1. Bar Code and e-Commerce in the Supply Chain: Where to Start

This Guide is about bar code implementation of warehouse and distribution systems used in integrated supply channels.

So why bother?

1.1 Benefits of bar code

Essentially, companies use bar code because scanning is easier and more accurate than manually entering data on a keyboard.

Keyboard data entry can create numerous problems. Inaccuracies and delays in updating inventory contribute to lower turns, missed delivery dates, lower sales, reduced productivity, etc. (The list is long.)

Bar code can be used for much more than inventory accuracy, but to help explain why its implementation is skyrocketing, try making a list of the Benefits of Inaccurate Inventories. You won't need much paper. Conversely, make a list of the adverse consequences of an inaccurate inventory. Like a pebble tossed into a pond, the negative effects ripple throughout your entire business.

1.2 Bar code self-exam

Some of these questions relate to your operations directly; others to the types of problems a manufacturer might share with its channel.

Not incidentally, "yes" answers to questions could represent opportunities. Solving the problems involved could distinguish you from your competitors. This Benefits of Bar Code Self-exam Worksheet can also be found in Appendix A.

❏ **YES** ❏ **NO**   *Do your customer service people physically verify stock counts before making a delivery commitment, because they don't trust the computer inventory?*

This seems normal, but it shouldn't be; the practice is a consequence of inaccurate inventory records. The cost of verifying stock counts is a waste, because no value is being added to your product or your service. Bar-code-assisted receiving, physical-inventory/cycle-counting and order picking systems all contribute to the accuracy of your inventory counts, and may allow you to eliminate this time-consuming practice.

❏ **YES** ❏ **NO**   *Does your sales force spend valuable time apologizing for service problems, instead of selling?*

A surprising amount of selling time is spent apologizing for service problems, such as late deliveries and incorrect shipments. Considering the high cost involved, the sales force should not waste its time apologizing.

❏ **YES** ❏ **NO**   *Do you ever lose a sale because your inventory incorrectly reports that a product is not in stock when it really is?*

Delayed entry of receiving reports and inaccurate counts can understate your inventory. Bar-code-assisted receiving and physical inventory may prevent these lost sales.

❏ **YES** ❏ **NO**   *Do you close business to take physical inventory? Do you lose sales when you close?*

It takes less time to take physical inventory with the assistance of bar code-- especially if bar code helps your company implement cycle counting. The time savings may allow you to stay open.

❏ **YES** ❏ **NO**   *Do you ever deliver late because your inventory incorrectly reported that you had a product but you didn't? Do you lose customers as a result?*

Inaccurate inventory records frequently cause late deliveries. Customers that track delivery performance may split their business or switch all of it because of poor delivery performance. Bar-code-assisted physical inventory, especially cycle counting, may improve your company's on-time fill rate.

❏ **YES** ❏ **NO**   *Are you ever forced to stop production or switch from one product to another because your inventory system incorrectly reported the quantity on hand?*

Your inventory indicates that you have it but you don't, so you stop production or switch to another product, which reduces your manufacturing throughput. An accurate inventory could eliminate or significantly reduce this problem.

❏ **YES** ❏ **NO**   *How much time does your work-in-process inventory spend in between value-added operations? This is inventory at rest. Could you reduce manufacturing lead times if you knew where, and for how long, work- in-process sat idle?*

It's not unusual for work in process to be at rest 90% of the total manufacturing lead-time. Manufacturing lead times can be reduced by minimizing the time inventory spends between value-added stations. A bar-code-assisted production reporting system will identify the amount of inventory at control points, and tell you how long it's been there. By identifying production bottlenecks, the system helps production managers solve problems that lengthen manufacturing lead times.

❒ **YES** ❒ **NO**   *Do you have warehouse-to-warehouse transfers? How many are caused by an inaccurate inventory? What does each transfer cost your company?*

Bar code technology makes it easier to take inventory, so you can economically cycle count. The increased frequency improves the accuracy.

❒ **YES** ❒ **NO**   *Do you ever make special deliveries to correct delivery errors? How much would this cost be reduced if you made fewer errors?*

Picking errors cause at least one extra delivery expense. In some cases, the total number of delivery vans have been reduced simply by eliminating picking errors through bar-code assisted order picking and/or shipping verification.

❒ **YES** ❒ **NO**   *Do you ever pay rush freight charges because your inventory incorrectly reported you had product?*

Your inventory said you had it but you didn't. To meet your delivery promise, you pay a rush charge. By making your inventory records more accurate, bar-code assisted physical-inventory/cycle-counting, put away and order picking systems would reduce this cost.

❒ **YES** ❒ **NO**   *Do your warehouse people spend time looking for merchandise that's not where the computer says it is?*

You may be able to handle more warehouse transactions with the same number of people if you eliminate the time they waste looking for merchandise that's not where the computer says it is. A real-time, bar-code assisted put away and order-picking system will increase the accuracy of your location records.

❒ **YES** ❒ **NO**   *Do your warehouse people waste time because the computer-assigned storage location is full, forcing them to find a temporary location?*

You may be able to handle more warehouse transactions with the same number of people if you eliminate this problem. A bar-code assisted real-time order

picking system may solve the problem by updating the location file when the order is picked, instead of when the pick ticket is printed.

❒ **YES** ❒ **NO**   *How much does your company spend on forms used solely for manual data entry? Could this cost be eliminated with a bar code data collection system?*

Bar code data collection systems usually reduce or eliminate the cost of forms.

