309
(812) 855-2607
cbrown@indiana.edu

Mohan V. Tatikonda, D.B.A.
Associate Professor
Kelley School of Business
Indiana University
Indianapolis, IN 46202-5151
(317) 274-2751
tatikond@iupui.edu

Iris Vessey, Ph.D.
Professor
Kelley School of Business
Indiana University
Bloomington, IN 47405-1309
(812) 855-3485
ivessey@indiana.edu

Table of Contents

EXECUTIVE SUMMARY	4
OBJECTIVES	4
APPROACH	4
RESULT	4
KEY ACCOMPLISHMENTS.....	4
<i>Improved Customer-Facing Metrics</i>	4
<i>Reduced Costs</i>	5
<i>Repositioned Company for Long-Term Growth</i>	5
INTRODUCTION	5
BUSINESS.....	6
SUPPLY CHAIN CHALLENGE.....	6
FOCUSING ON CUSTOMER-FACING ISSUES IN A COMMODITY MARKET	7
REDUCING COSTS THROUGH IMPROVED BUSINESS PROCESSES	7
POSITIONING FOR LONG-TERM COMPANY GROWTH	8
INITIATIVE HISTORY AND IMPLEMENTATION APPROACH.....	8
INITIAL SAP R/3 IMPLEMENTATION PROJECT.....	8
ADDITIONAL PROJECTS COMPLETED	9
<i>Business Integration Projects</i>	10
<i>Business Improvement Projects</i>	10
<i>Business Process Innovation Projects</i>	10
PROJECT METHODOLOGY.....	11
<i>Review of Business Process Innovation Proposals</i>	11
<i>Team Structure/Roles</i>	12
<i>Project Processes</i>	13
NEW STRUCTURE AND PROCESSES FOCUSING ON SUPPLY CHAIN INNOVATIONS	13
LOOKING FORWARD: ADDITIONAL SAP INITIATIVES	14
OUTCOME	14
DEMAND-PULL PHILOSOPHY	14
THE CUSTOMER SIDE	16
<i>Customer Service</i>	17
Continuous Process Improvement.....	17
Multiple Customer Service Channels	17
<i>Vendor-Managed Inventory</i>	18
<i>Order Delivery</i>	20
Transportation Management.....	20
Leveraging Information Richness for Order Delivery	20
<i>Looking Forward: The Customer Side</i>	21
INTERNAL SUPPLY CHAIN	21
<i>Distribution Center Operations</i>	21
Wireless Scanning in Distribution Centers	22
Distribution Center Profiling.....	23
Leveraging Information Richness for Distribution.....	23
<i>Manufacturing Operations</i>	24
Production Resources and Tools	25
Production Planning and Shop Floor Scheduling	26
Leveraging Information Richness on the Shop Floor	27
<i>Looking Forward: The Internal Supply Chain Vision</i>	28
THE SUPPLIER SIDE	28
<i>Supplier Consolidation and Purchasing Economies</i>	29

<i>Collaborative Commerce through Supplier-Managed Inventory</i>	30
<i>Looking Forward: The Supply Side</i>	30
BENEFITS REALIZED: 1997 TO 2002	31
CONCLUSION	31

Executive Summary

Objectives

NIBCO INC., a midsized manufacturer of flow control products, competes in mature markets, and its commodity markets have recently undergone significant consolidation. Continually improving its supply chain efficiencies and differentiating its products with value-added services have become NIBCO's new bases of competition. NIBCO is supporting its strategy with an integrated systems platform that is also an engine for the company's long-term growth.

Approach

NIBCO initially focused on migrating to a demand-pull inventory philosophy and improving its customer-facing capabilities, while at the same time reducing its internal supply chain costs. Continuous business process improvements were initiated to improve newly visible **perfect order metrics**. Multiple customer service channels and a vendor-managed inventory (VMI) program were introduced to increase electronic ordering and enhance customer loyalty. Inventory replenishment policies and wireless scanning for warehouse management were continuously refined to improve order fulfillment accuracy and worker productivity. Cost savings were achieved from the consolidation of raw material purchasing, followed by supplier-managed inventory pilots. The structures and processes developed for its initial SAP® R/3® project have been modified for business-led process improvement and integration initiatives. mySAP™ Supply Chain Management (mySAP™ SCM), which encompasses capabilities initially implemented with SAP R/3, is enabling visibility across both internal and external supply chains while providing a solid systems architecture for long-term growth based on business integration capabilities.

Result

NIBCO is now positioned as a leader in information technology (IT)-supported business process innovation within its industry. Using mySAP SCM and other SAP solutions, NIBCO has measurably:

- Improved customer service by focusing on order accuracy, product availability, and other components of its perfect order metric
- Developed multichannel customer service capabilities and electronic partnerships for VMI
- Reduced business costs through business process improvements in both its internal and external supply chains
- Repositioned itself for competing on value-added services and electronic integration capabilities

Key Accomplishments

Improved Customer-Facing Metrics

- Increased the perfect order rate from 30% to 87%
- Improved the on-time delivery rate from 60% to 99%
- Reduced stockouts from 11% to 2%
- Reduced order-to-ship times from more than 48 hours to 8 hours for key customers
- Improvements for the customers with which NIBCO conducts VMI: improved average inventory turns 75% and decreased inventory by 30% to 50%

Reduced Costs

- Lowered inventory levels from \$102 million to \$76 million
- Improved inventory turns by 17% from 3.66 to 4.27
- Reduced annual sales and administrative costs by 19%
- Lowered annual distribution costs by 20%
- Lowered annual purchasing costs by \$6 million
- Decreased overall support staff by 16%
- Decreased customer service center staff by 40%
- Reduced financial closing cycle from 10 to 2.5 days
- Reduced baseline procurement costs by approximately \$40 million per year

Repositioned Company for Long-Term Growth

- Attracted new customers and established sole-source customers with value-added services
- Smoothed product demand through VMI
- Increased electronic share of orders from 28% to 54%
- Added a suite of Internet customer self-service capabilities
- Enhanced the number of electronic data interchange (EDI) transactions to include the complete business life cycle
- Migrated new acquisition to mySAP SCM platform within six months

Introduction

NIBCO is a worldwide provider of flow control products, including valves, fittings, hangers, supports, seismic bracing, and struts. Established in 1904 as the Northern Indiana Brass Company in Elkhart, Ind., NIBCO has grown to over \$400 million in sales revenues and 12 manufacturing facilities in the United States, Mexico, and Poland. A privately held company, NIBCO employs more than 2,900 employees, referred to internally as **associates**, and manufactures more than 20,000 different stock-keeping units (SKUs).

NIBCO's flow control products are used in several industries, including the residential and commercial construction, industrial, and irrigation markets. Its plastics manufacturing processes involve polyvinyl chloride (PVC) and acrylonitrile butadiene styrene (ABS) resins, and injection molding is used to create plastic valves and fittings. Its metals manufacturing processes involve casting, machining, and assembly of pipe fittings, valves, and other pipe products made of copper, bronze, iron, and steel.

Two-thirds of NIBCO's sales are in commodity markets. Key commodity customers include large wholesalers such as F. W. Webb; large ("big box") retailers such as Home Depot, Lowe's, and Menard's; hardware cooperatives such as Ace Hardware and True Value; and a substantial number of smaller customers. The remaining one-third of NIBCO's products are make-to-order. For its specialty products marketing, the company has a direct sales force to work with engineering firms, architectural firms, and contractors that specify the flow control products to be used in their custom projects.

In 1995, the firm developed a long-range strategic plan that called for radically improved information flows in an attempt to ensure company survival and growth. By mid-1996, NIBCO had become one of the first midsized manufacturers in North America to plan and execute a big bang implementation for multiple SAP R/3 modules. On December 30, 1997, it replaced most of its legacy systems at its headquarters, 10 domestic manufacturing plants, and four newly consolidated distribution centers.

After the go-live, NIBCO initially focused on continuous improvement of its customer-facing and internal supply chain processes to improve customer satisfaction, reduce costs, and increase revenues. Under a

new Supply Chain Systems directorship, NIBCO has engaged in a number of innovative competitive initiatives to leverage the integration capabilities of mySAP SCM (which encompasses capabilities initially implemented as SAP R/3) and other SAP solutions with both customers and suppliers. For example, successful VMI relationships have been established to provide value-added services to key wholesale customers and to smooth out NIBCO's demand. NIBCO is now also pursuing supplier-managed relationships.

The company plans to continue improvements by developing enhanced reporting and metrics, enabled by mySAP Business Intelligence, and enhancing its customer-facing processes, enabled by mySAP™ Customer Relationship Management (mySAP™ CRM). NIBCO's mySAP CRM initiative will focus on leveraging additional information and analytical capabilities throughout the sales cycle (for example, telemarketing, one-to-one marketing).

Business

NIBCO's mission is to be the worldwide choice in flow control products. It competes in mature markets: Its products are used in a variety of flow control applications associated with potable water, drain waste, and chemical and gas processing. There has recently been significant consolidation in NIBCO's customer base.

Competing on service has therefore become extremely important as a way for NIBCO to distinguish itself in commodity markets; competing on superior product quality alone is not enough. NIBCO is striving to be the manufacturer of choice not only as a result of its reliability as a supplier and low costs but also as a result of its value-added services.

Because of the low growth opportunities within its commodity markets, there is fierce competition for retaining existing customers and increasing market share. In an industry heavily dependent on distributors, increasing sales of existing products would involve major marketing efforts with the end users of its products, which could also lead to channel conflict. Other growth opportunities include acquisition of new commodity customers to provide value-added services and well-managed acquisition of related manufacturers.

