C H A P T E R   5

Portable Computing Devices

The most prominent feature of the mobile enterprise is the small computer each employee carries with him or her to access critical information. These are the tools mobile professionals use every day. Either they like their portable computers or they do not. In selecting which device they use, pay careful attention to their needs and prejudices.

You should also think about the impression such devices leave with your clients. After all, your mobile professionals are your company's ambassadors. In large measure, the outside world will form its opinion of your company as a result of contact with these representatives. If your mobile professionals operate in a smooth manner, the world is likely to have a good impression of your company. If, on the other hand, your company's representatives are clumsy and they carry around a lot of stuff they do not know how to use, they are likely to leave a bad impression. To this end, you should choose your portable computing devices carefully. Features, usability, and even fashion should play a role in your selection.

In this chapter I talk about the different kinds of portable devices that are available for use by your workforce. I specifically call out the cases where one is more appropriate than another, and I discuss different combinations you should consider.

ENTERPRISE REQUIREMENTS OF PORTABLE DEVICES

One indicator of the state of the industry around portable devices is the number and variety of products and accessories on the market. As in any early market there is a good deal of fragmentation. A lot of different players are

vying for market share. They are approaching this business in different ways, using different standards, and emphasizing different features. Eventually many of these companies will get nudged out and a few winners will emerge. Once this happens the industry will settle on de-facto standards.

However, this is unlikely to happen anytime soon. The underlying technology is changing too quickly—forever making new things possible and allowing new entrants into the market. For you, the buyer, the result is a lot of confusion. You are now confronted with new possibilities that may be applied to your competitive advantage, but you cannot do so without first cutting through all the noise and understanding what is real and what is just a bunch of fluff. Those who fail to make the difference between hype and reality run the risk of jumping in front of a parade that is heading down the path of industrial disaster.

Of course, the danger of standing still as the parade marches by is that your competitors may jump out in front and lead the way in your industry. How many times have we seen this in the past? A paradigm shift of the magnitude we are now witnessing will eventually change just about everybody's business. Those who pick it up early and forge a clear path ahead will be able to leap frog over the competition.

It all comes down to understanding this new technology and determining how, if at all, it applies to your business. The good news is that for our purposes we *can* make some sense of the fragmentation around portable computing devices. Let's start out by thinking through what it is a mobile enterprise might require of portable devices. We can do this by looking at two sets of parameters:

- *Functional requirements*: What are the features you require of portable devices? Table 5–1 can be used as a guideline for thinking through the kinds of questions to ask when selecting what is most appropriate for the job functions you have in mind.

- *Economic and practical considerations*: What does owning such a device entail? Table 5–2 lists the economic and practical considerations that should be taken into account when you choose portable computing devices for your workforce.

Maybe you have a few parameters to add to the lists in Tables 5–1 and 5–2. Only *you* know the full set of requirements for your specific case. What is important is that you start out with a list or lists similar to what is shown in these two tables. This will facilitate an objective evaluation of the portable devices.

TABLE 5–1   Feature Requirements of Portable Devices

Factor	*Questions and Concerns*
Wireless access	• Do you need the device to have direct access to a public wireless network? Which networks do you want access to?
Synchronization	• Which applications and data do you need to synchronize and what kinds of synchronization procedures are acceptable?
Indoor/outdoor use	• Do you need to use the device inside? If so, you will have to consider in-building network coverage, and you will have to consider how good the display is indoors. • Do you need to use the device outdoors? If so, you will have to make sure the display is readable under sunlight.
Size	• Do you need the device to be small enough to put in a pocket? • Does the screen have to be small enough not to interfere with face-to-face conversation?
Weight	• Does the device have to be especially light?
Multimedia	• Do you need to be able to view videos or listen to audio recordings? • Do you need to be able to record video or audio?
Add-ons	• Do you need to add a bar code reader, a camera, global positioning system (GPS), or something else?
Ruggedization	• Are you going to operate the portable device in a dusty environment, in hazardous weather, or in a place where it will have to withstand shock?
Battery life	• How long do you need to operate without being plugged into the wall? • How much time can you tolerate for recharging the battery?
Boot-up time	• How long can you wait for the portable device to boot up?
User interface	• Do you need color display? • How would you like to enter data? • How much screen space do you need? • Do you require the ability to make phone calls?