❒ **YES** ❒ **NO**   *Are your customers insisting that you bar code your shipments?*

This is a labeling, not a data-collection application, unless it's used in conjunction with the advanced ship notice (EDI or e-commerce) transaction. The real question is, how much do you want the business?

❒ **YES** ❒ **NO**   *Could you increase your sales by voluntarily offering to bar code your merchandise?*

Rather than waiting for their customers (or the competition) to force them into bar coding, some companies are promoting their ability to bar code label their shipments. The benefit to some customers is significant. If your competition is not offering the service, it may be possible to defer the cost by charging for it.

More accurate and timelier information is needed to improve inventory control, but keyboards aren't the right tool. Bar code is the right tool because it is fast and accurate--about 15 times faster and 10,000 times more accurate than keyboard data entry.

1.3 Bar code applications

Bar code can be used almost everywhere data is manually entered into a computer. Manufacturers, distributors, retailers, financial services, public utilities, phone companies, government agencies, health care providers, transportation companies and virtually every other type of industry are using bar code to replace keyboard data entry. Consider the following partial list of applications:

- Counting raw materials and finished goods inventory.
- Automatic sortation of cartons and luggage on conveyor belts and palletizers.
- Lot tracking.
- Fixed asset tracking.
- Production reporting.
- Time/attendance and labor reporting.
- Automating warehouse operations, including receiving, put away, picking and shipping.
- Identifying production bottlenecks.
- Document tracking.

- Package tracking.
- Access control.
- Tool crib and spare parts issuance.
- Controlled substance tracking.
- Patient billing.
- Retail POS (Point of Sale) price look up.

One of the most reassuring facts about bar code is that virtually every company that has installed a bar code system is looking for other places to use it.

1.4 Frequently asked questions

Following are answers to several prevalent questions. These questions can also be found in Appendix B. This section, too, emphasizes the benefits of bar code; the Q&A format is used, if for no other reason, for variety.

Question #1: *What areas within a distributorship can benefit from the use of bar code technology?*

Answer: Any place information must be key-entered into the computer. For example:

- The sales counter;
- The receiving dock;
- Picking and put-away on warehouse floor
- Taking physical inventory or cycle counting;
- Verifying shipments;
- Logging serial numbers.

Question #2: *How would you suggest, step-by-step, that a distributorship implement bar code technology?*

Answer: A short answer is difficult. Unless a customer is demanding labels on shipments or the advanced shipping notice, which is an EDI or e-commerce transaction linked with a bar code, a distributor should:

- Develop a working knowledge of what bar code can do;
- Review your operation and see what can be improved through more timely and accurate information;
- Be honest about the real cost of carrying inventory;
- Be honest about the quantity of errors, and the cost;
- Make a management commitment to reduce overhead by 20%;
- Briefly describe, in writing, what you want to improve, how you will measure the improvement and how you think the altered system will work;

- Use that document to select a technology partner (your computer system supplier or some other outside services); have them explain how their equipment or system will meet your needs; then make a selection.

Of course, there are training and installation issues.

Question #3: *What are the up-front expenses and the payoffs?*

Answer: The up-front expenses are what most everyone sees, or thinks he sees, and more. The cost of the equipment can be anything from $200 for a scanner to plug into your existing computer terminals, to a fully-portable hand-held $2,500 computer. Printers can cost $700 to $2,500. But there are other subtle expenses, like management planning and design time. And, of course, there'll be new software to integrate with your existing system.

Constantly overlooked is the cost of not using bar code. What are the real costs of errors and out-of-date inventory reports?

Regarding payoffs, one distributor simply put it this way: "I have been using bar code for about 18 months and I now ship 25% more volume without any additional people."

Question #4: *Very briefly, what are the basic advantages of using bar code technology?*

Answer: The basic advantages are that the bar code provides timely, error-free information that can be used to validate receipt, movement or counting of products. It reduces key-entry time, transcribing time and almost all errors.

Question #5: *Why do trade associations promote the use of bar code technology?*

Answer: The main reason is to drive costs out of the supply chain. If, for example, a shipping error costs a manufacturer $50 to handle the re-pick, ship and credit, it probably costs the distributor another $50 to contact the supplier, return the item and handle the credit memo--$100 in profit taken out of the distribution channel. At a 5% pre-tax profit, that's the equivalent of a $2,000 sale. Think of the cost of receiving, counting, storing and managing inventory; the costs that bar code can reduce are really astounding.

Question #6: *What are the consequences of not migrating to the use of bar code technology?*

Answer: It would be like not using telephones in the 50's, not using computers in the 80's or not using Faxes in the 90's. This is the information and communication age, and bar code is part of it. To not use bar code is to ignore the effective tools your competitors are using. The consequences are obvious.

Question #7: *What would you say to a distributor to encourage the use of bar code?*

Answer: I'd ask him to tell me:

- The advantages of handwriting and then key-entering product identification information;
- The advantage of not really knowing (minute to minute) what is in stock;
- The benefit of shipping the wrong item to a customer;

- Why a counter person--who could (using bar code) identify and accurately price all the items on an order in a few seconds--would prefer to take several minutes to key stroke the information into the computer and also increase the error rate.
- Why it is better to close the place down for a day or two to take physical inventory rather than doing it in several hours--and having the reconciliation out as the job is being done.

Question #8: Sell me on the use of bar code technology!

Answer: Imagine your biggest competitor saying, "Bar code is too expensive for you, you're not sophisticated enough, you can't afford the investment, it will never catch on."

Then imagine your best customer saying, "The guy down the street has better delivery, lower prices, more attentive salespeople, never sends the wrong stuff and it is always priced correctly; sorry, I'm buying there."