These market forces combined to make effective supply chain management a pressing issue for NIBCO. The firm adopted its strategy of increasing service efficiencies and reducing internal costs in connection with its vision of how it could retain customers and improve market share.

People in NIBCO's top management were already believers in the bottom-line impacts that a well-configured enterprise system package could bring. As a privately held company, NIBCO helped to finance an owner buyout in 1999 with a one-time inventory cost savings from its initial SAP R/3 implementation. Under the continued leadership of Chairman, President, and CEO Rex Martin, the business now seeks to improve its competitive position by leveraging old and new investments in business process improvements and robust, scalable systems that integrate its internal and external supply chains.

Supply Chain Challenge

Because most of NIBCO's products are commodities, the margins are low, and there is strong competition for existing market share. When NIBCO completed its big bang implementation of SAP R/3 at the end of 1997, it improved its visibility into its supply chain processes. However, the company knew that much more was necessary to improve its business processes to better service its customers, reduce costs, and reposition the company for long-term growth. For example, executives and managers knew that in some cases they were unable to make the best decisions because they lacked broad, integrated, and

current data; customer service was characterized by excessive product stock-outs, late deliveries, and incorrect shipments; and frequent, large variations in short-term demand, the **bullwhip effect**, led to excessive manufacturing capacity and inventory levels to service these demands.

The supply chain challenges were clear. Improving the efficiency of its supply chain was a competitive necessity. NIBCO also needed to compete on value-added services as a way of distinguishing itself from its competitors in its commodity markets.

Focusing on Customer-Facing Issues in a Commodity Market

Customer-facing processes are critical in commodity markets in which there are numerous suppliers of largely undifferentiated products. Customer satisfaction with order fill rates and customer loyalty resulting from value-added services are the new bases of competition, especially in markets with significant customer consolidations. The effectiveness of customer service depends on order-taking accuracy and order fulfillment efficiency. These, in turn, require product availability and accurate available-to-promise dates. Customer service levels, calculated as the perfect order provision rate, were running at 30%.

In the past, when NIBCO received a customer order, it would be filled by a divisional distribution center closest to the customer. As part of its initial SAP R/3 implementation, NIBCO consolidated its distribution centers from 17 to 4 to better manage inventory and improve order fill rates. It also moved to a demand-pull environment. However, the company's diverse customer base and large number of SKUs make for a very complex environment:

We needed to work heavily on the distribution arm of the business.

John Hall, Director of Supply Chain Systems, NIBCO

The initial SAP R/3 implementation was just the starting point for improving customer service. Still ahead were business-led initiatives to improve business processes. Business-technology partnerships would be needed to leverage the opportunities provided by a standard enterprise system architecture with e-business capabilities.

Reducing Costs through Improved Business Processes

Because of the low profit margins in NIBCO's marketplace, competition based on low price is the norm. Hence, reducing order service, logistics, and manufacturing costs is a competitive imperative. Improvements in NIBCO's supply chain processes, both intra-organizationally and inter-organizationally, have therefore been a major focus since its SAP R/3 go-live.

To reduce costs, NIBCO needs to make better use of both its physical and human resources:

After go-live, we had a lot of processes that were labor intensive, people intensive – a lot of extra steps, paperwork issues.

John Hall, Director of Supply Chain Systems, NIBCO

When you have a process that is repeatable and consistent, then you can begin to ask, "How do I improve it?"

Rex Martin, Chairman, President, and CEO, NIBCO

Positioning for Long-Term Company Growth

In addition to focusing on its short-term survival, NIBCO needed to position itself to be profitable over the long term. Therefore, aside from increasing its revenues over the short term, NIBCO needed to invest in building relationships with its customers and suppliers and in developing a scalable IT architecture that would enable the company to easily absorb acquisitions for long-term growth.

We really see our business model with SAP to be very efficient and productive: We can add a company with different products and take them national very quickly.

Rex Martin, Chairman, President, and CEO, NIBCO

If a domestic manufacturer with the same sales and distribution channels is acquired, NIBCO could quickly integrate those channels into NIBCO's own IT platform with a minimal resource investment. Economies of scale could be achieved from consolidations with NIBCO's own functional units. NIBCO could also quickly bring an e-business capability to the customer base of the acquired firm. This would result not only in new revenues but also in a base of customers that become loyal to NIBCO.

Initiative History and Implementation Approach

In 1995, NIBCO's top management endorsed a long-range strategic plan that called for radically improved information flows for company survival and growth. At the same time, the company transitioned from a business division structure based on customer markets to a matrix structure by function and business management teams with profit and loss (P&L) responsibilities for product groups. NIBCO soon realized that it had serious problems with visibility into its internal operations: The company needed to move from a fragmented legacy system environment to an integrated system platform.

Initial SAP R/3 Implementation Project

Every time someone would stand up and [present their long-range plan], they'd say we could do this wonderful thing, "but..." and the "but" would be that we needed good systems. This led to a fundamental change in the way we viewed IT.

Rex Martin, Chairman, President, and CEO, NIBCO

Instead of being a cost of doing business that would continuously be restricted, IT became a strategic investment in the business and IT spending was almost doubled: New integrated systems were needed to enable a new cross-functional process orientation and greater returns on assets.

A business operations manager was released full time by early 1996 to develop task force recommendations for enterprise resource planning (ERP) package and implementation partner selection. NIBCO's executive leaders endorsed the internal recommendation that SAP R/3 be purchased and implemented through a big bang approach. NIBCO's selected implementation partner was IBM.

The internal project team was led by a trio of senior managers with accountabilities for business process, technology, and change management. Other company directors participated as business process experts (business review leaders), and power users from the various business functions were dedicated full time to the project team or played part-time roles as extended team members from October 1996 through the end of 1997. On December 30, 1997, NIBCO went live with version 3.0f of SAP R/3 sales and distribution, production planning, materials management (including warehouse management), and financial and controlling modules. All company employees normally included in the bonus program were rewarded

with a one-time project bonus for a successfully functioning system that was implemented on time and within the planned \$17 million budget across headquarters, 10 North American plants, and four newly consolidated distribution centers.

Additional Projects Completed

Since its initial SAP R/3 implementation, NIBCO has conducted six major projects while engaging at the same time in a number of continuous business process innovation projects. Two of the six major projects were to implement new functionality (human resources and e-business), two were integration projects (Polish operations and a new domestic acquisition), and two were SAP R/3 upgrades (to 4.0b and then to 4.6c). Exhibit 1 shows the major initiatives in which NIBCO has engaged since the SAP R/3 go-live and their timeline.

1998	1999	2000	2001	2002
<p><u>01/98</u> NIBCO implements SAP R/3 in all locations with wide variety of core functionality</p>	<p><u>03/99</u> Upgrades SAP R/3 to 4.0b</p>	<p><u>01/00</u> Implements NIBCO eCommerce</p> <p><u>04/00</u> Implements Human Resources</p>	<p><u>03/01</u> Upgrades SAP R/3 to 4.6c</p> <p><u>12/01</u> Purchases mySAP SCM and other SAP business licenses</p>	<p><u>05/02</u> Incorporates Polish business unit</p> <p><u>11/02</u> Incorporates domestic acquisition</p>

Exhibit 1: Timeline of NIBCO's Major Projects Following SAP R/3 Implementation

The two upgrades were treated as separate information systems (IS) projects with no new business functionality.

We made a strategic alignment decision to stay relatively current on both hardware and software. We try to upgrade SAP every 18 to 24 months. We have done it efficiently, although it is going to become more complex [because of integrating non-North American operations and a recent domestic acquisition].

Gary Wilson, Vice President and Chief Information Officer, NIBCO

The other major projects, as well as the continuous business process innovation projects, all involved significant business management involvement, described as follows.

Business Integration Projects

NIBCO has leveraged the knowledge gained from its initial SAP R/3 project management for its two recent integration projects with little outside consulting help. These two projects involved replacing legacy systems with mySAP SCM and other SAP solutions for an international business unit and a recent acquisition. In the company's Polish operations, SAP solutions were implemented in May 2002. This project was viewed as an internal pilot for integrating a new acquisition, and the project team created templates for future use. A domestic acquisition (TOLCO) in California was finalized in June 2002, and, five months later, a dedicated project team of business and IT associates implemented mySAP SCM and other SAP solutions in the acquired company. Although make-to-order processes were also added, about 60% of NIBCO's business processes were used without configuration changes.

We have been able to effectively take 60% of our business operating processes defined in SAP and implement them unchanged....It standardizes them with our business functionality almost immediately.

John Hall, Director of Supply Chain Systems, NIBCO

As with other SAP-related projects, a post-implementation review of the TOLCO project will be undertaken to capture the knowledge gained from this acquisition and to improve the processes and roles for subsequent domestic acquisitions.

We have a fairly good model on how to bring up remote sites and domestic acquisitions.

Rex Martin, Chairman, President, and CEO, NIBCO

Business Improvement Projects

NIBCO has conducted a number of large-scale business improvement projects since its initial implementation of the SAP R/3 software.

The human resources project brought further cost reductions. The e-business project in January 2000 was multifaceted and included launching a new Web site with product and order visibility to customers, as well as initiating the VMI program based on EDI transactions.

Business Process Innovation Projects

At the same time that NIBCO has conducted these major projects, the company has engaged in a series of continuous improvements to its business processes. In fact, NIBCO's initial implementation of SAP R/3 by January 1, 1998, has resulted in a totally different focus for the company, improving the way it does business, a process facilitated by the information provided by its SAP systems.

