Electronic Commerce Payment Systems and Order Fulfillment

11

Contents

Learning Objectives

Upon completion of this chapter, you will be able to:

1. Describe cross-border EC and the issues that arise in EC payments and fulfillment.
2. Describe the major changes in retail and their impacts on EC payments.
3. Discuss the different payment cards used online and processing methods.
4. Discuss the different categories and potential uses of smart cards.
5. Describe the issues with and solutions to online micropayments.
6. Understand PayPal and third-party payment gateways.
7. Understand the major types and methods of mobile payments.
8. Describe the differences and key characteristics of digital and virtual currencies.
9. Define EC order fulfillment and describe the EC order fulfillment process.
10. Describe the major problems of EC order fulfillment.
11. Describe various solutions to EC order fulfillment problems.

OPENING CASE: CROSS-BORDER EC—PARTNERING WITH TMALL GLOBAL

The Problem

In EC, "the world is your oyster." It can transcend borders, opening product lines and services to a growing international market. The problem is that like the original line from Shakespeare's "The Merry Wives of Windsor" it may take a substantial sword to open it.

When a buyer makes an online purchase from a merchant or seller in another country it's called international e-commerce or **cross-border e-commerce**, the two concepts are

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synonymous. Sometimes, researchers and practitioners refine the definition to exclude EC trade between countries that share a common language, border, and currencies (Goodale 2014). For example, trade between the USA and Canada is treated as international because their currencies and financial regulations differ and the free-flow of goods is restricted by law, while trade between many of the neighbors in the European Union are considered domestic because they share a common currency (the Euro), common payment resolution (SEPA—see Section 11.3), and open borders. Because of the polyglot nature of many of these countries, they often share one or more languages in common. When countries share common geography, language, payment systems, and currencies, a number of the key barriers to cross-border commerce are eliminated.

According to a recent report (Alizilia 2015) by Accenture and AliResearch (the research arm of the Chinese Alibaba Group), in 2015 there were approximately 300 billion global cross-border B2C transactions which represented around 16% of all B2C transactions. These transactions were the combined result of the purchases of 360 million B2C shoppers worldwide which was only 25% of all online buyers that year. So, only one out of every seven transactions was cross-border and only one out of every four buyers made cross-border purchases.

Based on additional figures from a survey of 24,000 adult consumers in 29 countries across the globe (PayPal 2015), in virtually every region of the world the USA and China are by far the most popular online cross-border purchase destinations. The only exception is in Western Europe where cross-border purchases tend to be made within the region. From the buyer's standpoint, the countries with the strong proclivities for cross-border purchasing (i.e., those with more than 70% of their online purchases being cross-border) are scattered across the globe and include Canada, Ireland, Austria, Israel, Nigeria, Singapore, and Australia. Those with the weakest proclivities include the USA, UK, Germany, Netherlands, Poland, Turkey, Japan, South Korea, and China.

By 2020 (Alizilia 2015), the outlook for cross-border transactions is predicted to change substantially. The volume of cross-border transactions is projected to have a compound growth rate of close to 30% between now and then, so that cross-border transactions will reach around 1 trillion. This will represent about 30% of the estimated total for that year. At that time, close to one out of every two of the estimated two billion shoppers will make cross-border purchases. For merchants and sellers these estimates paint a picture of massive opportunity—the "oyster." It also represents a substantial opportunity for banks and payment service providers, So, where's the "sword?" What's needed to take advantage of the opportunity?

The Solution

Suppose a merchant wants to expand his or her online B2C specialty clothing and apparel business to handle overseas buyers. Point of fact, there are more cross-border purchases for clothing and apparel than any other product category by a wide margin. Given this fact, how hard could it be to sell clothing on the international market? With English and credit cards being de facto standards on the Internet, it seems like most merchants could engage in cross-border EC by simply adding support for international credit cards and delivery. While this might work for a handful of transactions in some parts of the world, experience tells us it would not work for even the average number of sales transactions handled by most EC retailers.

A recent study of a sample of 180 online B2C merchants in ten countries by Pymnts (2015) assessed the characteristics of those already successfully engaged in international B2C, as well as the readiness of the sample to participate in cross-border transactions. Based on their analysis of 60 features, the number one key finding was that the top ten merchants "think local." They treat international customers as if they were domestic. They offer multiple languages, multiple currencies, and multiple payment systems. They customize pages to the customer's country (e.g., simple things like address and phone fields). They support access through a variety of devices, especially mobile. They simplify the checkout process, eliminating the need for extensive user profiles. They also offer free shipping and rewards to encourage repeat business.

The second key finding of the study (Pymnts 2015) was that the vast majority of businesses in the sample were far from ready to engage in cross-border transactions. It's understandable given that there are currently 195 countries in the world with a combined total of 6500 spoken languages and 180 currencies, not to mention differing customs procedures, logistics, physical infrastructures, and other regulatory and legal systems.