1.5 Misconceptions and clarifications

Many companies have hesitated to even consider bar code because they think it is too complicated, too expensive or too intimidating. Most of these concerns are based on misconceptions about what bar coding is — and what it isn't. This list of bar code misconceptions and clarifications can also be found in Appendix C.

1. Bar coding is complicated.

Clarification: A bar code works like a visual Morse Code. Instead of using dots and dashes, characters are encoded in a unique sequence of bars and/or spaces that can be read by bar code scanning equipment. You create a bar code by sending the data you want encoded to a printer that knows the proper bar and space patterns.

2. Bar code will force me to change my information system.

Clarification: Carrying the analogy of Morse Code and bar code a bit further, when armies began using Morse Code, they didn't have to replace all their old generals with generals who knew Morse Code. The generals receive decoded messages. With bar code, the computer system receives a decoded message.

The information system has three primary parts:

- Inputs (such as part numbers, quantities, etc.) commonly entered via the keyboard.
- Computer processes such as report generation, mathematical calculations, file creation, etc.
- Outputs such as printed or screen reports.

Bar code can impact all three areas, but its primary impact is on the input side. In its simplest form, adding bar coding is like hiring the world's fastest and most accurate data-entry clerk. Would you

change your information system if you hired the best data-entry clerk? Bar code can frequently be added with very minor software changes or, in some cases, absolutely no changes to your host software.

If your customers are asking you to bar code their shipments, the output side of your information system will also be affected, because printed bar code labels must be created. The input side would be affected if you weren't currently capturing all the data your customers wanted on the labels.

3. *Bar coding will force me to change my part numbers.*

Clarification: Bar code doesn't change what you enter, it changes how you enter it. Your internal part numbers need not change to accommodate bar coding.

4. *Bar coding is expensive.*

Clarification: Compared to the clerical cost of manual entry and the cost of resulting errors, bar coding is a bargain. Payback usually occurs in less than one year! With the large variety of bar code equipment and applications software available today, managers from small and large companies are usually surprised by how little bar code actually costs.

5. *Implementation will be too disruptive to my business.*

Clarification: When implementation is planned properly, with adequate training and modular installation of manageable applications, the disruption is minimized. Planning is the key.

6. *Small parts need to be individually labeled.*

Clarification: Every part doesn't have to be labeled. Hardware stores have many items, like nuts, bolts and pipe nipples, that don't have bar codes on them. They handle this by using bar code menus, showing a picture of the item next to a bar code, creating standard package quantities and by labeling storage locations. Manufacturers and distributors using bar code do the same thing.

7. *Resistance to bar coding will be difficult to overcome.*

Clarification: The new system will involve change. Your employees might resist bar code, but maybe not for the reasons you imagine. In some cases, people think their jobs are in jeopardy. Sometimes they think bar coding will make their jobs more difficult, or just won't work. Resistance often is based on ignorance. They don't understand the technology, don't know how it works, don't understand why it's needed and don't know what it will mean to them. No wonder they resist! Share this kit with them.

It's important that everyone receive adequate training on the need to use bar code and are given the power to affect how the new system will work. Involving future users on the development team de-

mystifies the project and gives them ownership. In many cases, workers have made significant contributions to the project design, and have worked to ensure its success.

1.6 How to use this book

Do not hesitate to skip over chapters and jump around; we even do that in this section! Use the Table of Contents to jump to sections of greatest interest.

Our goal in writing this book is to provide a practical guide that will expedite implementation of bar code-related systems and equipment. It is in the style of a workbook and takes a simple, straightforward approach. This book is primarily for executives who must decide whether or not to use bar code; it is not written for those who specialize in the technical aspects. Therefore, non-essential technical detail is intentionally omitted. Chapters 1, 2 and 3 will set the foundation. Chapters 5 and 6 provide a Bar Code Primer and a first level of detail about standards.

If you're going to use bar codes you'll probably be buying some equipment, software and (perhaps) implementation assistance. At that point you'll need to know what to ask for, if the prices quoted are about right (too high; or worse, too low) and if the improvement supplier truly has the *right solution*. Finally, you must to be able to verify suppliers' claims.   It's all covered in this guide; primarily in Chapters 7, 8 and 9.

But first, this workbook will help you identify your true needs (Chapter 4), which is an obvious prerequisite to determining the capabilities required of the bar code-related system, equipment, or implementation-assistance provider. Understanding needs will help you avoid inappropriate suppliers:

- who low-ball a bid and do not include all the hidden costs.
- who pad the cost justification by including capabilities the distributor can't use or doesn't need.

This type of understanding will also avoid another problem: Overlooking the supplier who, on the surface, might seem expensive--but has what the distributor really needs.

And, hand in hand with needs assessment, is budgeting -- which should involve identification of the overhead costs reduced through the use of bar codes. Simply put, the cost-avoidance computation puts the expense of bar code implementation into perspective.

This book will help you quantify the amount of money which can be saved in *receiving, storing, picking & shipping, counter sales, warranty tracking* and *core returns* (also Chapter 4). Much of the savings will come from altering current methods, and eliminating steps from an existing process. This is not a book on re-engineering, but the need to alter inefficient processes that should be replaced by automation. The book simply explains the automated procedure and the cost impacts; it will not analyze the viability of existing methods. Examples of referenced automated procedures include batch and wave

picking, scanning to verify shipment and electronic banking. We do not argue the pro or con, but do note possible savings.