Now, the following interview quotes from Ken Eme, Vice President of Supply Chain at NIBCO, clearly articulate the company's current vision, as well as the utility of integrated systems:

We took the SAP implementation as an opportunity to redefine our supply chain business processes. The implementation was the trigger to make it happen. It also helped us define and communicate our supply chain philosophy.

Ken Eme, Vice President of Supply Chain, NIBCO

Having a standardized system across our network of plants helps us do many more things remotely than before. Further, it reduces our personnel training expenses and helps us leverage expertise across our plants. Personnel can move from one factory to another and be ramped up very quickly – this makes our associates even more agile and flexible.

Ken Eme, Vice President of Supply Chain, NIBCO

The standardization brought about by the SAP system provides us with complete, real-time visibility into inventory levels, production order status, and sales orders, helping us gain a better understanding of our total position and opportunities.

Ken Eme, Vice President of Supply Chain, NIBCO

Gordon McCrory, Director of Metals Manufacturing, highlights the role of the SAP solutions in both the achievements that have been gained and the future benefits envisaged:

Some of the side benefits from SAP may potentially be of the greatest benefit: for example, the things that SAP can do for us from a high performance work organization standpoint....If you believe that people closest to the work have the best ideas and can make improvements, then you need to be able to get the information to them.

Gordon McCrory, Director of Metals Manufacturing, NIBCO

The improvements NIBCO has made to its work processes involve all aspects of both its internal and external (both supply-side and customer-side) supply chains. These processes, and therefore the systems that support them, all have in common the underlying demand-pull philosophy. NIBCO's major achievements are characterized under innovations and improvements to customer service, improvements in order fulfillment, initiatives to improve manufacturing operations (the internal supply chain), and improving procurement.

Project Methodology

Experience over the years has taught NIBCO that only projects that have a significant business input and participation are successful. All business-focused projects are run by the business and completed jointly by business and information systems.

Each funded project that requires corporate IS resources follows a standard methodology, which includes established roles and responsibilities, as well as standard processes.

Review of Business Process Innovation Proposals

Ideas for improving the use of SAP software come from two sources. Some ideas come from functional area experts who are also knowledgeable about mySAP SCM. These business experts explore the software to determine processes that the business area might use to its advantage. Very small changes in configuration that do not require corporate resources may be made directly by such functional associates.

Other ideas come from areas in which an operational unit is experiencing difficulties: An analyst in the business area works with an analyst from the SAP Center of Excellence at NIBCO to determine how the current version (or new release) of mySAP SCM might be configured to address the problem. Proposals for such projects, which range in size from 80 to 8,000 hours, are submitted to an approval process by a cross-functional business review team (BRT). Approved projects need to add to the profitability of the company in at least one of three ways: Generate revenue, address compliance issues, or reduce costs.

The BRT comprises representatives from each major function (sales, marketing, manufacturing, logistics, finance, human resources/payroll), many of whom were on the original SAP R/3 project. This team now meets on a monthly basis. However, after the initial go-live, the team held weekly, multi-hour conference calls to address problems, especially those related to customer-facing issues.

Team Structure/Roles

Business innovation projects that require corporate resources are conducted under a multi-tier structure, which includes a steering committee, a core team, and a change management structure that utilizes an extended team. See Exhibit 2.

The project sponsor is at either the vice president or director level. The steering committee for the project typically consists of five to six people. For example, for a project for a specific plant site, the plant manager may serve as the site manager on the steering committee, along with a subordinate who is serving as a site project leader from the business side. Steering committee members are expected to spend about 5% of their time ensuring that the strategic needs of the process are met; they are also expected to make decisions for the core project team when an impasse is reached. Business personnel are heavily represented on the steering committee because the business is responsible for the system, the master data, and so on.

The core project team leader serves as the liaison between the steering committee and the actual project team (core team). The team leader is a person with both business and technical skill; a team may have more than one leader. A business analyst (IS) with customer-facing project management skills may lead the project or may be paired with a business co-leader when such skills are less well developed.

The goal is to get business systems analysts into the business. This makes the job so much easier, because they gain knowledge of the business side and can expand their skill sets.

John Greaves, Manager of SAP Center of Excellence, NIBCO

The team leader or leaders are responsible for conducting and monitoring the project on a day-to-day basis. The core project team typically has seven to nine persons, including two or three ultimate users of the new system (for example, from the shop floor), other business users who are driving the process changes, and one business systems analyst. A manufacturing person working for Supply Chain Systems (see Exhibit 2) is probably also on the team.

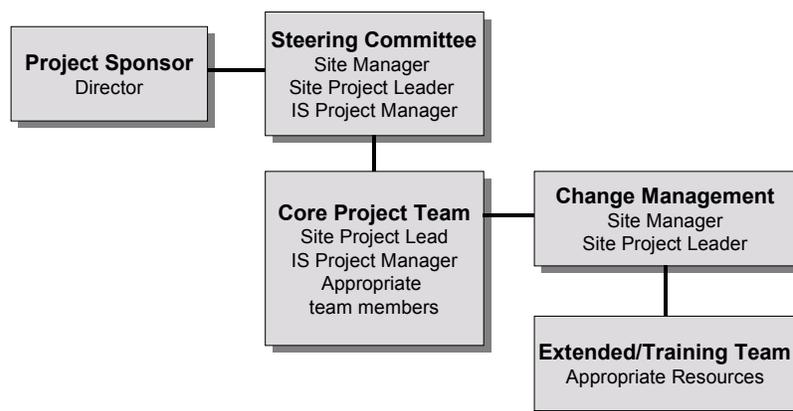


Exhibit 2: Team Structure

Change management activities, which were a key part of the initial SAP R/3 implementation, also play a role in business innovation projects and are led by business managers. For larger projects, additional change management resources are typically dedicated to the project. Finally, there are one or more extended team members. These people perform project work as needed, some of them perhaps for only a few hours. Because they, too, are accountable for success of the project, all process changes are communicated to them. In addition, they participate as trainers.

Project Processes

NIBCO has developed a stepwise methodology, supported by templates, over several years. It consists of six phases (initiation, analysis, design, building, testing, implementation), and each phase has specific activities and deliverables. Formal signoffs by appropriate business partners are part of the methodology.

The original SAP R/3 project team built its own support tool by using an Access database, called Project Office, to track all configurations and transport processes by project. Since the original go-live, the tool has been refined and expanded. Today, it contains a database of about 1,200 scenarios to test changes made to the software. The tool also captures time against projects to calculate cost charge-backs to the business. On the basis of this tool, project status is communicated on a monthly basis to NIBCO's executive team under three headings: business metrics, project tracking, and infrastructure metrics (for example, response times, network availability).

NIBCO also conducts post-project reviews sometime between 60 and 120 days after the initial implementation of a project. The review has two objectives: to ensure that the system is working as desired and to capture the knowledge gained to apply to future projects. Although the company has standardized the overall project management process, each project manager approaches a project in a slightly different way. NIBCO is seeking to capture the project knowledge gained by these managers so that the learning points can be applied to future projects under other managers.

From the viewpoint of fulfilling business process objectives, the steering committee and BRT examine the project to be sure that the process is valid and the system is delivering the intended results. When the outcome is judged satisfactory, the project receives its final business signoff and is moved to production status. From the viewpoint of improving the project methodology, NIBCO is developing a survey to seek feedback from personnel who are most affected by the project, as well as those who served on the steering committee, core team, and extended team. The survey focuses on such things as how specific things were accomplished and how well the project performed against the plan with regard to functionality delivered, delivery of the business process, and delivery of training. The process is also examined from a financial perspective: how the project performed against estimated hours, the strong points, and the areas of greatest deviation, based on budget and time.

New Structure and Processes Focusing on Supply Chain Innovations

To place more emphasis on internal supply chain innovations, the company created a new director position for Supply Chain Systems, reporting to the Vice President for Supply Chain in early 2001. Three associates with well-honed SAP knowledge and no daily operational responsibilities report to the director. These resources are dedicated to project work with the Supply Chain Systems director and the SAP Center for Excellence at NIBCO helping manufacturing plants, distribution centers, procurement, and engineering to improve their efficiency and effectiveness:

- One technical person responsible for manufacturing projects
- One business manager responsible for logistics projects (warehouse management, freight management, and so on)

- One business manager focused on EDI, customer- and supplier-managed inventory systems, and other e-business initiatives

They are totally dedicated to help [each workgroup] improve their world electronically so that we can work smarter and not harder.

John Hall, Director of Supply Chain Systems, NIBCO

NIBCO's processes for the VMI program with customers have been well honed. The manager of Supply Chain Systems responsible for the VMI program establishes and coordinates the core team. Initially, the goal is to achieve buy-in from a potential VMI partner, so that 24-month consumption history and sales activity data can be released to NIBCO in order to develop a VMI proposal. Questions that need to be addressed include the following:

- Is the replenishment cycle weekly, biweekly, or monthly?
- How many locations are targeted?
- What improvement metrics will be used for the VMI customer?

For projects that go forward, one of the challenges is working in parallel with the customer's resources to analyze the customer data, perform EDI testing, and gain final approval from management for establishing the VMI relationship.

A VMI team typically includes three types of participants from the customer site: their purchasing manager; at least one EDI person within the customer's IT group; and a logistics person in the customer's warehouse, distribution center, or branch location to which NIBCO is replenishing supply. Extended team members at NIBCO who are involved with VMI projects include customer service representatives and the managers of that customer account. Regular weekly conference calls are held with the customer during the initial implementation.