TABLE 5–2   Economic and Practical Considerations

Factor	*Questions and Concerns*
Cost	• How much does it cost to buy and maintain?
Popularity among thieves	• Do people like to steal this kind of device?
Ease of replacement	• How easy is it to acquire a replacement? Do you have to stock up or can you just go to the store and buy a new one? • How easy is it to acquire parts and add-ons?
Compatibility	• Does the portable device use standards that are going to prevail? • Is the device compatible with other hardware and software to which it must interface now and in the future?
Aesthetics	• Is the device going to show a good image of your company? • Will your mobile professionals be proud to carry it around?

Remember also that part of what you will have to do is match the tool to the job function. For each job function there may be a different set of needs; and as such, you might choose a different portable computer for each professional role.

THE RANGE OF DEVICES AVAILABLE

For the most part, we can place portable computing devices into the five categories shown in Box 5–1. The devices you will be considering will probably fall into one of these classes.

Box 5–1   Categories of Portable Computing Devices

The following are devices that the mobile professional can use today:

- **Cell phones:** most cell phones on the market today offer some kind of data service. Most offer a short messaging service (SMS) and many also offer wireless access protocol (WAP) services that allow a minimal form of Web access.
- **Personal digital assistants (PDAs):** we are now seeing a tremendous amount of advancement and market uptake in PDAs. Due to the small size and relatively high computing power of these devices, they are fast becoming a favorite among mobile professionals.
- **Smart Phones:** we are just now starting to see viable products that offer both the capabilities of cell phones and PDAs. This is a powerful combination whose proponents view it as the device to end all devices.
- **Tablet computers:** these are computers with a large screen and no built-in keyboard. Input is through a stylus. The idea is that using these computers is like using a tablet of paper.
- **Notebook computers:** so far these have been the portable computing device of choice. Many people have gotten rid of their desktop computer and now just use a notebook, which they can carry around outside of the office. At the same time, many notebooks are powerful enough to use in the office just like a desktop computer.

These devices differ in terms of features and computing power. They also differ in terms of cost, size, weight, battery life, and boot-up time. To get an idea of how these devices compare, it is useful to plot a rough graph positioning them by functionality versus inconvenience, as is shown in Figure 5–1.

Keep in mind that what someone calls a useful feature is highly subjective. Likewise, what is considered an inconvenience will differ from company to company and from person to person. How you rate features and inconveniences will depend on the job function where the device is to be applied, as

Trade-Offs in Choosing Portable Devices
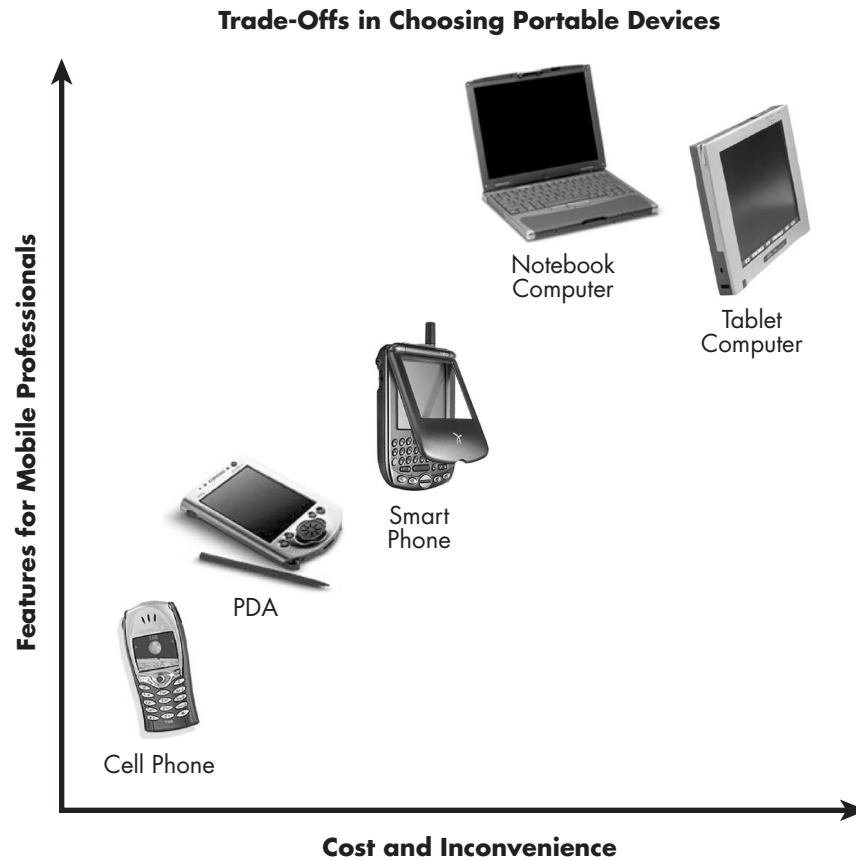
FIGURE 5–1   Rough positioning of portable devices.

well as on personal preferences. For these reasons, Figure 5–1 should only be taken as a very rough plot of features versus cost and inconvenience.