Treating potential cross-border customers as if they were all "local" is almost an impossible task. Because the barriers and issues that need to be addressed in cross-border sales are so intertwined, it is hard to do it in a phased approach or piecemeal fashion. This is why most businesses start by offering a small segment of their product or service listings to a handful of countries. Also, instead of setting up local legal entities within the countries of interest or creating on their own with fully localized features for each of the countries to be served, many companies start by working with a partner who is conversant in the world of cross-border

commerce and who has a site or portal that is already serving a broad spectrum of cross-border consumers.

This was the approached used by Costco when they decided to offer some of their products to the burgeoning B2C market in China.

Costco's 2015 annual report provides an overview of the company and the general strategy and operating principles (Costo 2015). Costco Wholesale Corporation began operations in 1983 in Seattle, Washington. From the beginning they have focused on operating membership warehouses in the USA and Canada, as well as a handful of foreign countries including the UK, Mexico, Japan, Australia, Spain, Taiwan, and Korea. Worldwide there are 686 warehouses, the bulk (569) of which are located in the USA and Canada. These warehouses, which average about 144,000 sq.ft., are run by 200,000 employees and service 81 million cardholders. Cardholders pay annual fees that vary by country, although they are around $55 in the USA.

Their basic strategy is to offer lower priced, high quality, nationally branded, and Costco private-label (Kirkland Signature) products across a range of categories including food, sundries, hardlines, softlines, fresh foods, and ancillary products (e.g., gas stations and pharmacy). Given the low price strategy, the profits come from selling focused inventory (3700 SKUs) with high sales volumes and rapid turnover coupled with "operating efficiencies achieved by volume purchasing, efficient distribution and reduced handling of merchandise in no-frills, self-service warehouse facilities." They also come from membership fees.

In 2015, Costco total sales were $114B with an annual growth rate of 20% annual. The overwhelming majority (97%) of these sales were in-store. Costco was late getting to EC and, as a consequence, they lag behind their competitors. Their anemic EC sales are also a consequence of their expressed strategy. EC sales don't generate memberships, nor do they encourage much foot traffic along with in-store impulse buying.

While Costco's international presence is limited, it was hard for Costco to ignore China's astounding retail growth, especially from online sales. In order to test the retail market in China, Costco decided in 2014 to enter the market by setting up shop on Alibaba's Tmall Global site without capital investments in Chinese real estate.

In recent years, the Alibaba Group (see Section 11.9) has made a concerted effort to encourage cross-border online B2C imports. Toward this end, in 2014 they launched a new cross-border EC website called Tmall Global. It's a platform that enables foreign companies to sell to Chinese consumers without having a physical presence in China. This was particularly attractive to Costco because they were wary of following the same path of the big box stores.

Tmall has a number of key features supporting cross-border EC, but two of the more important are Alipay and Tmall's bonded warehouses and logistics-partner network (Tran 2015). Alipay is Alibaba's payment platform (sort of like PayPal). It is the largest payment system in China, used much more than credit or debit cards which Tmall also supports. The platform automatically handles currency conversion so that Chinese buyers pay in Yuan and retailers are paid in their home currency (once a buyer has received their goods). Basically, once a merchant is hooked up to Alipay, it provides entfee to China's 300 M online buyers. The other key feature revolves around a set of bonded warehouses located in five major cities (Shanghai, Guangzhou, Hangzhou, Zhengzhou, and Ningo) where merchants can pre-ship products in large quantities. The warehouses are in duty-free zones dedicated to handling imports and delivery for international merchandise purchased online. They not only enable faster shipping times to customers but also lower fees on customs and duties. Technically, the warehouses are operated by customs, but in reality the actual goods are the responsibility of Alibaba's logistics subsidiary, Cainiao, who uses a network of third-party logistics providers (3PLs) to perform the necessary warehouse activities including the sorting, picking, delivery, and customs clearance.

In exchange for these types of key services, which aren't free, retailers must meet certain criteria. Among other things they have to (Tran 2015):

- Have a retail or trading license.
- Prove they own the brands or have rights to distribute them.
- Provide their Tmall site in Chinese.
- Have products manufactured outside China inspected and approved by Tmall.
- Provide customer service including Chinese language service support.
- Support customer returns and provide a return location in China.
- Provide shipping direct to the consumer in China.

Many of the required services can be and are often outsourced to third-party providers, who are preapproved and endorsed by Tmall Global.

The Results

Today, Costco's Tmall Global site sells around 200 items from its food, healthcare, and private-label Kirkland Signature product offerings. They also used their base in

Taiwan to help support operations and rely on Tmall's inventory storage and 20 day delivery to limit operating expenses.

Unlike some of the other 5400 Tmall Global customers, Costco has enjoyed a modicum of success. While there are no official annual statistics provided by Costco or Tmall, Tmall did report that Costco sold over $6.4 million in the first month of operation and that during the 2014 Single's Day Sale Costco sold $3.5 million in merchandise.