NIBCO's supplier-managed inventory (SMI) initiatives are in their infancy, and, as yet, there have been no structural changes on the supplier side of the external supply chain.

Looking Forward: Additional SAP Initiatives

In 2002, NIBCO invested in additional software purchases: mySAP™ Business Intelligence (mySAP™ BI), mySAP CRM, transportation planning, and e-procurement. For the future, NIBCO plans to use this software to support a wide variety of factory floor improvements, additional business metrics data collection and analysis, and product life cycle management (PLM) and product data management (PDM) to facilitate and streamline new product development and product redesign efforts.

Outcome

NIBCO's initial implementation of SAP R/3 laid the foundation for the company to engage in a process of continuously improving its business processes.

Demand-Pull Philosophy

NIBCO greatly restructured its supply chain process concurrently with the initial implementation of SAP R/3. The long-established forecast-push approach to supplying product to customers was replaced with a demand-pull approach. This initiative had a massive influence on all aspects of NIBCO's supply chain, cutting across customer service, the distribution system, manufacturing operations, and procurement.

Traditionally, NIBCO had collected demand forecasts from customers and constructed an aggregate forecast of future demand. These forecast figures, in turn, drove medium-term and short-term production planning decisions in which the bulk of the manufacturing activity focused on make-to-stock production. This product was then pushed from NIBCO manufacturing plants to NIBCO distribution centers (DCs) regardless of emerging short-term demand patterns – information on immediate actual sales demand was not considered or even commonly available through NIBCO’s stovepipe legacy systems.

The new approach involved a complete change in the corporation’s mind-set:

That was a huge cultural shift for NIBCO: going from a push to a pull system. It took a while to get that ingrained.

Clyde Hayes, Director of Supply Management, NIBCO

Now, product would be “pulled” through the supply chain, with the customer triggering the pull process. A customer purchases product from NIBCO, which is supplied or “pulled” from the appropriate DC. Should the supply of the given product fall below a pre-established level (the reorder point), the DC places a replenishment order with the appropriate NIBCO plant. Here the DC “pulls” product from the plant. The plant then replenishes the stock of that product, either through provision from its own finished goods inventory or through rapid production and shipment of that finished good, often in Kanban quantities (which are predetermined, fixed order quantity levels, often based on storage and shipment container sizes). In turn, the plant “pulls” raw materials and components from its own inventory and from suppliers for subsequent materials conversion at the plant. The pull philosophy embraced by NIBCO is consistent with tenets of just-in-time manufacturing and lean supply chains.

The new system is notable in two ways: first, the reliance on actual customer orders as the driver for day-to-day replenishment and production activity (versus demand forecasts as the driver) and, second, the direction of triggers for the movement of product (from the marketplace rather than from the manufacturer). The demand forecasts employed previously to guide supply of product to customers were necessarily speculative, typically inflated, and often inaccurate. In contrast, actual customer orders represent true immediate customer demand.

NIBCO embarked on this radical change to its supply chain processes with two overriding goals: to significantly increase customer service through greater product availability (in turn further differentiating NIBCO’s product/service bundle to customers in the marketplace) and to drastically cut inventory and other operating costs.

To make the demand-pull process possible, NIBCO implemented a system of **inventory zones**. Inventory zones are numerical values or ranges specifying desired inventory levels. The end product (an SKU) is typically stored at a specific DC, but in special cases, it may be stored at a manufacturing plant or even at a customer site (for example, for customers served through VMI). Statistical analyses are used to determine the maximum level of end product to maintain, the reorder point quantity, and the safety-stock level. This approach was implemented initially by evaluating the prior year’s historical demand pattern for a given SKU and aiming for a 99% product availability service level. Currently, a rolling 12-month sales demand history, along with seasonality information and customer-specific inputs, is assessed periodically to reevaluate the zone levels. Zone levels may change as often as twice a year for a given end product.

Although NIBCO had identified the need to move to a demand-pull environment before its initial SAP R/3 implementation, the migration to this approach was enabled by the SAP solution. The software is able to handle the massive volume of transactions required, as well as providing highly accurate and complete real-time information on actual customer orders, inventory levels at all relevant sites, and communication of replenishment requirements between sites. NIBCO maintains 20,000 SKUs through inventory zones.

The demand-pull process has led to many benefits at NIBCO:

- Product availability levels have increased.
- Replenishment of product to customers is faster, providing efficient and quick customer response.
- Delivery is more timely.
- Labor savings at DCs and plants have become significant as operations activity has become more attuned to actual customer requirements rather than to inflated forecasts and use of buffer capacity to cope with uncertainty.
- There have been gross reductions in the bullwhip effect, leading to smoothing of workloads throughout the supply chain and to reduced costs through less expediting, fewer rush orders, and less overtime work.
- Shop floor production now involves small batch sizes more closely matched to short-term customer demand. This reduces work-in-process and finished goods inventory levels, in turn reducing working capital requirements, physical space requirements, and inventory deterioration.
- Reduced batch sizes also increase the frequency of machine setups. This has led shop floor personnel to find creative solutions to setup time reduction and machine uptime maximization.
- To support the rapid response inherent in the demand-pull process, plant personnel have rationalized shop floor production processes to greatly reduce product flow times.
- Inventory zones allow pooling of demand and supply into relatively few locations, in turn allowing lower inventory levels while providing higher levels of customer service.
- Inventory costs have been reduced substantially.

The Customer Side

Customer-side issues are critical in commodity markets because the margins are low and there is fierce competition for existing market share. Customer-facing issues were NIBCO's first priority as it was preparing to implement SAP R/3 at the end of 1997, and they still are today.

Before the go-live, NIBCO management developed a new metric to better capture and monitor its ability to satisfy its customers. Internally called the **Big 6**, NIBCO developed a perfect order metric to capture the percentage of orders that were perfectly fulfilled. The metric is calculated by multiplying six elements, which include order accuracy, product availability, and order-to-ship timeliness. When 90% of orders are executed perfectly on each of the six dimensions, for example, the Big 6 metric is a modest 53%.

After SAP R/3 was installed, the Big 6 metric could be tracked easily on a weekly basis. In the past, the company believed that it was doing a good job of service delivery; however, using the new Big 6 metric, NIBCO found that only about 30% of its orders were perfectly executed. To keep the entire company focused on improving its Big 6 perfect order performance, Chairman, President, and CEO Martin made the metric a portion of NIBCO's annual bonus calculation, which the company pays to all salaried and hourly workers – from the CEO to the shop floor associate.

Between 1997 and 2002, NIBCO achieved a threefold improvement in its perfect order rate – from about 30% to 87%. To achieve this figure, each of the six metrics had to be executed perfectly 98% of the time.

To achieve this high level of order execution, NIBCO targeted many specific areas on the customer side of its supply chain. The customer service initiatives included continuous process improvement projects as well as the introduction of multi-channel customer service by leveraging the Internet. As part of its thrust to provide value-added services to its wholesale customers, a VMI program based on EDI transactions has been rolled out. NIBCO has also achieved greater efficiencies in its order delivery, in part by consolidating its DCs and by increasing shipment accuracy. These internal and external supply chain initiatives are described as follows.

Customer Service

You do not compete in our market any more with product and price; you've got to compete with service....The Big 6 metric became a large part of our culture.

John Hall, Director of Supply Chain Systems, NIBCO

Today when you say "Big 6," everybody in the organization knows what it means. There is a direct connection to compensation across the organization.

Jerry Whiteford, Vice President of Finance and Treasurer, NIBCO

Continuous Process Improvement

A cross-functional Customer Excellence team was established after the go-live. Once a week, the team members have a multi-hour conference call to address customer service problems that had been raised and to brainstorm ways to better leverage their SAP R/3 investment by further improving automated processes and personal customer service for different types of customers.

As the company increased its visibility to customer data, it also began to refine its Big 6 metrics to be more attuned to a customer's view of a perfect order. For example, the product availability dimension is being transitioned to track **fill rate**, which is measured first as **line fill rate** and then as **piece fill rate**.

In essence, the customer does not experience our product availability; what they experience is our fill rates. Product availability is still just a notch upstream from what the customer actually experiences.

Jim Drexinger, Vice President of Sales and Marketing, NIBCO

Multiple Customer Service Channels

NIBCO has also leveraged its SAP platform to provide multi-channel customer service through the Internet. For example, smaller customers that do not have EDI capabilities can place orders either through NIBCO's call center or at their convenience by using NIBCO's password-protected Web site: www.nibcopartner.com. Electronic order confirmation is available for all customer orders through all channels.

Since its initial SAP R/3 implementation, NIBCO has also increased its usage of EDI linkages with its large retail (big box) customers for automatic replenishment and customer service. For example, thousands of documents are transmitted directly from Home Depot to NIBCO every day. More than 50% of its sales orders are now automated, which has led to reductions in order entry errors, as well as to the capability to automate invoicing and advanced shipping notices.

Both EDI and non-EDI customers have direct online access to real-time information through NIBCO's extranet. For example, information about product availability and price quotes are available 24 hours a day, seven days a week, through direct access to NIBCO's SAP data. Customers can check open invoices and their year-to-date purchase history by product. Hot links to carriers allow customers to check the status of the delivery of a given order. NIBCO's Web-based applications also provide marketing

information to help distributors promote NIBCO's products, as well as provide remote online support to a field sales force, including engineers who work with engineering and construction firms on contract specifications to create pull-through demand for make-to-order products.

These multi-channel capabilities, along with the standardized processes used by its call center staff, have enabled NIBCO to increase its efficiencies in providing customer service; for example, the personnel in the service center have been reduced by about 40%. At the same time, NIBCO has been increasing its market share and improving its customer service performance.