As you see, tablet computers are graphed as having fewer features and more inconveniences as compared to notebooks. Why then would anybody want a tablet instead of a notebook? Those people who prefer tablets have very specific needs. For example, many people want a computer they do not have to open to view the screen. They want to be able to view data on a large screen using a device they can hold in one hand. Tablets are also generally more resistant to abuse. They can take a coffee spill—notebooks cannot.

You may also be wondering why two-way pagers are not included on the list of portable computing devices. The reason I have left these devices out is that pagers by themselves are of limited usefulness to the mobile profes-

sional. Those that will enjoy long-term success in the marketplace are the ones that are either part of a cell phone or that offer PDA functionality as well. The Motorola V.200 is an example of the former and the RIM Black-Berry is an example of the latter. These devices are included in the discussions on cell phones and PDAs, respectively.

CELL PHONES

Mobile professionals are already using a cell phone—so much so that in many cases, it is taken for granted. Nowadays, carrying a cell phone is like carrying around a wallet and keys.

But do not forget how powerful a tool the cell phone is. After all, this is how mobile professionals make calls and this is how other people can reach them virtually anywhere. There is no doubt that the cell phone has already greatly enhanced the efficiency of workers on the move. But what can the cell phone do to help you access enterprise applications?

In cases where exchanges are relatively small, the cell phone might be the portable computing device of choice. For example, you can send a dispatch order including the address of the next trouble site to a technician's cell phone. The engineer can accept or reject this request and even get a little more information on the problem by clicking on a universal resource locator (URL).

Another case where the cell phone is a sufficient tool for accessing enterprise applications is where you are using an application that offers a voice menu with voice recognition. Your mobile professional can navigate the menus and enter data by speaking. As long as the list of things that need to be said remains small, this could work quite well. However, be careful when there is a high degree of variation in what needs to be done from individual to individual or from session to session. Voice recognition technology is still quite primitive. You can get hung up having to repeat yourself several times before becoming so frustrated that you just give up on using a voice application altogether.

In these two examples, there is no need to get a sophisticated portable device. If your problem is simple, do yourself the favor of keeping the solution simple. Stick with using cell phones.

Choosing a Cell Phone

Your choice of cell phone will go hand in hand with your choice of wireless network provider. The service provider will support only a certain set of phones. Often, they will provide the phone and the subscription as a package.

Which phones are supported by the operator will depend on which wireless network technology is being used—and in many cases, on which partnerships the operator has with handset manufacturers.

Cell Phone Features

The basic functions offered by the current generation of cell phones are voice calls, caller ID, voice mail, short messaging service (SMS), and address lists. There are several additional features that are of interest to the mobile professional. Box 5–2 lists some of the important ones.

Box 5–2   Additional Cell Phone Features for Mobile Professionals

Some additional cell phone features that are important to the mobile professional are:

- **Wireless application protocol (WAP)**: to allow a limited form of Internet browsing.
- **Messaging**: allowing users to send mail messages via a paging service.
- **Voice activation**: to allow you to initiate phone calls or other simple commands by speaking to your phone.
- **Infrared**: to allow you to *beam* information to another cell phone that is only a foot or so away and pointed at your phone. Infrared is also a useful way to connect a computer to the phone to allow the computer to use the data services of the phone.
- **Bluetooth**: to exchange information with other devices within 10 meters without having to point the devices at one another. Bluetooth is also an excellent way of providing data services to a computer. The computer can control the phone via the Bluetooth connection. You can do all this without removing your phone from your pocket.
- **Predictive text entry (T9™ or iTAP™)**: to ease data entry by reducing the number of keystrokes needed to enter a word.
- **Speakerphone**: for hands-free communication.
- **Synchronization**: to synchronize contacts and calendar with your desktop or notebook computer.

A WAP browser, messaging, and special data entry features all serve to make your cell phone a little more like a data device. In fact, a cell phone with these features might be the right tool for many mobile professionals.