Savings for other EDI or e-commerce-related functions--like *purchasing* and *order entry*, as well as *invoicing, receipts* and *payment* -- are also identified, although the dollar amounts are not quantified. (This Guide focuses on bar code, but EDI / e-commerce is mentioned when addressing those aspects of the business system related to inventory replenishment, i.e., order placement and receipt, because bar code and EDI / e-commerce are so closely related in these activities.)

Worksheets are provided to help the reader develop a budget based on cost avoidance and to help identify the estimated design, equipment, software, interfacing and implementation costs.

What this Guide doesn't do. This book doesn't (because it can't) provide a *precise*, step-by-step explanation of why and how to implement bar code *in your company*. The technology isn't as complex as most initially think, but all the variables can be somewhat intimidating. This is no small, simple undertaking.

Indeed, if someone should suggest that any similar endeavor that will generate the savings and efficiencies virtually guaranteed by bar code is a slam dunk, run (don't walk) away.

Exponentially increasing the difficulty of providing implementation *specificity* for your company, in a publication such as this, are the complexities and variability of distributors. The differences aren't as great as usually thought, but you are different. Your methods of operation, goals and circumstances have much in common, but you're different.

Don't misunderstand. This isn't an apology. We sincerely believe (actually, we know) that bar code implementation is essential to your growth--quite possibly to your survival. Though somewhat frustrated (because we can't tell *each* of you *precisely* what *you* should do and when *you* should do it, in this book) we're convinced that bar coding is an imperative for the vast majority of heavy duty distributors. And here's the point using a baseball analogy: You've got to get into this game, but most of you don't even know the way to the proverbial ballpark. This is a guide to, and into, the ballpark; it explains the basic rules, and the fundamentals of pitching, hitting and fielding. We even warn you about spitballs, *but you have to swing the bat.*

Continuing with the analogy for just a while longer: Baseball is a highly complex game; the more you know about it the more you know how much more there is to know. Many instructional manuals have been written, but none begin to cover all the intricacies caused by all the variables. Nevertheless, baseball can be a highly rewarding experience, without all that expertise. All you really need are the fundamentals, common sense and good instincts. Kind of like business. Bar code implementation is a bit similar; but it's not as complex as baseball; it's not even as complex as some of these sentences. (Enough of that, and this.)

1.7 The bar code implementation alternatives

Several approaches can be used to add bar code capability to transaction processing systems (more in Chapter 7):

- Buy a new computer system with bar code capability. Certainly, any distributor who is considering a new computer system should ensure that the capabilities discussed in this book are included in that system.
- Purchase a bolt-on bar code system to use with an existing computer system. The issues to be considered here include the cost, the effect on internal operating practices and the responsibilities of both the existing computer system provider and the supplier of the bolt-on bar code system.
- Add scanning and printing equipment to an existing system, using in-house resources and expertise. This alternative requires consideration of the capabilities of the existing computer system, acquisition of the bar code equipment, the difficulty of adding on, and the cost (compared to a bolt-on system).

1.8 The solution steps

The selection of the correct alternative to implementing bar codes in the distributor environment requires six general steps:

1. Identify the true needs of the company.
2. Identify potential bar code suppliers.
3. Analyze these suppliers' capabilities and match them to the needs of the company.
4. Create an implementation plan.
5. Install the solution.
6. Test, then use to improve productivity and service.

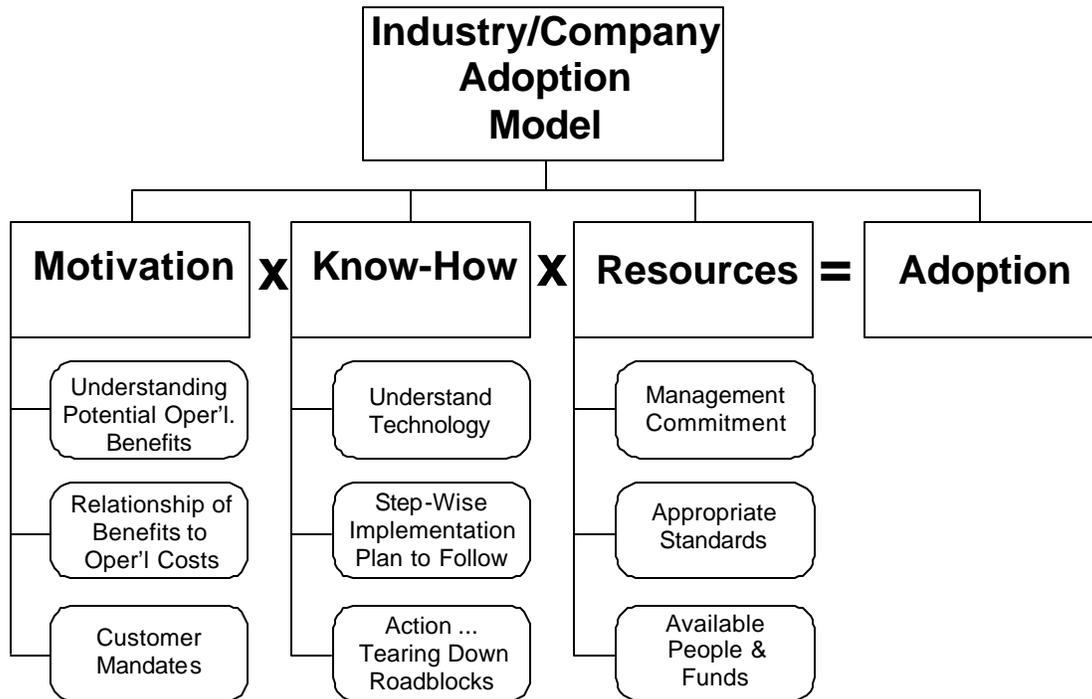## 1.9 Technology is part of the organization

The definition and installation of any new technology system can be perplexing for other reasons not already mentioned. And the concomitant anxiety can be magnified because the concepts involved deal with core requirements that, although long present, may not have been recognized as fundamental. Please remember that, yesterday, people were the organization. Today, more than ever before, the technology is part of the organization.