Vendor-Managed Inventory

In order not only to retain customers but also to increase its market share, NIBCO needed to develop innovative ways to provide additional value-added services, particularly for key customers of its commodity products. NIBCO's objective is to become the easiest, most valued supplier with which to do business. Using mySAP SCM, the company looked for ways to develop electronic partnerships with its customers, which would increase customer loyalty and decrease its customers' switching costs.

One of its most successful innovations has been a VMI program for large wholesalers. VMI requires a large amount of transaction data on a daily or weekly basis across thousands of SKUs per customer. It therefore requires a robust enterprise system.

NIBCO's first VMI customer was a leading wholesaler whose president had challenged all current and potential copper suppliers to provide an efficient customer response capability. The company with the successful proposal would become their sole-source provider of copper products.

NIBCO captured the contract and developed first a manual process and then a fully automated replenishment process driven by mySAP SCM. Under VMI, the customer no longer places an order; instead, the customer provides a daily inventory level report electronically. NIBCO uses that report to monitor the customer's inventory levels on a daily basis, and inventory is replenished weekly. NIBCO guarantees that its customer will never run out of NIBCO products and that the customer's orders can therefore always be filled. Backup plans are developed to deal with extraordinary events.

By mid-2002, NIBCO had developed competency in VMI, providing these value-added services to eight strategic wholesale customers who entered into sole-sourcing agreements with NIBCO for specific, high-moving products. One of the primary benefits to NIBCO has been the smoothing of demand. One of the biggest difficulties in NIBCO's supply chain is that the demand from some of its large customers tends to fluctuate, which can create a bullwhip type of response to a false demand, despite the fact that the yearly demand of its largest customers is fairly stable. Price changes, orders from a new large customer, or other events can create extreme fluctuations when the marketplace really does not need the product for 30 to 60 days.

VMI has taken a tremendous amount of the bullwhip effect out of the supply chain response: our demand pull coming through the plants is now more related to what the final customer buys than it is to what our wholesaler buys.

John Hall, Director of Supply Chain Systems, NIBCO

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 also typically has a centralized inventory system servicing multiple branches.

We have a very diverse customer base out there...and their ability to make investments in information technology is radically different. A \$10 million or \$20 million business in a single location has a

radically different ability [to make investments] than a \$5 billion or \$10 billion firm, or a Home Depot at \$60 billion.

Jim Drexinger, Vice President of Sales and Marketing, NIBCO

Many of NIBCO's domestic wholesale and retail customers have already made an investment in EDI. For those that need to start from scratch, the investment includes not only technology (hardware, software, and sometimes ongoing value-added network operational costs) but also ongoing technical support personnel. The alternative is outsourcing to an EDI trading partner. Four EDI transactions are currently involved: product data activity (transaction number 852), product order acknowledgment (855), advanced ship notice (856), and invoice (810).

We replenish millions of dollars worth of inventory when the first human intervention is literally when our distribution center gets the picking list out of SAP to fulfill an order to be shipped to our VMI customer.

Jim Drexinger, Vice President of Sales and Marketing, NIBCO

NIBCO and a few of its VMI partners work with a center of technology excellence in the American Supply Association (ASA), with whom the EDI standards for wholesale distributors were developed (ASA Express). For example, NIBCO has participated in the development of standards for electronic product catalogs.

We are really dealing with an industry that is working hard to embrace technology.

Jim Drexinger, Vice President of Sales and Marketing, NIBCO

Since 1999, NIBCO's VMI team has honed its processes and systems so that a new VMI partnership can be established within a period as short as two to three weeks, once customer buy-in is achieved. A marketing team provides the initial presentation for the customer, informing them of the types of improvements that other VMI customers have already achieved; then, if there is buy-in, a statistical analysis is performed to model their purchase landscape and determine the potential benefits for the customer. The customer's past 24-month purchase activity is typically analyzed in conjunction with customer inventory data, growth forecasts, and seasonality effects. It is not uncommon for 300 to 600 SKUs to be involved. This approach is followed by a proposal for mutually agreed upon aspects of the contract, including reorder point levels for automatic replenishment. Implementing VMI in the short timeframe is facilitated by the fact that mySAP SCM allows for multiple cross-references for Universal Product Code (UPC) bar codes to accommodate a specific customer's product name and labeling needs.

Before SAP, that was difficult. Now we can have a call in the morning...and by the end of the day we have a new trading partner. It can be that easy.

Diane Krill, Director of Customer and Marketing Services, NIBCO

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. The idea is to create a unique service that is available from NIBCO alone. Having a well-honed SAP architecture to build on, as well as the experience resulting from several years of internal SAP experience, gives NIBCO an initial competitive advantage in its industry.

Without the SAP platform as the backbone, we would never have been able to get to that level of e-commerce commitment within the timeframe that was being mandated [by the customer].

Jerry Whiteford, Vice President of Finance and Treasurer, NIBCO

The benefits of the VMI program have been compelling. The critical business metrics used by NIBCO's customers are the success measures that are tracked for the VMI program; the program, for example, is sold primarily on the basis of gross margin return on inventory (GMROI). Other metrics that are tracked are the increase in the customer's inventory turns, the decrease in the customer's inventory items and dollars, and the increase in pallet or physical storage requirements. The proposed improvement levels for all VMI customers to date have been realized or exceeded.

In some cases, we cut their inventory levels quite significantly because there was a lot of hedging on their part before this [VMI] process.

Chris Mason, Manager of Supply Chain Systems, NIBCO

Order Delivery

A fundamental objective of the initial SAP R/3 implementation was to increase the amount of information available to distribution managers and workers to improve order fulfillment decision making and, hence, gain economies and improve customer service.

Customers have benefited greatly from the many delivery-focused initiatives that NIBCO has undertaken. The initiatives that have focused on improving the shipment of product to the customer in response to a customer order are outlined as follows.

Transportation Management

In 2000, NIBCO took further advantage of SAP's transportation management capabilities to better plan order shipment activities. To use the transportation management module, NIBCO designed new geographic zone systems to identify customer locations and incorporated detailed customer-specific information.

On the basis of information now visible as a result of implementing mySAP SCM, NIBCO distribution managers can better determine how to consolidate customer order shipments according to customer location and product type to optimize distribution routing, choose freight mode alternatives, and reduce overall transportation expenses.

Additional transportation management capabilities were used to better determine freight charges. Actual, detailed transportation rates could be determined, in turn allowing exploration of alternatives, more accurate billing of freight to customers, and better reconciliation of freight expenses charged to NIBCO and charged to customers.

The SAP transportation management functionality helps us identify areas where we can aggregate and consolidate our shipments to reduce our transportation expenses.

Larry Conn, Director of Logistics, NIBCO

Leveraging Information Richness for Order Delivery

NIBCO continues to implement mySAP SCM to improve order delivery and provide value-added services to the customer.

One approach that NIBCO implemented uses mySAP SCM to send a customer an electronic **advance ship notice** (ASN) once the assembly of a customer shipment is complete and transportation has been initiated. This notice tells the customer that an order will arrive, what time it will arrive, and what the order contains. This information helps the customer plan for receipt of the order (including planning labor for receiving) and helps the customer communicate expected delivery dates and times to its own downstream customers. Currently, NIBCO is implementing "verified" ASN, in which NIBCO assures the

customer that the stated items are indeed in the shipment and in the correct quantities. This initiative was based on the request of a major retail home-improvement chain. In this way, the customer need not conduct any receiving activities to determine whether the proper product and quantities have been shipped, which therefore reduces the customer's costs. This quality assurance by NIBCO is made possible by the very high accuracy of radio frequency (RF) scanning in the pick process. NIBCO also plans to install ASN functionality for interactions between its manufacturing plants and DCs.

Another significant initiative that NIBCO is pursuing in this area is the **express ship interface**. NIBCO ships many products via United Parcel Service (UPS), for example. When a shipment is weighed, shipment information, including UPS rates, will be stored directly in the SAP system.

NIBCO has also implemented **order combination** as a value-added service to customers, as well as a way of reducing its own costs. If a customer places three orders in a day, then NIBCO consolidates those orders and arranges a single shipment rather than sending three individual shipments.

Further initiatives involve using mySAP SCM for both domestic and international customers to automate both custom labeling and bills of lading. This replaces earlier manual processes.

Looking Forward: The Customer Side

NIBCO also is making plans to implement mySAP CRM functions to better understand its customers and to identify more value-added opportunities. NIBCO's CRM initiative will focus on managing customer interaction and communication, leveraging additional information and analytical capabilities throughout the sales cycle (for example, telemarketing, one-to-one marketing), and call center management, including voice integration for the call center. The VMI program continues to be a major focus, and there are numerous projects in various stages of completion. In addition, the company is exploring new and better ways to leverage its intranet and extranet capabilities that are based on the SAP platform.

Internal Supply Chain

Distribution Center Operations

The process of preparing a shipment to the customer involves the following steps: A customer order is routed to the appropriate DC according to the nature of the customer channel; the DC office converts the customer order into an internal DC shop floor pick order; DC shop floor workers pick the necessary products and place them on pallets; and, once all items have been picked, the items are collected into a shipment package to the customer. This process involves numerous support processes, including replenishment of materials at the DC through incoming shipments from NIBCO manufacturing plants, planning the physical layout of product locations in the DC, shipment order package labeling, and freight management. Exhibit 3 presents the logistics process.