WAP Browser

Many phones come with a WAP browser. WAP, which is the acronym for *Wireless Application Protocol*, allows limited Web browsing from a mobile phone. It does this through protocols that are adapted to the peculiarities of wireless networks. WAP includes a markup language, called wireless markup language (WML), which takes into consideration the limited screen and data-entry capabilities of a mobile phone.

You cannot directly access the same Web pages you would through the Web browser on your desktop PC. Either the Web site you access is written for WML or a portal has to be used to pick out fields from a Web page and package them for WML. Typically, network operators have a portal, which allows access to a limited number of sites.

Most of the cell phones on the market today offer a WAP browser that conforms to the 1.1 version of WAP, even though the WAP Forum has already released both WAP 1.2 and WAP 2.0 specifications. The biggest change from WAP 1.1 to WAP 1.2 is the *push* feature. This allows a message to be sent to the phone without the user first having to make a request. WAP 2.0 is a major revision aligning WAP more closely with standard Internet protocols.

Messaging

Some phones provide an *always-on* messaging service. A good example of this kind of phone is the Motorola V-200, shown in Figure 5–2.

This mix of telephone and messaging is best offered on networks with a two-way paging service. The messages can be *pushed* to the phone much like a paging message, that is, the user does not have to ask if he or she has mail.

FIGURE 5–2   Motorola V-200 phone-pager. Courtesy Motorola, Inc.

The network just sends it to the device as it arrives. The user checks mail when convenient and can usually be sure that the device has received the latest messages automatically.

Data Entry

One of the major limitations of the cell phone as a data device is the size of the keyboard. Most phones are limited to 12 keys—the 10 keys used to dial numbers and two special keys: "*" and "#". These same keys are used to enter letters of the alphabet and punctuation. Depending on the menu context, the phone will interpret keystrokes as either a number or a letter. When the keys are interpreted as letters it may take three or more strokes to get the right letter. For example, you have to hit the "2" key three times to select the letter "c."

T9 Text Input

An improvement on this is the system devised by the company Tegic Communications, which was acquired by America Online in 1999. This data entry system, called T9 Text Input, was originally developed to assist people with severe disabilities. Using special glasses that detect eye movement, a person can make a selection. Since it is impossible to focus on enough different places to make up a full keyboard, each selection maps to more than one letter. To resolve the ambiguity, the T9 system uses a database of commonly used words to propose an ordered list of possibilities to the user based on his or her selections.

The same principal was applied to handheld devices with limited keypads. For example, on an Ericsson T39 cell phone, if you type the sequence 5-6-8-3, the T9 software allows you to select one of the two words "love" or "loud," or the segment "jove."

Most of the phones on the market today use T9 for data entry.

iTAP™

Motorola developed its own algorithm for predictive text entry. This system, called iTAP™, is similar to T9. As the user types, the system narrows down a list of possible word segments based on a dictionary of 35,000 preconfigured words and any words the user has added. The order of words in the list is based on the commonality of the word and on the user's past selections.

Whether you use T9 or iTAP will depend on which software the phone manufacturer has licensed. Either system is sufficient for light data entry and short messaging. For more intense data entry, you will need a keyboard.

FIGURE 5–3   Ericsson Chatboard®. Courtesy Sony Ericsson Mobile
Communications.

Keyboards

Some cell phones offer a small keyboard as an accessory. An example of this
is the Ericsson Chatboard®, shown in Figure 5–3.

The chatboard is attached at the bottom of the phone and allows key
selection with your thumbs. The usability is similar to that of email pagers,
that is, you are not likely to win a contest in typing speed. However, for mes-
saging it does the job quite well.

PERSONAL DIGITAL ASSISTANTS (PDAS)

Apple Computer coined the term *personal digital assistant* (PDA) in refer-
ence to its Newton MessagePad device, which was first released in 1993. This
first PDA did not become very popular due in large part to the difficulties
with its handwriting recognition. It was just too hard to enter data accurately.

Three years later in 1996, Palm Computing released the Palm Pilot. This
was the first successful PDA. The thinking behind this creation of Jeff Hawk-
ins, a founder of Palm Computing, was that a handheld device should not be a
PC crammed into a smaller form factor. Instead, it should provide a small set
of simple functions tailored to the needs of people on the go. At the same
time there had to be a way for the device to synchronize with a desktop com-
puter. In this way, the user could keep only one version of his or her schedule
and contact list. The Palm Pilot used a simple letter recognition scheme that
worked very well. This scheme, called *Graffiti*, allowed users to easily enter
simple text using a pen-like instrument (a *stylus*).