1.10 What it takes: Putting this technology to work for you

There is a formula for the adoption of bar code or any other technology. It includes nine elements. Small bar code systems do not require much attention to each element. But, on the other hand, large systems do require a deeper level of understanding. If you have at least a cursory understanding of these nine elements, you'll better know your strengths and limitations.

Appendix D contains a worksheet that walks you through a self-analysis based on the nine elements. Don't get bogged down in an evaluation process; but give it a little time, because the exercise will help you categorize and organize the information you'll be gathering. And it'll help you assess the relative importance of the information.

A successful bar code implementation project includes all of the items in the chart below.

Industry/Company Adoption Model

Motivation X **Know-How** X **Resources** = **Adoption**

Motivation	Know-How	Resources
Understanding Potential Oper'l. Benefits	Understand Technology	Management Commitment
Relationship of Benefits to Oper'l Costs	Step-Wise Implementation Plan to Follow	Appropriate Standards
Customer Mandates	Action ... Tearing Down Roadblocks	Available People & Funds

1.11 The steps to installing a system

Another tool to facilitate understanding is the Implementation Game. It's a game board that looks much like a Monopoly game board. It identifies all the moves to a successful implementation, including the four major steps: define the project, design and document the system, develop the system, and deploy the new system in accordance with the detailed design.

The game board, like the Adoption Formula explained in Appendix D, should help you understand the pieces of the puzzle--and serve as a map, showing where you are in relation to where you must go. A complete outline of the implementation game is included in Appendix E. It can be used as a checklist to monitor progress through the project. For now, just understand the elements involved.

Note: You will notice the chapters are identified on the first two legs of the game board. This book only takes you through the planning stages. The other two stages will be different for each company. For more information, go to www.quadii.com/bcig/.
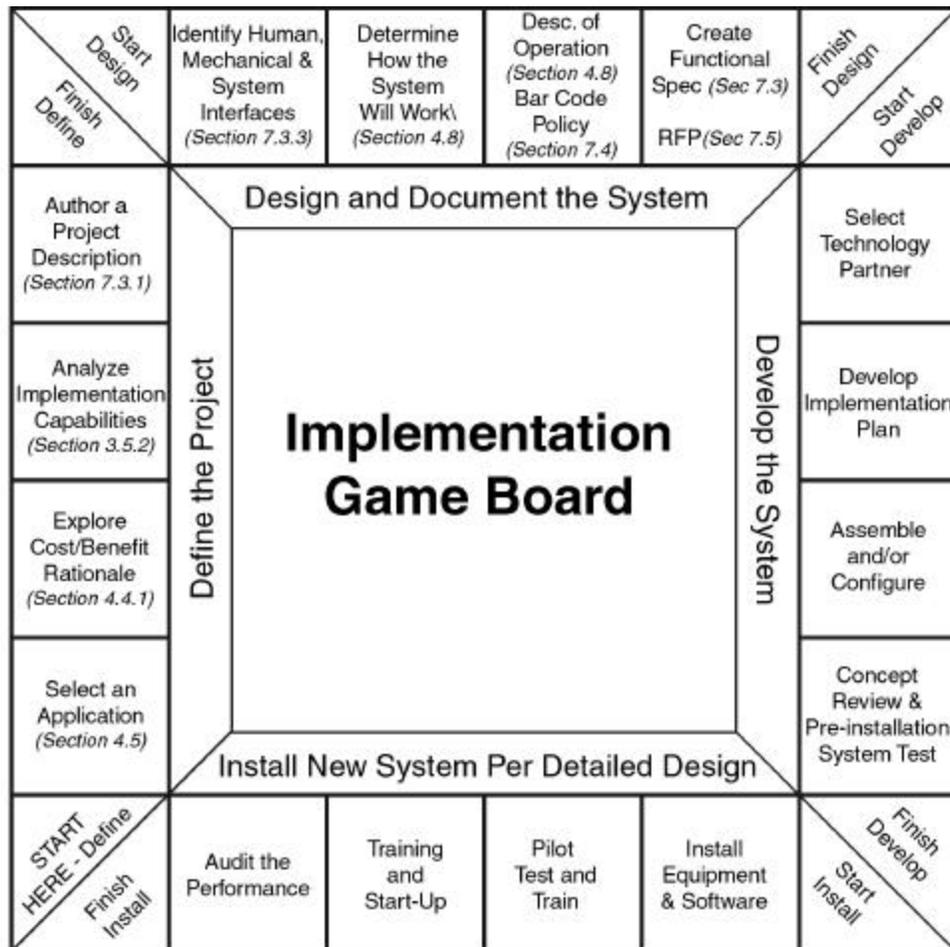

Figure 1-1

2. How & Why Technology Will Cause Change

2.1 What must be accomplished

Three broad sets of issues must be addressed to successfully implement any new technology:

2.1.1 Business requirements

Obviously required: an understanding of the products, the customers, the flow of goods-services-money-information, and the processes that support the flow throughout the entire enterprise.