It took some time for the initial SAP R/3 implementation to come to fruition. However, it greatly increased NIBCO distribution managers' visibility into detailed customer order information, the physical location and status of all customer orders, DC picking orders, product levels of each SKU in the various DCs, product replenishment shipments due from manufacturing plants, usage (activity or sales) levels of each SKU, detailed customer profile information, and historical product sales level by SKU and distribution channel.

Now my teams understand SAP very well, and it is very helpful for us in running our business. But it took a good two years to understand what it did, what it offered, and how we can continue to enhance the configuration to benefit our operations.

Larry Conn, Director of Logistics, NIBCO

At the time of its big bang SAP R/3 implementation, which included warehouse management capabilities, the DCs were consolidated from 17 geographically dispersed centers to four very large DCs.

The product gets to end use application through a tremendous web of different channels and different influences.

Jim Drexinger, Vice President of Sales and Marketing, NIBCO

Managing downstream logistics more effectively was therefore crucial to improving NIBCO’s customer service levels.

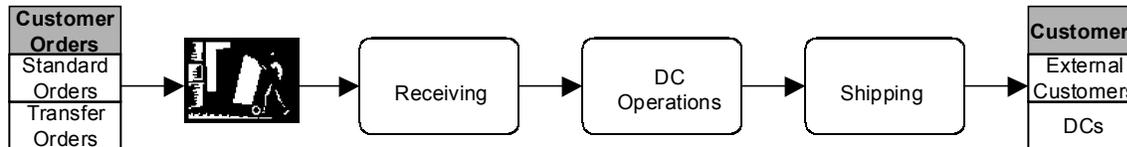


Exhibit 3: The Logistics Flow

Wireless Scanning in Distribution Centers

The first major initiative undertaken after the initial SAP R/3 implementation was the installation of a comprehensive RF bar code scanning system in the Atlanta DC. RF scanning involves the use of mobile wireless devices such as handheld wands and computers on forklifts. This project was started in early 1998 and was completed by the end of that year. The Atlanta DC was chosen to be the pilot project because it serviced NIBCO’s retail channel customers and so already had full bar codes in place for products and shipped only full boxes or cases to customers.

The shop floor DC workers now scan a customer order and are given electronic instructions regarding how much of each SKU to pick and where exactly the product is stored. The workers scan the bin on a DC shelf to determine that it contains the correct product, and then they use the electronic interface to confirm that the appropriate quantity of product was picked. Previously, the paper documents that were used could not provide this level of detail, real-time tracking, and advisory information. In preparation for the new RF technology, DC shop floor workers received a week of classroom and on-the-job training, dispersed over the course of a month.

This project was implemented with assistance from NIBCO corporate headquarters IS staff. To develop the system, the IS staff were on site at the DCs, riding forklifts to fully understand the shop floor workers’ needs. A third party provided the RF “middleware” (software to link the RF devices directly to mySAP SCM). This middleware is currently being phased out and replaced with scanning capabilities now embedded in mySAP SCM.

You cannot get it to work effectively by having an IS person program it at corporate. I want the IS personnel on a forklift in the DC as we trial through the process, so they can experience firsthand what an operator on the floor has to go through to pick an order via scanning....There is nothing like being there firsthand experiencing system delay times and transactions.

Larry Conn, Director of Logistics, NIBCO

This also provides better project management and project ownership cross-functionally. You get more of a team approach...to satisfy the user.

Larry Conn, Director of Logistics, NIBCO

RF scanning has increased the number of order lines and full orders (shipments) filled each hour, as well as increasing order accuracy (the right products in the right quantities to the right customer). Furthermore, the number of DC workers has decreased. Utilization of the RF scanning technique in the DCs continues to increase, as measured by number of lines and orders scanned (versus picked manually) over time. New employees are able to ramp up much more quickly because they need not learn the NIBCO numbering system; they need learn only the scanning technique.

RF scanning was rolled out to the other two DCs (Columbus, Ohio, and Los Angeles) two years after the highly successful completion of the RF scanning pilot at the Atlanta DC. The Columbus and Los Angeles DCs presented a more complex RF scanning implementation because these DCs service NIBCO's wholesale customer channels, and, as a result, they did not have widespread bar codes already in place. Furthermore, order picking at these DCs in some cases involved partial box picking in which individual products rather than whole boxes were picked. Although boxes may have bar codes, individual pieces do not commonly have bar codes. The RF implementation at these DCs involved installation of the RF hardware and software but also a simultaneous program in which bar codes were introduced and applied to products held at those DCs. After two years, approximately 98% of those items now have bar codes.

Now, you just go to a bin in the DC, scan the bin and you know that you are in the right place, and then scan the box. So you get the right material, and you just move on to pick the next order.

Larry Conn, Director of Logistics, NIBCO

RF scanning has been a very important process put in place to improve accuracy and increase our efficiency in the DC. It has been a huge initiative for us and very successful.

Larry Conn, Director of Logistics, NIBCO

We have had great results from our RF bar-coding initiatives. We plan to expand our use of bar-coding with RF capabilities well into the future.

Ken Eme, Vice President of Supply Chain, NIBCO

Distribution Center Profiling

Distribution center **profiling** involves a Pareto-style detailed analysis of activity levels (sales) for each SKU in a given DC. The layout of the DC storage shelving and bins and the location of each physical product are reevaluated periodically to reduce picking times and movement times on the DC floor. The increased visibility into SKU activity provided by mySAP SCM is foundational to this profiling and re-profiling. Each re-profiling increases order and line picking efficiencies as a result of lower cumulative travel times of people who handle stock picking and replenishment on the DC floor.

After we got warehouse management smoothed out and got our RF, most of the distribution centers became very focused on re-profiling or laying out their DCs in a much more productive way than they had been laid out originally....They go through and look at volume and might actually move product from a high volume picking area to a lower volume picking area based on what's happening over the current history or 3-to-6 month demand volume....As we re-profiled, the DCs would get more and more productive as they used the SAP functionality.

John Hall, Director of Supply Chain Systems, NIBCO

Leveraging Information Richness for Distribution

mySAP SCM, particularly the warehouse management capabilities, provided greater information availability than had the prior information systems. mySAP SCM has aided in detailed distribution operations planning and shipment interactions with the customer.

One of NIBCO's first efforts to use mySAP SCM to enhance distribution capabilities was in-house development of an **order deliveries due report**. This summary screen provides detailed information on customer orders at a line level, rather than solely at the order level, for purposes of available-to-promise and due-date analyses. This report provides additional information to distribution managers and shop floor workers regarding the relative priority of each order and line.

Another way the capabilities of mySAP SCM are to be leveraged is through the **pick-pack** capability currently being implemented. This functionality allows a DC shop floor worker to pick an SKU, load it on a pallet, and note in real time on which pallet in the customer's shipment that SKU is located. Before this, a customer receiving a shipment would receive a packing list that identified the items contained in the shipment but not identifying the specific pallet. This information helps customers quickly receive and disaggregate their shipments, in turn reducing their receiving costs and increasing their own internal service levels.

The warehouse activity monitoring capability has helped NIBCO track all transactions in progress at a DC, including in-progress and completed shop floor picking. This capability monitors time started, time completed, and time open for each transaction, greatly reducing the number of orders that otherwise might fall through the cracks. Tracking warehouse activity increases customer service.

NIBCO continues to implement further mySAP SCM capabilities to improve distribution. Current initiatives under investigation or initial implementation include development of custom labeling by means of mySAP SCM instead of through separate systems, and interfacing mySAP SCM with UPS systems for integrated shipment planning.

SAP was definitely an enabler to help us bring down our distribution cost.

Larry Conn, Director of Logistics, NIBCO

I'd say year 3 it really started taking off, with our understanding of how to configure, how to go in there for data, how to start using the data that SAP provides to help us manage our business more effectively. There is no doubt in my mind that this tool has helped us manage our business more effectively. No doubt in my mind. But it has been a long road.

Larry Conn, Director of Logistics, NIBCO

Manufacturing Operations

NIBCO's manufacturing configuration includes plants at 12 sites, including Mexico and Poland. Four locations produce primarily plastics products, involving injection molding operations for fabrication of single-piece plastic parts (for example, pipe elbows) through a single step, continuous-flow operations process. The primary raw materials employed are ABS and PVC plastic resins. Production activity at the other sites involves primarily fabrication, machining, assembly, and testing of metal assemblies, such as valves, in a batch-flow operations process. The primary raw materials employed are copper, bronze, and iron, and the production process at these sites is notably more complex because of the multiple steps in production necessitated by multipart assemblies, which may contain up to 30 unique parts. Exhibit 4 presents NIBCO's manufacturing process.

On the supplier side, primary vendors supply metals, plastic resins, packaging materials, and miscellaneous hardware (nuts and bolts). There are also transfers of components among NIBCO plants, in which a plant adds value to components produced elsewhere. The manufacturing plants currently ship primarily to NIBCO DCs but they are increasingly shipping full truckloads directly to certain customers. The primary responsibility of NIBCO's manufacturing plants is to ensure high product availability at NIBCO's DCs.

The initial implementation of SAP R/3 production planning capabilities served to replace a great many plant-specific, small, localized production planning programs and spreadsheet-based decision support systems with a centralized information system. The implementation therefore resulted in common terminology and common systems across the plants, which allows, when appropriate, remote management of local plant activities. Furthermore, use of the software helps to reduce personnel training duration and costs, which, in turn, increases worker agility. Ideas and improvements from one plant diffuse to other plants more rapidly, facilitating the acceleration of organizational learning. Good ideas that could not be leveraged before can now be implemented more widely because of standardization.