The Palm Pilot device was so well received by consumers that it kicked off a new industry. Within a few years, several other companies jumped on to ride this new wave with their own handheld products. Today there are at least two dozen different brands of PDAs on the market. All offer the six basic functions shown in Box 5–3.

Box 5–3   Basic functions of a PDA

The basic functions of a PDA are:
- **Calendar**: to set appointments
- **Directory**: to store phone numbers and address information
- **Notes**: to take notes
- **Calculator**: to perform arithmetic
- **Alarm**: to wake you up or remind you of an event
- **Task List**: to track a set of things you intend to do

Many PDAs also offer word processing, spreadsheet, and time and expense applications. In addition, there are a variety of third-party applications developed for these small computers. The built-in software features, and the third-party applications available for a PDA, are determined by the operating system it runs.

Indeed, the OS is the biggest factor that sets one PDA apart from another. While there are several different operating systems powering PDAs today, three dominate:

- Palm OS
- Pocket PC
- EPOC

These operating systems have gained popularity among independent software developers who have collectively produced a rich set of applications from which you can choose. Fortunately for us, many of the software developers have created applications specifically targeting the mobile professional.

Palm OS-Powered PDAs

Companies that make Palm OS-powered PDAs include Palm, Inc. and Handspring. PDAs from these two companies are shown in Figure 5–4.

FIGURE 5–4   PDAs running Palm OS. Left image courtesy Palm, Inc. Right image courtesy Handspring, Inc.

To synchronize with the desktop, a system called HotSync is used. This requires a program to be installed on the desktop to interface with the PDA. In order to initiate synchronization, the user places the Palm device in its cradle and presses the HotSync button. Users may synchronize with both Mac and Windows desktop computers.

For data input, the user has a choice between an onscreen keyboard or the Graffiti system for letter recognition. The onscreen keyboard can be accessed when the cursor is in a text field. The layout is like that of a QWERTY keyboard.

Most users prefer Graffiti. Under this scheme, the user draws letters on the screen with a stylus. The letters have to be written in a special way. The Graffiti system recognizes letters by the shape of the stroke of the stylus, and by the origin and direction of the stroke. With the exception of the letter "X," every character can be written with only one stroke of the stylus. It takes most people less than 20 minutes to learn Graffiti.

Pocket PC-Powered Devices

Windows CE is an embedded version of the Windows family of operating systems. This embedded operating system is modular, allowing different frameworks or packages to fit to different classes of devices. The package used for PDAs is called Pocket PC; and the PDAs it runs on are called the same thing—Pocket PCs. Companies that make such PDAs include HP and Casio. Pocket PCs from these two companies are shown in Figure 5–5.

FIGURE 5–5   Pocket PC devices. Left image courtesy Hewlett-Packard Company. Right image courtesy Casio, Inc.

To synchronize with a desktop computer, the user places the PDA in its cradle and synchronization commences automatically, that is, in contrast to Palm PDAs, users of Pocket PCs do not have to press a button to start synchronizing. On the Pocket PC, synchronization is through a system called ActiveSync, which, like HotSync, requires a program on the desktop and one on the PDA. ActiveSync supports synchronization with Windows desktops, but not with Mac desktops.

Data entry can be accomplished through an onscreen keyboard, much like that of the Palm devices. The user may also work with a letter-recognition scheme or a full-blown handwriting recognition scheme called the *Transcriber*.

The Pocket PC letter recognition scheme is called *Character Recognizer*. Like its Palm OS counterpart, Graffiti, Character Recognizer identifies letters by the shape of the stroke, as well as by the point of origin and the direction of the stroke. It is even easier to learn to write for Character Recognizer than it is for Graffiti, since with the former the letters look more like the way you really write. This being said, in either case you can master the system in a matter of minutes.

If your handwriting is really good, and if you are really patient, you might try the Transcriber. Using this system for data entry you write whole words at a time using printing style, cursive style, or a combination of the two. The system interprets your handwriting and shows you the result. You can then correct any of the Transcriber's mistakes.

Unfortunately, unless your handwriting is really good, you will spend a lot of time correcting the Transcriber's interpretation of what you have written. This method of data entry is not yet magic enough to be useful.