Because of Costco's razor thin margins, whatever revenues are made have to be weighed against the benefits and costs accrued from the site and partnership. On the benefit side, the operation (Mahajan 2015):

- Enables them to test the market without having to invest in real estate, this was the mistake that many big box retailers (e.g., Home Depot and Best Buy) made when they entered the Chinese market.
- Allows them to experiment with the market to determine those products that will sell, the features that are important to Chinese customers, the prices they can charge, and the general spending patterns of Chinese consumers with respect to their offerings.
- Alleviates the need for a local business license to establish an online store. This can be a complex, lengthy, and costly endeavor.
- Eliminates many of the typical interchange costs associated with card-based payment systems and reduces overall logistical costs by speeding transit time.

In terms of limitations, the operation:

- Restricts them from advertising on Tmall Mainland and Taobow which accounts for 80% for China's online sales. They have to rely on company name and brand recognition to drive business.
- Charges merchants a deposit fee ($25,000), an annual fee (somewhere between $5000 and $10,000), a sales commission fee of 2–5% of the product price and logistics fees, and an Alipay fee of 1% of the product price and logistics fees.
- Eliminates a key element of their business strategy—membership fees.

There's no assurance that Costco will succeed in the Chinese online B2C market. There is tremendous competitive pressure coming from leading Chinese retailers and from other cross-border retailers and manufacturers. If they are successful, eventually they will probably have to go the local route, establish an independent online presence in China in order to reduce their overall costs.

Sources: Alizilia (2015), Goodale (2014), Mahajan (2015), PayPal (2015), Pymnts (2015), and Tran (2015) (all accessed May 2016).

LESSONS LEARNED FROM THE CASE

From the consumer's point of view, the world of online retail is pretty simple—select, pay, confirm, and wait for delivery. From the merchant's point of view, online life is anything but simple. Regardless of whether a merchant is running a domestic or international operation, there are a large number of complex issues that need to be addressed in making a business successful. A major difference between the two types of operations is that when a merchant tries to expand hers or his online business by going international the problems are exacerbated—almost like running separate, local businesses in the different countries.

As the open case highlighted, among the litany of issues that have to be addressed by merchants, some of the key issues revolve around: (1) handling electronic currencies and payments; (2) managing and fulfilling orders once payment has been made; and (3) ensuring that the linkage between the financial side and the logistical side appears seamless to customers. This chapter focuses on these issues.

Almost since the inception of e-commerce, the world of e-payments has been dominated by credit cards, debit cards, and third-party surrogates like PayPal tied directly to cards or bank accounts. Today, this world is in flux. While the traditional e-payment methods still dominate worldwide, this is changing rapidly. The changes are being driven by the rise of omnichannel retail, the expanding use of mobile devices, innovations in the world of digital or virtual currencies, as the changing demographics of B2C consumers.

The first part of this chapter deals with this changing payment world. First, it examines the underlying shifts driving the changes. Next, it looks at the major forms of payment worldwide including cards, third-party systems, mobile payments, and virtual currencies. The chapter also explores the players and processes associated with the various payment alternatives along with the underlying reasons why some have been widely adopted while others have not.

The latter sections of the chapter delve into the second of these issues—order fulfillment and logistics. Order fulfillment and logistics are part of the larger arena of supply chain management and execution. Their importance was recently highlighted by Tong Wenhong, the CEO of Cainao (discussed in the opening case), when he stated, "If e-commerce was the focus of China's economy in the past 10 years, logistics will be the focus for the next 10." In this chapter, we will describe the role that fulfillment and logistics play in EC along with some of the major logistics problems that are encountered and the solutions designed to alleviate those problems.

11.1 CHANGING RETAIL LANDSCAPE

"Retail stores will completely die." "Cash is King no more." "The PC is dead." It's easy to find any number of pundits proclaiming the imminent demise of some historical pillar of off-line or online retail. However, as the writer Mark Twain was once quoted as saying "…the report of my death has been grossly exaggerated." Clearly, online shopping, digital payments, and mobile devices are all growing at substantial rates relative to their historical counterparts, but as Bill Gates has said "we always overestimate the change that will occur in the next two years and underestimate the change that will occur in the next ten." None of these are in immediate danger of passing, especially when they are viewed from a global perspective.

Omni-Channel Retail

Overall, worldwide retail sales are growing, but EC retail sales are growing faster (eMarketer 2015). In 2015, global retail sales were close to $24 trillion. By 2019, they will be around $29 trillion, a growth rate of 6% annually. In contrast, EC retail sales were estimated at $1.7 trillion in 2015 which was 7% of the total figure. This online segment of sales is projected to grow at over 8% annually for the next few years and will reach $3.6 trillion in 2019. By that time, they will be 12% of the total. Loosely translated, this means that for every $1 of EC sales there are $9 sold elsewhere (primarily in stores).

In todays world of omni-channel retail, it's misleading to look at in-store versus online as a zero sum game. Online and offline activities are intertwined. If I spend time in a store looking at some item of interest, check out its features or fit, go online to check competitive prices and reviews and availability elsewhere, and then decide to go home and order it online, is this an online sale or an in-store sale. What if I don't go home, but instead order it from a web kiosk in the store? In-store or online sale? Technically, these "showrooming" sales would probably end up in the EC column. Now, what about the reverse. Suppose, I'm at home and spend time on my smartphone checking on the prices, reviews, and availability of some product, then decide to go to the store and buy it. The store will get the credit, but the sale was really the result of my "web-rooming" activities.