2.1.2 People requirements

Teams of people will use the new technology; you must know these teams and their inter-relationships. You must be sensitive to employee needs--and fears of the new technology.

2.1.3 Systems requirements

Understand what computer and material-handling related technology can do for your people and your business, i.e., how the systems support the business requirements.

2.2 Management and control

Customers have been spoiled. They will no longer abide minor inconveniences, like backorders, or being shipped the wrong item. A distributor must truly manage its inventory and transaction-processing systems if it's to provide this unreasonably demanded hassle-free service.

Obviously, knowing customer needs, products (new and old), and demand forecasting is critical--but so is control. Control is making sure the inventory asset is not stolen, misplaced or misdirected. Simply put, you cannot manage what you cannot control.

Controlling the inventory and the transaction processing system basically involves making sure (1) you received what you requested, (2) you picked what was needed, (3) you assembled what was ordered and (4) you shipped what a customer asked for. It also means, for a counter transaction, that you billed and adjusted inventory for precisely what was carried out of the store. And, if a core or other item was returned, that credit was applied properly.

This would all be relatively easy, if it were not for inaccuracies in identification, location and communication. Bar code can virtually eliminate these inaccuracies.

2.3 The efficient channel

The potential effect of bar code implementation on the entire distribution channel was briefly mentioned in the Q&A section of Chapter 1; that point certainly deserves some elaboration.

Although companies can benefit from employing the technology individually, the big payoff comes when many customers and suppliers (trading partners) do it together. Inter-company processes must be integrated to increase the efficiency and drive cost out of the supply channel. More simply put, distributors must seek to involve their manufacturers and customers in inter-company efficiency improvement endeavors.

That fact was documented in a study now several years old but still valid, "Project Pocketbook," conducted by the American Supply & Machinery Manufacturer's Association (ASMMA) and the Industrial Distribution Association (IDA). The redundancies detailed in the study, listed below, could be substantially eliminated with bar codes and EDI / e-commerce:

1. An order is entered into the customer's system, the distributor's system, and the manufacturer's system, with a repetitious, manual effort at all three locations.
2. Products traveling from manufacturer to distributor to customer have to be handled, checked, verified and entered into separate systems at multiple stops at each point.
3. Inventory is carried at all times at the customer, distributor and manufacturer locations.

The above confirms the need to use technology to integrate the organization (ordering, receiving, picking, shipping) and complete channel (manufacturer, distributor, customer). Experience with individual companies indicates that technology in general, and bar codes and EDI / e-commerce specifically, can dramatically improve efficiency and eliminate cost.

This will become clear (painfully so, to some) as two- and three-step distribution channels embrace supplier-assisted inventory management — a.k.a., vendor-managed inventory (VMI). It's here, now!

3. Benefiting from Bar Codes: What You Must Do

First we will address the concept of "re-engineering" business processes and quantifying the benefits. Then we will look at how one company implemented bar code technology.

3.1 This book is *not* about re-engineering!

Sooner or later we had to use the word "re-engineering." Although the main focus of the book is definitely *not* re-engineering, we believe technology implementation provides an ideal opportunity to evaluate business processes--and make changes that reduce cost and increase service to the customer.

3.1.1 What is re-engineering. Why do it?

Over the years, the talk about business re-engineering (more appropriately process re-engineering) is a result of dramatic progress in computer and information technologies.

Jack Shaw, author of a book "Doing Business in the Information Age," explained: Re-engineering (of anything) is required when advancements alter *enabling technology* so radically that processes designed using the old technology no longer capitalize on the capability of the new technology.

One of his examples is easier to understand: Warfare was repeatedly re-engineered with the development of gunpowder, aircraft, radar, atomic weapons, etc. We still have foot soldiers, but they now carry night vision equipment and global positioning systems.

A company must re-engineer from time to time when technology can provide a clear advantage, to itself or competitors. In distribution, for example, a company that uses bar codes for picking verification may be able to eliminate the final inspection process. The re-engineered process will be lower in cost than that of a competitor who uses final inspection to ensure accuracy.

Today's computer systems are not just faster and cheaper versions of the computers of 20, 10 or even five years ago. They are vastly more powerful. Their capabilities have been enhanced many times over. This extends to communications networks, the human interfaces and the processing capability. Therefore, many business processes in use today, *designed around paper systems or forerunner computer systems*, should probably be redesigned (re-engineered) to capitalize on this enhanced technology capability and the ability to actively collaborate with partners up and down the supply chain.

3.1.2 Process improvement vs. process re-engineering

Many companies use computers to automate previously manual business processes. This eliminates many errors, improves inventory accuracy and represents a form of process improvement. The goal of re-engineering, on the other hand, is to eliminate some current processes. The difference between process improvement and process re-engineering can be seen in several upcoming examples and comparisons.

3.1.3 Understanding processes is the key

Most companies initially look at process improvement from a departmental perspective, and incrementally improve activities like order entry and order picking. A few have viewed both activities as one, calling it order fulfillment, and designed (re-engineered) a new process that uses information technology to eliminate steps. That new process will rearrange departmental interaction. Understanding the interaction of various components, to simplify the whole, is what re-engineering is all about. It requires change; change is difficult (for industries, companies, departments and individuals); but change is critical to survival.