We were after an enterprise-wide system, and we were after the synergy that we would get company-wide and the total cost and the total capabilities we would have in the company, not just optimizing manufacturing.... We now know what is the true customer demand. We now know what we should be making, what the customer wants. So, in a nutshell, that's the greatest thing SAP brought to manufacturing.... "Facilitated" is not strong enough of a word. SAP has made it possible. We could not even really set inventory zones up and have visibility in manufacturing into what the customer wants without SAP.

Gordon McCrory, Director of Metals Manufacturing, NIBCO

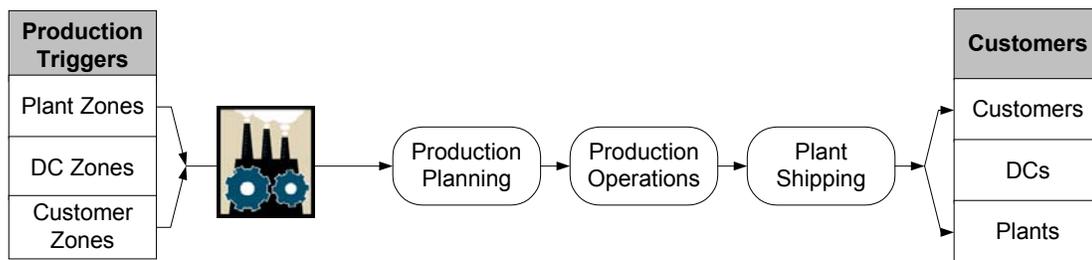


Exhibit 4: The Manufacturing Flow

Production Resources and Tools

A key objective of the initial SAP R/3 implementation was to greatly increase the capability to support production-related decision making, both in production planning and in detailed shop floor activities. Given the relative complexity of operations (and opportunities for greater immediate benefits), NIBCO's production resources and tools functionality (PRT) was first implemented in a metals plant, based on capabilities of mySAP SCM, and has subsequently been rolled out in two other metals plants. It is anticipated that PRT capabilities will be adopted by other plants in time and that the functionality will be enhanced over time. The PRT module will make available in real time up-to-date, complete, centralized, and easily accessible customer order and detailed production information, including inventory levels and production order status. The PRT information will include the following:

- Detailed bill-of-material data
- Complete product routing
- Detailed procedures for a given manufacturing conversion step
- Part drawings and blueprints
- Tooling information
- Safety instructions
- Quality instructions

Implementation of PRT requires careful and thorough cleansing of the master data on which mySAP SCM relies. This data includes not only the bill-of-materials information but also the routings, safety instructions, and other information just noted.

This information, easily accessible through information kiosks and printouts, will bring the information as close as possible to those on the shop floor who perform the actual materials conversion. Information of this breadth and currency was not available before the initial SAP R/3 implementation.

The ability of mySAP SCM to incorporate new information in real time will be fundamental to the value of this information on the shop floor. For example, an engineering change made to a part will be communicated immediately to the shop floor through the PRT package of information associated with that part; this information will eliminate delays in implementing the engineering changes. Because they will then have information on upstream and downstream processing steps, rather than solely on the step they conduct, shop floor workers will be able to envision the total process for their products by accessing the complete product routing. Tooling information will allow shop floor associates to ascertain that all the required tooling is available and that moving forward with setup is appropriate. Before the SAP R/3 implementation, it was not uncommon for lengthy setups to be initiated and then subsequently torn down because of lack of availability of tooling. The availability of comprehensive, real-time tooling information will therefore increase machine uptime. The safety instructions will provide guidance and compliance information regarding materials and processing steps. The quality instructions will provide quality assurance guidance and codify the quality assessment procedures and corrective actions. Furthermore, individual shop floor associates will be able to incorporate their personal notes regarding the manufacturing of certain parts, notes that they will be able to access the next time they produce those parts.

Use of the PRT functionality will increase product quality, including increased first-pass yields; enable greater equipment utilization and uptime, as measured by the shop floor process reliability measures that NIBCO employs; and facilitate the development of cross-functional skills among shop floor associates. Furthermore, use of PRT functionality will lead to substantial reductions in the number of supervisors. Because information will then be widely available rather than restricted to a few knowledgeable supervisory workers, there will be less need for supervisory personnel.

All the information an operator needs to do his or her job and do it right, is right there – available to the operator doing the work – and that is foundational, in my opinion.

Gordon McCrory, Director of Metals Manufacturing, NIBCO

Production Planning and Shop Floor Scheduling

mySAP SCM capabilities have made a big difference in both medium- and short-term production planning and scheduling. Before its initial SAP R/3 implementation, NIBCO conducted medium-term production planning through sales, inventory, and production planning (SIP) team meetings in which demand forecasts were compared to inventory levels and production capacity to determine production scheduling for the coming quarter. Now, given the availability of real-time information on actual customer orders, NIBCO is able to rely more on production for actual orders rather than on speculations about future demand.

The visibility that mySAP SCM provides with regard to customer order requirements, production in-progress tracking, and resource availability has changed tactical shop floor production scheduling as well. A large portion of the sequencing and scheduling of orders and production activity is now automated within mySAP SCM. Previously, numerous local programs and analyses were required. This automation, made possible by mySAP SCM capabilities, has reduced the number of production planning personnel required. Furthermore, the visibility into customer order details allows shop floor personnel to be

proactive in avoiding potential stockouts and improving customer satisfaction when assessing scheduling priorities.

Leveraging Information Richness on the Shop Floor

Bar Code Swiping on the Shop Floor. Bar code scanning, which is integrated into mySAP SCM, allows detailed tracking of production progress on the shop floor, including release of raw materials, movements on the shop floor, processing of materials at each workstation, and movement of the completed work to finished goods inventories. The capabilities of mySAP SCM provide visibility into all in-progress work activity: the quantity of pieces, the steps that have been completed, and the physical location of the work batch. This tracking capability is widely employed at the metals plants, and similar capabilities have been found to be very useful in tracking NIBCO interplant transfers, as well as in communicating Kanban quantities and replenishment needs among plants. Furthermore, NIBCO is piloting mySAP SCM capabilities for tracking shop floor personnel time and attendance through proximity and bar code scanning. The information is linked to NIBCO's human resource systems.

Manufacturing Cells, Kanban, and Constraint Optimization. NIBCO initiated conversion of certain plants from a traditional functional shop floor process layout to cellular manufacturing with product layouts before the initial SAP R/3 implementation. The cells vary considerably within and across plants. Some employ Kanban production and replenishment quantities and approaches. Others employ drum-buffer-ropes (DBR) techniques (also known as constraint optimization), which rely on identification of production bottlenecks and detailed planning of workload before, through, and after the bottlenecks. The information richness that mySAP SCM provides has supported the operation of the cells. The system can distinguish between Kanban-oriented and DBR-oriented cells (and even variations among those cell types), providing part and product tracking information with bar code scanning as necessary according to the cell type.

A number of personnel work policy changes were made as part of the shift to cellular manufacturing. Workers were no longer experts with a single piece of machinery but were expected to be cross-skilled and able to operate all pieces of equipment in a cell. Worker pay was changed from piece rates to an hourly wage set at 20% above standard, with additional group-based incentives for production performance.

Performance Measurement and Feedback. Real-time tracking of activity in progress, together with process reliability measures that NIBCO has implemented on the shop floor, allows instantaneous feedback to shop floor associates and managers about equipment utilization, product quality, and other shop floor performance measures. This information allows rapid adjustment to new circumstances.

SAP made it possible to measure product availability on the manufacturing floor. Once I could measure it, I could set targets.

Gordon McCrory, Director of Metals Manufacturing, NIBCO

Postponement. The enhanced visibility into customer order details provided by mySAP SCM capabilities allows product postponement; for example, a unique plastic fitting may be packaged in 16 different types of boxes for 16 different customers. NIBCO can now store the plastic fittings and very rapidly provide custom box packaging, rather than storing the finished product in 16 different types of boxes. This postponement of customization until the last possible moment increases customer service through greater product availability and simultaneously reduces asset requirements in the form of work-in-process and finished goods inventories. Postponement is made possible through the real-time knowledge of actual customer orders that mySAP SCM provides.

Capital Projects. mySAP SCM is used for financial tracking and cost control of large capital equipment projects. Any new information regarding an equipment installation, such as a charge to a vendor for

certain services, is instantaneously updated in project records, allowing real-time tracking of such projects. This approach results in more complete information and real-time access to the information, in turn allowing better expense management and project progress tracking.

You gain all the synergy by having it part of SAP. As soon as a transaction is made on a capital project, there it is, and you know it.

Gordon McCrory, Director of Metals Manufacturing, NIBCO

Plant Warehouse Management. The plant warehouse management capabilities of mySAP SCM are used to control inventories in selected manufacturing plants. The improved inventory control has decreased inventory losses and reduced the work-in-process inventory levels. Furthermore, the time and effort to conduct cycle counting has fallen from 1.5 days to 1.5 hours, while the accuracy of inventory cycle counting has increased from 90% before the initial SAP R/3 implementation to 99.5% following the implementation. At the same time, support personnel requirements have decreased by two-thirds. At selected plants, cycle counting is further supported by RF capabilities.