While these and other combinations aren't possible with every product and every retailer, they are rapidly becoming so for leading retailers. A few years ago, retailers' store systems and online systems—both front office and back—were completely separate. This made it difficult to offer and service customers with all these possible combinations. However, today many of the world's leading retailers are transitioning systems, so they can provide their customers an array of browsing, buying, and delivery choices.

There is no doubt that the number of retail stores and retail square footage are on the decline. So is the foot traffic within most stores. A lot of this decline is a function of online shopping, but this doesn't mean that stores are completely dying. It does mean that the shopping experiences we know today are morphing into something different, so that strictly keeping score of in-store versus online dollars may be moot. This is why, for example, Forrester Research (O'Grady 2016) has been reporting the relative position of online, Web-influenced, and non-Web-influenced off-line sales. When these distinctions are made, they estimate that the $3.6 trillion in global retails sales for 2016 sales will be divided among the three categories 8%, 44%, and 48%, respectively.

Cash Versus Noncash Transactions

Both off-line and online noncash payments are on the rise. In absolute terms this doesn't mean that cash payments are declining and ultimately dying. In fact they are actually increasing but at a slower rate than noncash payments.

Unlike noncash payments, it is very difficult to track and accurately measure the total use of cash in a country. Governments try to track how much cash is in circulation, but most governments have no way of accurately knowing who's using how much cash to buy what. In fact, this is one of the reasons that some people like cash, as well as the digital counterparts like bitcoins.

One thing we can measure is ATM activity. The ATM business is booming (Gordon 2015). In 2014, the installed base of ATMs worldwide was three million and is expected to be at four million by 2020. Indeed, China with the fast growing economy had 600,000 ATMs that year, an increase of 500% from the year before. In 2014, there were over 90 billion cash withdrawals worth around $14 trillion. That was an increase of over 4%. Of course, in the future we'll be able to load our electronic wallets from ATMs, so we'll have to make a distinction between cash versus electronic withdrawals.

From a cash standpoint, another thing we can estimate is the relative number of consumer transactions that are cash versus noncash. A widely cited report from MasterCard (2015) noted that cash accounts for 85% of global consumer transactions, although this percentage varies widely by country. Actually, in the vast majority of countries the percent exceeds 85%. Included in this majority are China, Spain, Brazil, Japan, India, and Russia. This is followed by a group of countries like the USA, Australia, Germany, and South Korea where the percent of consumer cash transactions falls between 55 and 70%. Finally, there is a very small handful of countries where the percent is between 40 and 50%. These are the closest thing we get to a cashless society and include Singapore, the Netherlands, France, Sweden, Canada, and Belgium.

There is a substantial push by a number of governments to eliminate cash transactions as much as possible. However, because of its ubiquitous role in small-value transactions and among lower income populations who have few financial alternatives, it's close to impossible for a government to eliminate cash even in a country that is economically advanced.

This pattern between cash and noncash consumer transactions mirrors the pattern between off-line and online retail sales. More specifically, like in-store retail cash is king and increasing. However, noncash transactions are increasing more rapidly and gaining market share. These gains are being driven by EC sales transactions. While cash can be used for EC purchases (e.g., cash on delivery or transfers from cash accounts), the vast majority of these sales involve noncash payments of various sorts.

Like cash in the broader world, cards—credit and debit—have been the king of global noncash payments since the early 2000s. Looking at figures from a Capgemini Financial Services Analysis (2016), overall noncash payments fall into one of four groups—cards, direct debit, credit transfers, and checks. Except for Europe where cards represent about 45% of all noncash payments, in every other region of the world the share of card transactions ranges from a low of 50% in Latin America to a high of over 80% in Emerging Asia.

Data from worldwide survey of 13,000 consumers in 26 countries conducted by Nielsen (2016) provides a closer look at how noncash transactions are used globally in the online world. Respondents were asked to indicate what methods they used to make B2C online purchases in the last 3 months. Payments were divided into five categories—credit card, debit cards (third party), digital payments systems (e.g., PayPal), direct debit, and cash on delivery (COD). The top three payment methods for a number of key geographical areas are shown in Table 11.1.

Globally, cards (credit and debit) are the most frequently used, followed by digital payment systems. However, it's obvious that the relative importance of a particular method varies from one region to another. Clearly, China is an anomaly because neither credit cards nor debit cards are in its top three. In China digital payments are used most frequently by a wide margin. In China the popularity of digital payments results from the fact that Alibaba is by far the largest EC site in the county, and Alibaba relies on its own proprietary payment system called Alipay. Again, it is also important to point out that COD is the leading payment method in four out of the nine areas which all happened to be developing economies where there is a large portion of "unbanked."