3.2 A comparison of process efficiency

3.2.1 Time consumed in receiving and shipping activity

Activity	Regular	Improved	Re-engineered
Issue PO to supplier	3 to 20 min.	3 to 20 min.	Auto/ EDI / e-commerce
Receive material	7 to 20 min.	7 to 20 min.	7 to 10 min.
Verify receipt	15 to 45 min.	7 to 15 min.	Auto/ASN
Store material	8 to 20 min.	4 to 10 min.	4 to 10 min.
Update inventory	300 to 900 min.	2 to 5 min.	Auto
Process supplier invoice	5 to 25 min.	5 to 25 min.	Auto
Receive customer PO	3 to 20 min.	3 to 20 min.	Auto
Pick for shipment	5 to 25 min.	3 to 7 min.	3 to 7 min.
Update inventory	300 to 900 min.	2 to 5 min.	Auto
Issue customer invoice	3 to 15 min.	3 to 15 min.	Auto

3.2.2 Regular process

- No use of bar code.
- Shipping errors: 2%-4% (loss of 25% of pretax profit).
- Inventory accuracy: 75% by item, quantity and location (requires 15% more inventory, to meet customer service levels).

3.2.3 Improved process

- Uses bar code.
- All material handling activities improved with computer assistance (bar code).
- Improved activities, like batch picking and order verification, are used.
- Computer update is close to real-time using radio-frequency-linked (RF) terminals.
- Shipping errors: less than 1% (pretax profit up 20%).
- Inventory accuracy: 99.99% (inventory carrying charges dramatically reduced).

- This represents a 30% to 50% increase in productivity, and has almost eliminated lag time for inventory update.
- Greatly improved customer service, while reducing operating expenses.

3.2.4 Re-engineered process

- Non-value-add activities dramatically reduced.
- Ordered via EDI or e-commerce. Paid electronically. No matching of packing slips, invoice, check, etc.
- Item received with advanced shipping notice (ASN), which provides better delivery scheduling.
- Receiving process validates receipt, and 60% of the time enables cross-dock (item sent to point of use or sale without storage). This eliminates double handling.
- Shipment automatically triggers invoice to customer, with Electronic Funds Transfer (EFT) and/or automatically posts receipts to accounts payable with EFT payment--no lag time and no human intervention unless human authorization desired.
- More staff time to devote to selling and sourcing new products.
- New relationships formed with suppliers and customers based on ability to manage and control inventory better--but at lower delivered (not simple unit) cost.

3.3 A case study

Bill Derville is President of General Tool in Portland, Oregon, and a past president of the Industrial Distributors Association (IDA). His firm is typical of thousands of small-to-midsize distributors. After discussing his needs and desires with his business system supplier, both agreed the software would need major modifications if the system were to take advantage of what bar code offers. Bill decided to develop his own warehouse-activity-related system and "bolt it on" to his existing business system.

This "bolt on approach" was not unique; some have been more successful than others; but Bill's implementation went smoothly. It serves as a textbook example of "how to do it," if you must.

3.3.1 Three insights

Three insights from Bill Derville's experiences are:

1. Do not reinvent the wheel if you don't have to. The company that supplied the warehouse system enhancement had a pre-developed program, a result of considerable experience and ongoing improvements. What you need may already exist.

2. Do not rule out (or rule in) your own computer system supplier. Some system suppliers have "begun to see the light" and are integrating bar code applications into their software. Integration is good. Experience with bar code standards, equipment and software is essential.

3. Again, make sure you understand:

- What can be done with bar code to really improve your operation.
- How it will benefit your business.
- How the use of bar code will eliminate steps in the process, not merely automate old ones.

3.3.2 Steps in the implementation

And now an explanation of what Bill and his team did:

1. He took time for an entrance-level education on the technology and what it could do. He attended some seminars provided by his trade association. He bought a few books and videos, and used them to educate others in his company.

2. He organized a team, including the warehouse manager; together they:

- Identified the problem: poor inventory accuracy.
- Determined the cause: picking errors.
- Then determined a solution: picking verification.
- Stated the system goal: increase inventory accuracy by eliminating shipping errors.

3. They agreed on a metric and a method to measure their goal: Inventory accuracy will be measured by the accuracy of item, quantity and location--through cycle counting and again during physical inventory at year's end.

4. The types of activities that had to improve to meet the goal were identified: taking physical inventory, receiving, and shipping verification.

5. A flowchart of how they wanted the new system to work was developed.

6. The flow chart was used to author a Functional Specification, explaining the system they conceived.

- It included samples of the computer (and portable) screens to enter the information and display reports.
- Also included: examples of labels that would be used to identify products, locations and orders.
- This required the team to know what information would be bar coded and what they expected to key enter.
- It also required the design team to know where the information came from, and where it went.

7. The team realized that some methods and activities would have to change, and got "buy in" from the people involved.

8. Using the Functional Specification, they developed a Request for Proposal (RFP). It explained what they expected, but did not specify exact hardware or software (this allowed the bidders to use their own creativity and experience to present solutions).

9. Several bar-code-system suppliers were invited to review the RFP and propose solutions.

10. The team met with the bar-code-system suppliers to determine how the proposals would meet the Functional Requirements contained in the RFP. Experienced suppliers addressed some issues the team had overlooked. And the team showed the system suppliers how the "packaged" system had to be modified.

11. They selected a supplier based on how it fit with General Tool' people, material handling system, computer hardware and business system.

12. Bill and other individuals devoted quality time with the selected system supplier to think through the human interfaces and implementation sequence.

13. In cooperation with the supplier, they diligently planned the equipment and computer testing, as well as the start-up activities, for those who would use the system.