Looking Forward: The Internal Supply Chain Vision

Looking forward, NIBCO sees significant opportunities for greater use of mySAP SCM in its manufacturing operations. NIBCO intends both to integrate stand-alone manufacturing systems more tightly with mySAP SCM, and to increase use of SAP capabilities. For example, NIBCO aims to interface the current non-SAP systems for shop floor input-output control in use at plastics plants with mySAP SCM. Greater integration will also include direct linkage of computer-controlled shop floor equipment into mySAP SCM for statistical quality control monitoring and analyses, as well as greater integration of human resource reporting and management systems. NIBCO is also seeking to increase the use of SAP functionality by leveraging capabilities for plant maintenance, to support capital justification of new equipment, and to aid in manufacturing layout analyses and manufacturing cell design. NIBCO also anticipates using bar code scanning for shop floor personnel time and attendance. The shop floor reporting capabilities of mySAP SCM will be used to support compliance processes such as International Organization for Standardization (ISO) audits, safety management, and environmental management systems. NIBCO seeks to expand its use of product life cycle management and product data management to integrate manufacturing operations with product engineering. Moreover, NIBCO seeks to leverage mySAP SCM information further by continually increasing coordination and communication between plants and DCs – for example, through standardized electronic notification to a DC of a shipment arriving from a manufacturing plant.

The Supplier Side

The mySAP SCM implementation to date has enabled greater economies and opportunities in NIBCO's supplier-interfaces. These include the following:

- Greater visibility into purchase history for each SKU across the entire company
- Standardization and formalization of procurement processes for ordering, receipt, recording, and payment
- Greater control and security over purchasing activity
- Automation of transaction-intensive activities and processes

Supplier Consolidation and Purchasing Economies

mySAP SCM provides visibility into comprehensive purchase transaction data. Examples of such data include which SKUs are purchased, by which NIBCO associate, at which NIBCO site, at what time(s), from which supplier(s), at what price(s), and with which pricing and ordering terms.

This increased visibility facilitates purchase consolidation and reduction in the number of suppliers. Data is now available to identify where the same part is purchased by different plants from different suppliers. For example, a commodity metals raw material was purchased from 15 different suppliers across the NIBCO plant network. That number has been reduced to four suppliers, each supplier being regionally based, and this approach has cut 30% of the purchasing cost for this raw material as a result of quantity discount pricing. Clyde Hayes, formerly Director of World-Wide Procurement, cites a similar example with major cost savings:

At first we did not have any idea that five plants were buying the same type of parts from ten different suppliers. Once we started learning that, we could leverage our purchasing dollars.

Clyde Hayes, Director of Supply Management, NIBCO

In another case, unique but similar parts were used at three different metal plants. A modification to the part design allowed a common part to be used across the three plants, reducing the number of suppliers and resulting in purchase quantity economies. The aggregation of SKU-level purchasing history information has allowed order pooling, supplier reduction, improved pricing terms, and procurement overhead reduction. Supplier consolidation, stemming in part from sole-source use or use of a few strategic suppliers, has also reduced supplier management staffing requirements.

Before implementing the SAP solution, NIBCO's procurement processes were highly localized and redundant – with significant purchasing activity conducted plant by plant – but is now largely centralized and more efficient. The standardization and formalization inherent in SAP's embedded business processes has served to greatly systematize and routinize procurement processes across all plants, which, in turn, has resulted in lower administrative costs.

mySAP SCM, in part because of its formal processes, allows NIBCO to take greater control over its purchases. Currently, purchase orders can be placed and approved only by persons with pre-approved authority, whereas previously many individuals could place a purchase order. The purchase activity controls increase security, cut costs, increase accountability, and allow greater identification of procurement opportunities through supplier reduction and the use of common parts. Furthermore, these controls make better use of manager time by systematically escalating only certain order types for higher level approvals and by providing summary tracking reports of purchasing activity.

There has been significant automation of procurement activities and processes, which has reduced errors, enabled smoother manufacturing activity, reduced repeat work of procurement activity, and cut costs throughout the process. For example, a three-way matching system built into SAP R/3 allows automated, almost instantaneous comparison of purchase orders, goods receipt documentation, and delivery invoices. The manual intervention and transaction handling that were required before implementation of SAP R/3 have been almost totally eliminated. Fewer procurement office personnel are required, and the natural errors that human handling can introduce have been eliminated as well. NIBCO has greater control over individual accounts payable payments and greater access to favorable payment terms. It is NIBCO's procurement vision "to complete the entire purchasing cycle with major suppliers with no paperwork changing hands."

From the viewpoint of overall procurement savings, there have been significant business gains:

SAP has paid for itself many times over. It has given us the capability to make much better business decisions – it is from a much greater knowledge base than we have ever had – and we can track performance closely.

Clyde Hayes, Director of Supply Management, NIBCO

Controlling procurement activity helps us leverage our investment. With the visibility into system and procurement process changes that were facilitated by the SAP implementation, NIBCO was able to average about \$4 million a year in baseline procurement savings.

Clyde Hayes, Director of Supply Management, NIBCO

Collaborative Commerce through Supplier-Managed Inventory

NIBCO is now leveraging its proven successes in VMI in a new arena: that of its suppliers. In this supplier-managed initiative (SMI), NIBCO suppliers manage, in an automated manner, the inventory of materials they provide to NIBCO.

A pilot project was conducted with one of NIBCO's biggest suppliers, a provider of plastic resins. The provider places resin in silos at a NIBCO plastics plant with newly-installed telemetrics equipment. NIBCO draws on this resin for use in its injection molding equipment and owns the resin once it draws it. Specially designed electro-optical devices in the silos monitor the level of resin remaining. The inventory levels, reorder point, and safety stock are determined by means similar to NIBCO's inventory zone process for demand pull. The inventory level information is communicated automatically and electronically to the supplier, who then replenishes that inventory as necessary. Financial transactions are also automated, with payment transfers once a month.

NIBCO entered into discussions with one of its very large suppliers that already had SAP and EDI capabilities in place. This was a trusted supplier with which NIBCO had a sole-source relationship and from which NIBCO had purchased for many years. At the start of the project, NIBCO and the supplier negotiated inventory level targets, frequency of inventory level data transfer, pricing/payment terms, and inventory monitoring techniques.

This SMI relationship has cut NIBCO inventory costs, greatly reduced transaction activity, increased availability for this key, high-volume raw material, and further cemented the long-term strategic relationship between NIBCO and its supplier. As a result of this pilot project, the supplier is exploring possible VMI relationships with other customers.

Looking Forward: The Supply Side

NIBCO is looking to greatly expand its SMI relationships and is exploring opportunities with other primary suppliers. In time, NIBCO hopes to have the majority of its primary suppliers providing products to NIBCO in VMI-style relationships, to further cut costs, allow greater product availability, and further automate transaction activities associated with the procurement process. In general, NIBCO is seeking to further integrate and automate relationships with suppliers through mySAP SCM. Projected initiatives include incorporating maintenance, repair, and operations (MRO) suppliers, which are currently not incorporated as suppliers in NIBCO's SAP system. MRO suppliers represent an enormous and highly diverse supplier base. Each factory has distinctive MRO needs and, hence, many localized and unique supplier relationships. NIBCO is also seeking to increase RF bar code placement capability in four ways: for improved order receipt and tracking; to ease management of consignment inventory, which is highly paperwork intensive; for inventory monitoring and tax issues; and to reduce plant administrative overhead.

Benefits Realized: 1997 to 2002

NIBCO has positioned itself as a leader in business process innovation within its industry and is well poised for the future. Its corporate business strategy is being realized by more efficient and effective processes enabled by SAP solutions. Today, NIBCO is a stronger company with closer relationships to key customers as a result of its initiation of value-added services based on electronic integration capabilities. NIBCO was the first company in its industry to leverage its IT infrastructure to offer VMI, for example.

Using capabilities of mySAP SCM and other SAP solutions, NIBCO has measurably:

- Improved customer service by focusing on order accuracy, product availability, and other components of its perfect order metric
- Developed multi-channel customer service capabilities and electronic partnerships for customers and suppliers
- Increased the effectiveness and reduced the costs of doing business through continuous business process improvements in both its internal and external supply chains

In addition, NIBCO has developed competencies in both SAP-supported business processes and business-led technology projects not only to integrate processes across business functions but also to enable a domestic acquisition to migrate to mySAP SCM quickly.

NIBCO is now positioned as a leader in IT-supported business process innovation within its industry.

Conclusion

NIBCO is already an IT leader within the flow control industry as a result of its early (1996 to 1997) investment in an ERP package (SAP R/3) to replace its legacy systems. As consolidation in the industry continues, automated transactions that reduce customer costs, as well as IT-based value-added services, are expected to become highly valued competitive tactics because of their influence on customer loyalty and, therefore, customer retention. When its customers and suppliers also increase their investments in information technology, NIBCO will be in an even better position to leverage its standardized enterprise system platform with expanded electronic linkages to customers and suppliers.

We see cost reductions and some nice growth opportunities [by leveraging] our SAP engine.

Rex Martin, Chairman, President, and CEO, NIBCO

NIBCO's next steps include improving decision making by implementing the business information warehouse capability of mySAP Business Intelligence, expanding revenue growth initiatives, and more tightly integrating mySAP SCM with the detailed manufacturing processes and shop floor activities. Implementation of business information warehouse capabilities will facilitate improved access to NIBCO's operational data, allowing its managers to gain greater insights into how to improve customer relationships, selectively increase prices, and achieve cost savings. The mySAP CRM implementation is expected to enable the company to continually improve its value-added services and to develop pricing and distribution strategies that are based on a deeper understanding of its customers' buying patterns, product manufacturing, and distribution costs.

NIBCO will also continue to use mySAP SCM to refine the Big 6, its perfect order metric, and other operational metrics, to better manage its business. Furthermore, mySAP SCM has enabled NIBCO to develop a new core competency: the ability to integrate new products and customers quickly through a

domestic acquisition strategy, which is designed to achieve economies of scale over the short term and to enable long-term company growth.