Table 11.1 Percent of respondents using EC payment method in last 3 months

Country	Credit	Debit	Digital	Direct debit	COD
Global	53	49	43	–	–
China	–	–	86	53	49
India	–	71	–	61	83
SE Asia	57	–	37	35	–
Western Europe	44	56	56	–	–
Eastern Europe	46	–	–	55	57
North America	74	–	38	–	–
Africa	–	52	–	42	54
Latin America	65	31	46	–	–
Middle East	46	11	–	–	64

Source: Based on data from Nielsen (2016)

Move to Mobile

It should be no surprise that the world is rapidly adopting smart phones. According to Ericson (Lunden 2015), in 2015 there were just under two million smartphone users globally, around 25% of the world population. By 2016, they expect the number to rise to over six million users or 70% of the world population. Much of this astounding growth is being fueled by developing economies and by the "digital natives" between the ages of 18 and 24.

Not surprisingly, the rapid adoption of smartphones is also highlighted by the number of global shipments of new smartphones versus the combined shipments of other computer-based devices including tablets, 2-in-1 hybrid tablets, portable PCs, and desktop PCs (Lunden 2015). At the end of 2011, new shipments of smartphones exceeded the shipments of PCs of all sorts for the first time. Today, smartphones account for 70% of all new shipments. By 2019, the percent will be close to 80%.

Clearly, the PC is on its last breath, but not so fast. First, ignoring the fact that Apple still refuses to provide touch screens on the Macbooks, most PCs are morphing into tablet devices which have mobile capabilities. Second, many smartphone users still have PCs that they use on a daily basis. Finally, when you look at the EC world, it's clear that PCs still rule the roost in terms of online purchases.

With respect to this latter claim, consider the data in Figure 11.1. This figure shows the percent on online purchases made with tablets, smartphones, and PCs. With the exception of two countries—Japan and South Korea where cell phone and smartphone usage is historically very high—PCs account for at least 70% of the purchases. Even in Japan and South Korea the numbers are around 50%.

Why is the percent of online purchases with PCs so much higher than it is for smartphones? There are a number of reasons. One reason is that sizeable percentage of smartphone users are still hesitant to put personal and credit information on their phones, fearing it might be stolen and hacked. This is the same sort of fear that slowed the use of credit cards for online purchases when EC was first getting started. Obviously, consumers got over it and they'll get over it again with

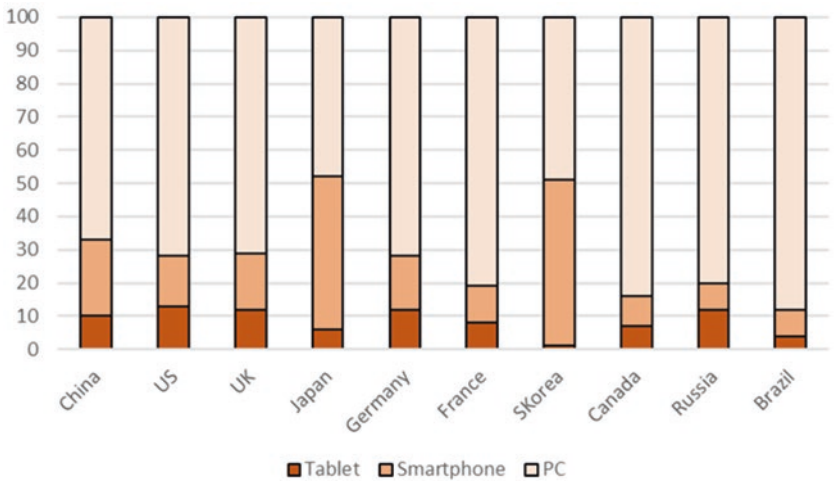

Figure 11.1 Percent of Total Country Online EC Spend by Device. Source: Keith, M. Global eCommerce Sales, Trends and Statistics 2015. September 2, 2015. **remarkety.com/global-ecommerce-sales-trends-and-statistics-2015** (accessed May 2016)

mobile devices. A second reason is found in the demographics of the buyers. Adoption of mobile devices is strongest among younger cohorts. Yet, the purchasing power of older cohorts is much larger than it is for younger cohorts. Globally, the median networth of those over 65 is close to 50 times larger than those under 35! Older consumers still use PCs. What this is likely to mean in the longer run is that the percent of purchases by smartphones will begin to climb rapidly. However, the dollar value purchased with PCs will be larger than it is for smartphones for the foreseeable future.

Implications for EC Payments

Since its inception in 1995, B2C EC has been dominated by a relatively simple set of business models, transactions, and payment types. Crudely put, at the beginning of the twenty-first century it was enough for the average merchant to offer a catalog of products and prices via a browser, to enable payment by card (credit and debit) or some third-party payment processor (e.g., PayPal), to provide systems for shipping the product and handling returns, and to provide customer support. Those merchants with both a physical and digital presence tended to run their online business as a simple, albeit separate, extension of their off-line world. Basically, it was as if a catalog business had gone digital. Like most catalog businesses, the primary focus has been on (non-perishable) products, not customers, and on domestic markets, not international buyers. Even today a large portion of EC sites still operate this way with a number of bells and whistles thrown in.