EPOC-Powered Devices

A British company called Psion developed the EPOC operating system to run its line of organizers. This particular operating system attracted several phone manufacturers, who, under pressure to develop more sophisticated phones, were looking to standardize an operating system for cell phones. In 1998, Psion, Motorola, Panasonic, Ericsson, and Nokia formed a joint venture, called Symbian, to take ownership of EPOC as standard operating systems for cell phones. EPOC is now sometimes called Symbian OS. To minimize confusion I will continue to refer to it as EPOC.

Because EPOC is designed specifically for cell phones, the resulting devices are actually Smart Phones, that is, they are PDA/Phone hybrids. We will revisit this concept in the next section.

Two companies with EPOC-powered devices on the market today are Ericsson and Nokia. Examples of devices from these companies are shown in Figure 5–6. EPOC is so flexible that two EPOC devices from different vendors may look very different and offer different user interfaces.

The devices running EPOC generally have a keyboard for data entry. These keyboards are too small for heavy-duty touch-typing, but they are much easier to use than a stylus and onscreen keyboard.

A system called EPOC Connect provides a number of services including data synchronization, file management, backup and restore, email, contact, and calendar synchronization. Connect uses an open architecture that allows device manufacturers and other software vendors to add different interfaces

FIGURE 5–6 PDA/phone hybrids powered by EPOC. Left image courtesy Sony Ericsson Mobile Communications. Right image courtesy Nokia.

and extensions. For this reason, Connect may look different on different devices. The device manufacturer may even brand its version of connect differently; for example, Psion brands its version "PsiWin."

RIM

We now talk about a device that does not quite fit in one of the five categories I laid out in the beginning of this chapter. There is a maverick in every herd. I am referring to the series of devices called BlackBerry™ developed by the company Research In Motion (RIM). These devices run a proprietary operating system and they use data-only networks. They have become very popular because they do one thing very well: wireless email.

BlackBerry uses the DataTac and Mobitex wireless data protocols, which are offered by the network operators Motient and Cingular Interactive, respectively. These networks have extensive coverage and in-building communications are very good. I cover DataTac and Mobitex in Chapter 7.

BlackBerry devices are frequently classified as two-way pagers or email messengers. However, I am classifying them as PDAs, because, as you can see in Figure 5–7, these devices have many of the features typically found in a PDA.

With BlackBerry handhelds, synchronization occurs wirelessly. As email arrives, and as calendar and contact information is changed, updates are *pushed* to the device. In the reverse direction, as users make updates on the device, the change is propagated to the enterprise wirelessly. Since Black-Berry handhelds make use of networks with extensive coverage—networks

FIGURE 5–7 RIM BlackBerry™ devices. Courtesy Research In Motion Limited.

that work well both inside and outside—the devices can be kept up to date pretty easily.

Data entry is through the built-in keyboard. The keys are small, making it impossible to touch type. But as long as there is not too much data to enter, these small keyboards work just fine.

RIM has also released a Smart Phone, which is shown in the section following this one on Smart Phones.

Accessories

In looking for PDAs for your mobile professionals you should consider the kinds of add-ons that will be needed, and whether they are available on the devices you like. Some of the more popular add-ons are shown in Box 5–4.

Box 5–4 PDA accessories for mobile professionals

Some important PDA accessories for the mobile professional are:

- **Keyboards**: The more data entry you have to do, the bigger the keyboard you need. Letter recognition and onscreen keyboards just will not cut it for heavy data entry. There are several full-sized external keyboards that can be used with PDAs. These keyboards can be folded up to about the size of a PDA when they are not being used.

- **Communications cards**: You may want a Bluetooth card to have the PDA control your cell phone and use its data communications services. You might also want to have a card that allows you to access the data services of your wireless operator.

- **Phones**: There are accessories that add telephone functionality to PDAs. This turns the PDA into a Smart Phone (see the next section for more on Smart Phones).

- **Barcode readers**: Many mobile workers need to scan bar codes. These workers can use barcode readers that plug into their PDAs.

- **Cameras**: Some job functions can benefit from the ability to take pictures and send them immediately back to the office.

- **Global positioning system (GPS)**: In industries such as transportation, or in cases where dispatch and routing are important, a GPS receiver could come in handy. GPS receivers can plug into your PDA.

Be careful to match the accessory to the make and model of PDA you are using. Aside from differences in the operating systems running on various PDAs, there are also differences in the type and number of add-on slots. The result is that the buyer has to be a little more careful in choosing accessories.