The system cost about $60,000 in hardware, software and design. It took about four months to define, four months to design and develop, and about a month to test and install. It uses 486 class PC's and three RF portable terminals, with more terminals planned. The first phase installed a shipping verification system and provided the capability to cycle count and take physical inventory. The next phase: receiving and location verification.

3.4 Costs and cost savings

Chapter 4, specifically section 4.5, will identify specific cost areas, and the savings associated with each. However, two generalized numbers are repeated time and again:

About 30% of the overhead costs associated with day-to-day operation are directly related to errors that could be virtually eliminated with bar code and EDI / e-commerce.

Within 18 months of implementation, distributors see a 20%-25% increase in throughput without adding staff or additional building space.

More on this subject in a later chapter; but, for now, we'd like you to know that the bar-code related performance improvement is almost immediate, and payback is usually less than a year.

3.5 What you must do

You must initiate change. That's the toughest part of any major project. What skills are required? All the skills may reside within your company, but you can't do it yourself, alone; you'll have to rely on others. This leads to a discussion of the implementation team. In later sections we'll explain how to ensure that the individuals on the team have the necessary skills.

3.5.1 Assembling the team

Bar code and EDI / e-commerce provide accurate, timely and inexpensive information to the three systems necessary for control. The goal is to harmonize the three. This may sound simple, but it requires a true understanding of (1) material handling and equipment, (2) computer-related software and equipment and (3) the processes that interact with both. A lot for one person! That's why a team is required, with individuals who can provide expertise in the various business processes, and in the tools (hardware and software) necessary to integrate them.

3.5.2 Implementation depends on level of integration

The team should consist of three types of people: executive, operations and technical. You may get some technical knowledge, and some concepts on operations, from outside your company--*but you cannot get executive commitment on the outside, and you must have the support of the users from the operations side of your business*.

Whether the team thinks you can install your own bar-code related system, or will require outside help, you need to know what disciplines are involved--and how much knowledge on each discipline is expected of you, your team members and your technology partner.

1. The disciplines are somewhat related and overlapping. Beware of anyone claiming to be expert in all.

2. A supplier is of course responsible for the performance of what it provides. And the best way to hold someone accountable for his performance is to have a good specification, describing what he's to do. In addition, external suppliers' roles must be well documented.

   But, you will ultimately be responsible for the integration of your own system. Yes, you can hire a company to hook it together. But you cannot shed responsibility for the ultimate success of the project.

3. Finally, the level of implementation you attempt must be a function of your team's level of technical expertise. That is, you cannot reasonably expect to implement a sophisticated system without technically sophisticated team members.

3.6 Extended team roster: skills required

1. Corporate strategy and vision as it relates to the mission of the company. It may come from the board of directors or the CEO. It may be developed by a management consulting firm. Regardless, they bring the following skill sets:

   - Distribution logistics concepts and methods.
   - Material handling methods.
   - Enterprise planning.
   - Process design (re-engineering).

2. Automatic data collection (ADC) capabilities, standards and design, as related to material management and control. Skills:

   - Understanding of the various ADC technologies, and which to use in a given situation.
   - Human, electronic and mechanical interfacing of ADC equipment with new and existing computer- and material-handling systems.
   - Standards pertinent to bar code and other ADC technologies.

3. Application software supplier. Skills:

   - Software capability to automate a process.
   - An understanding of the user's processes or transactions, and what the software provides to support them.
   - The software side of human interfaces, computer interfaces and machine or mechanical interfaces.

4. ADC equipment supplier. Skills:

   - An understanding of a specific equipment set, and the unique design and installation requirements.
   - Technology-specific standards.
   - Device-specific software and programming.

5. Computer and network technology supplier. Skills:

   - Knowledge of the performance characteristics of various alternatives.
   - Knowledge of fault tolerance, back up and redundancy.
   - Client-server technology for both hardware and software, if needed.

6. Project team and change management. Skills:

   - Ability to bring a group of individuals together, and facilitate their productivity through communication and commitment.

Skill Rating of the Implementation Team

SUPPLIER	1	2	3	3	2	1	USER
Corporate Strategy and Vision	X			X	X	X	Corporate Strategy and Vision
Project Team and Change Management	X	X			X	X	Project Team and Change Management
ADC Technology Skills	X	X	X			X	ADC Technology Skills
ADC Equipment Skills	X	X	X			X	ADC Equipment Skills
Application Software Skills	X	X	X			X	Application Software Skills
Computer Technology Skills	X	X	X		X	X	Computer Technology Skills
Design and Integration Skills	X					X	Design and Integration Skills

Figure 3-1

Each of the skills must be present on both the supplier and buyer side of the team. There is, however, a difference in skill level that we have ranked 1 through 3 with an "X". This chart provides a sample of how to rank the skills found on both sides. The buyer and the supplier should have at least a rank of 1 and a combined value of 4. For example, in the area of *ADC Technology Skills* the supplier has 3 and the buyer has 1; this is fine because the total is 4. There is a potential problem in the area of *Design and Integration Skills* because the supplier only has 1, as does the buyer.

3.7 Summary

The reason for the preceding detail is to aid vendor selection. Many companies will prefer to buy "turnkey." And many system providers say, "We can take care of everything." The skill sets identified here are the "everything." In section 9.4 we will use these skill sets as qualifiers, to verify whether your company really has a particular skill or if it must be obtained from a supplier.

Some tools: (1) the "Adoption Model" and the worksheet titled, "How ready are you to use bar code?" in Appendix D, and (2) the "Implementation Game" in Appendix E. They're explained in more detail in later chapters. In this chapter we've tried to document the great commitment required for the even greater rewards of the bar code systems.