For the last 10 years the underlying tenets and practices of this model have been under assault by the operational, technical, and demographic changes briefly described in this section. In the last 4–5 years these changes have picked up a full head of steam. Nowhere is this more apparent than in the area of payments both from the buyers' and sellers' side. The size of the assault in this area has been described as a tsunami. Literally, innovations aimed at supplementing, modifying, or replacing some aspect of electronic payments number in the thousands. Many of these are coming from new players and start-ups in the financial technology (fintech) industry.

While there are no industry standard categories for classifying these efforts and, thus, no official data for estimating associated volume and value, Capgemini Financial Services Analysis (2016) has attempted to address these deficiencies. They coined the term "hidden digital payments" to describe this overall collection of activities and divided the payments into four main types including:

- *Closed-loop cards and mobile apps*, enabling online and off-line payments and aimed at promoting loyalty.
- *Digital wallets (non-banks)*, supporting a variety of EC transactions.
- *Mobile money*, enabling mobile financial transactions for the "unbanked" and "underbanked."
- *Virtual currencies*, supporting the instantaneous transfer of "value" without the aid of traditional financial institutions.

For 2015, they estimated the total volume of hidden payments between 25 and 40 billion, a small percent of all non-cash transactions (between 6 and 10%).

Critical Mass

Before credit cards became the standard in EC, many companies tried to introduce nontraditional payment systems. With the exception of PayPal, they all died an early death. Today, the number of new systems far exceeds the number from those early years. A handful will probably gain widespread acceptance, another handful will gain regional acceptance, and the overwhelming majority of these will suffer the same fate as their predecessors. Even notoriety and a faithful group of followers is not any guarantee of success.

A case in point is the well-publicized virtual currency Bitcoin (**bitcoin.org**). Bitcoin is a peer-to-peer, encrypted digital currency powered by open source software (discussed in detail in Section 11.7). It has a sizeable number of users and supporters. It has a rocky history. At this point in time, some pundits are forecasting its demise as a currency. However, they are also forecasting that there's a good chance that its underlying technical foundation may be repurposed for other financial applications.

As Evans and Schmalensee (2005) pointed out back in 2005, it takes years for any payment system to gain widespread acceptance. For example, credit cards were introduced in the 1950s but did not reach widespread use until the 1980s. A crucial element in the success of any e-payment method is the "chicken-and-egg" problem: How do you get sellers to adopt a payment method when there are few buyers using it? Further, how do you get buyers to adopt a method when there are few sellers using it? In physics terms, how do the payment systems reach critical mass.

Critical mass depends on a number of key factors such as those listed below:

- **Independence.** Most forms of e-payment require the buyer to adopt some new technology in order to initiate a payment and the merchant to install specialized software and hardware to accept, authorize, and process a payment. If the new system can piggy-back on existing technologies and practices, it has an easier road to success.
- **Interoperability and portability.** An e-payment method must be integrated with existing information systems before it can be adopted.
- **Security.** How safe is the payment transaction? What if the transfer is compromised? Only safe systems will succeed.
- **Anonymity.** Some buyers want their identities and purchase records to be anonymous. This can be done only when cash is used. To succeed, special payment methods, such as virtual currencies, have to maintain anonymity.
- **Divisibility.** It is difficult for most payments systems to efficiently scale across a range of purchase prices. For example, on one end try using a credit card to buy a candy bar. On the other, try using a credit card to purchase a plane. Any method that can service one or the other of the extremes or can cover a wide range in the middle has a chance of succeeding.
- **Ease of use.** Credit cards are used for B2C and B2B e-payments because of their ease of use. E-payments must complement the trading methods.
- **Transaction fees.** Outside of cash, virtually any payment system costs someone money. When a credit card is used, the merchant pays processing fees. When a card is used to withdraw money, the cardholder usually pays. If the aggregate fees prove too costly for one of the parties, the system is likely to fail.
- **International support.** EC is a worldwide phenomenon. An e-payment method must be easily adapted to fit buying needs and local legal requirements before it can be widely adopted. The major exceptions are systems that are mandated by law.
- **Regulations.** A number of international, federal, and state regulations govern all payment methods. Any changes or new methods need approval of the regulators. PayPal, for instance, faced several lawsuits brought against them by several U.S. states for alleged violations of banking regulations.

SECTION 11.1 REVIEW QUESTIONS

1. What is omni-channel retail? "Showrooming?" "Webrooming?"
2. Why is it difficult to track the global use of cash?
3. What are the different types of noncash EC payment used in different regions of the world?
4. Describe the relative use smartphones, tablets, and PC for EC purchases?
5. What are main types of "hidden payments?"
6. What is the "chicken-egg" problem in EC payment adoption?
7. What factors are key to the successful adoption of an EC payment method?

11.2 USING PAYMENT CARDS ONLINE

Payment cards are electronic cards that contain payment-related data. They come in three forms:

1. **Credit cards.** A credit card enables its holder to charge items (and pay later), or obtain cash up to the cardholder's authorized limit. With each purchase, the credit card holder receives a loan from

the credit card issuers. Most credit cards do not have an annual fee. However, holders are charged interest if the balance is not paid in full by the due date. Visa and MasterCard are the leading cards.
2. **Charge cards.** These are special credit cards where the balance must be paid in full by the due date and usually have annual fees. Examples of issuers are American Express and Diner's Club (they both offer regular credit cards as well).
3. **Debit cards.** Payments made with a debit card are withdrawn from the holder's checking or savings account. The actual transfer of funds usually takes place in real time from the holder's account (if an ATM card is used). However, a settlement to a merchant's checking account may take place within 1–2 days. Again, MasterCard and Visa are examples of debit card issuers. For a discussion of some best practices for debit card usage, see **usatoday.com/story/tech/columnist/komando/2014/04/11/4-places-you-should-not-swipe-your-debit-card/7436229**.

Credit Card Reading

When paying with a credit card, it is necessary for merchants to read the content of the card and then transfer the content for approval and processing. This must be done in almost real time.

Several methods are available.

- **Stationary card readers.** The most common readers available are physical POS in stores. They are wirelined to the authorization and processing system.
- **Portable card readers.** These are used in places where wirelines do not exist (e.g., on airplanes). They may be connected wirelessly to the processing system, or may be stand-alone systems (sellers then take risks, usually for small payments).
- **Mobile readers.** These systems enable payments from mobile devices. They include credit card readers, which are plugged into the smartphones. The Square Reader (**squareup.com**), which has a "swiper" that plugs into the smartphone's headphone jack and reads the information from the magnetic strip of the customer's card, is such a device (see Section 11.5).

Processing Cards Online

The processing of credit card payments has two major phases: *authorization* and *settlement*. **Authorization** determines whether a buyer's card is valid (e.g., not expired) and whether the customer has sufficient credit or funds in his or her account. **Settlement** involves the transfer of money from the buyer's account to the merchant's. There are a number of parties involved in both processes including:

- **Customer.** The individual possessing the card.
- **Merchant.** The vendor that sells goods or services.
- **Issuing bank.** The issuer (usually a bank) of the credit (debit) card to customer (or businesses). Services customer accounts including billing and collecting month payments.
- **Merchant acquiring bank.** Enrolls merchants into a program that accept a specific card brand (e.g., Visa) and, on the merchant's behalf, processes debit or credit card payments made using that particular card brand.
- **Credit card (association) network.** Credit card networks determine where credit cards can be used and facilitate the payment process between credit card users, merchants, and credit card issuers.
- **Payment service provider.** The company that provides electronic connections and transaction services among all the parties involved in electronic payments (including authorizations). A payment service provider is also called a payment gateway provider.

The roles that the participants play, the linkages among them and the general flow of the authorization and settlement processes are depicted in Figure 11.2. For any given card and merchant there can be variations in the exact players and in the details of the process. However, regardless of whether the payment is being made off-line or online, they usually include:

- **Authorization Cycle**—[1] The customer initiates a payment transaction (fills out Web page, swipes a card, etc.). The merchant receives the transaction information [2]. This information is passed to its PSP where it is routed [3] to the merchant's acquiring bank (processor). The acquiring bank passes the information [4–5] to the issuing bank through the credit card network. If the issuing bank approves the transaction, an authorization code is sent

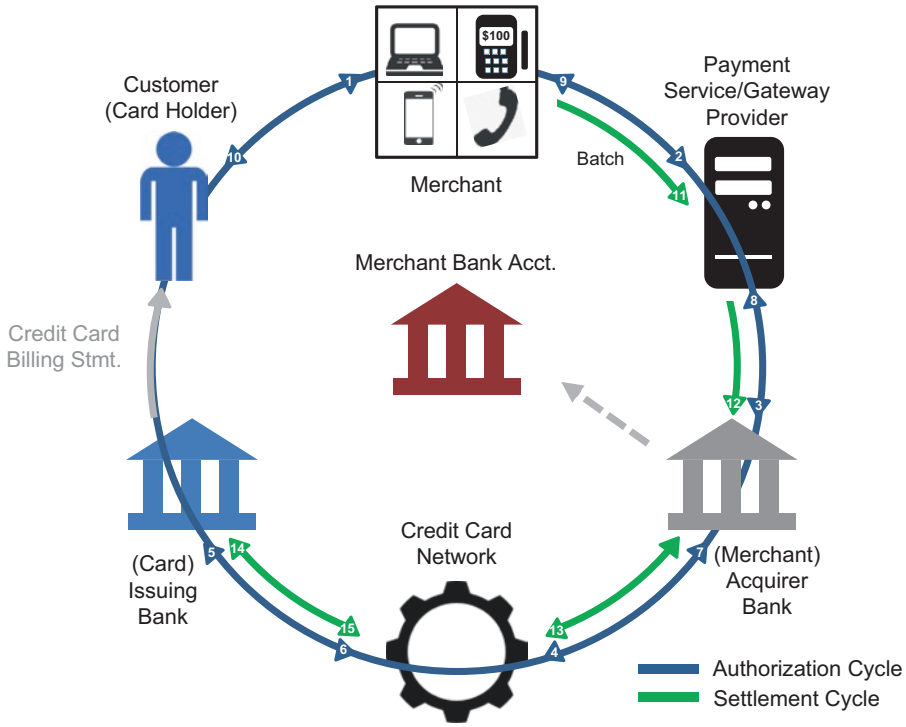

Figure 11.2 Credit card payment procedure (Drawn by D. King)

back [6–9] to the merchant via the same linkages. The issuing bank also holds an authorization associated with that merchant and consumer for the approved amount. Finally, the merchant notifies [10] the customer and fulfills the order.

- **Settlement**—At the end of the day, the merchant submits [11, 12] in batch all the approved authorizations they have received to the acquiring bank via its PSP. Again, the acquiring bank makes the batch settlement request [13, 14] to the issuing bank via the card network. The credit card issuer makes a settlement payment [15, 16] to the acquiring bank via the card network (the next day). The acquiring bank subsequently deposits [17] approved funds into the merchant's nominated account. This could be an account with the acquiring bank if the merchant does their banking with the same bank, or an account with another bank. The entire process from authorization to settlement to funding typically takes 3 days.

Although the entire authorization process involves a number of parties, it usually takes a few seconds. Some of that time involves various security measures—encrypting the information that is transmitted and checking for fraudulent transactions along the way. In contrast, the settlement process usually takes a few days. The settlement process can be slowed if the transaction depends on the customer actually receiving the order.

While cards are obviously convenient for both the consumer and the merchant, they cost the merchant money. This is one of the reasons smaller businesses are hesitant to support a laundry list of card brands and types because of the size and complexity of the charges that come with this support. The main fee that a merchant pays for offering credit card payments is called this **discount rate**. It might be something like 2%, 3%, or more of the transaction value. There are a number of factors that impact the rate like the size of the transaction, the type of transaction (e.g., card present or not), the particular brand of card, etc. A major portion of the discount rate (e.g., 85%) goes to the issuing bank—these are the fees charged by the issuing bank for handling authorization and settlement requests. This segment of the fees are called the **interchange rate**. The remaining amount is split between the credit card association (around one-third) and the acquiring bank (around two-thirds).

One way to eliminate or reduce some of the complexities and costs associated with card payments is by eliminating or consolidating some of the steps in the process—especially the processing options that link the merchant to the issuing bank. The following are the major processing options. The EC merchant may:

1. **Own the payment software.** A merchant can purchase a payment-processing module and integrate it with its other EC software. This module communicates with a payment gateway run by an acquiring bank or another third party.

2. **Use a point-of-sale (POS) system operated by a card acquirer.** Merchants can redirect cardholders to a POS system run by an acquirer. The POS handles the complete payment process and directs the cardholder back to the merchant's site once payment is complete. In this case, the merchant's system deals only with order information. In this configuration, it is important to find an acquirer that handles multiple cards and payment instruments. If not, the merchant will need to connect with a multitude of acquirers.
3. **Use a POS system operated by a payment service provider. Merchants can rely on payment service providers (PSPs)**, which are third-party companies that provide services to merchants so they can accept all kinds of electronic payments. The PSPs connect all participants in the electronic transactions. See an example at **usa.visa.com/content/dam/VCOM/download/merchants/bulletin-mobile-best-practices.pdf**.

Option number 1 is simply the base method that is shown in Figure 11.2. With option 2 the merchant steps to the side and lets the acquirer deal with the customer's payment. In option 3, the merchant simply deals with a third-party processor that handles not only card payments but other types of payments as well. These third-party companies can also alleviate the need for merchants to establish relations with acquiring banks.

Fraudulent Card Transactions

Although the processes used for authorizing and settling card payments off-line and online are very similar, there is one substantial difference between the two. In e-commerce, the merchants usually are liable for fraudulent transactions. In addition to the cost of lost merchandise and shipping charges, merchants who accept fraudulent or unauthorized cards for payments may have to pay penalties to the credit card companies. However, these are not the only costs.

There also are the costs associated with combating fraudulent transactions. These include the costs of tools and systems to review orders, the costs of manually reviewing orders, and the revenue that is lost from erroneously rejecting valid orders. According to CyberSource's sixteenth annual survey (CyberSource 2016) of online fraud management, fraudulent online card transactions still result in substantial losses although the rate of e-commerce revenue loss has remained steady (at .9%) for the past 5 years. The stability is a function of the measures that merchants have adopted to manage fraud. Over the years, the CyberSource surveys (CyberSource is a subsidiary of Visa) also have monitored the steps taken by merchants to combat fraud. Today, virtually every merchant has instituted automated processes backed by manual review to detect fraudulent transactions. The exact automated procedures vary from one merchant to the next. However there are some tools that are used by a majority. The key tools used in combating fraud are:

- **Card verification number (CVN).** More than 86% of all merchants use the **card verification number (CVN)** method, which detects fraud by matching the three-digit verification number printed on the signature strip on the back of the credit card (or the four-digit number on the front of the card, such as American Express cards) to the number stored by the cardholder's issuing bank. However, if a fraudster possesses a stolen card, the number is in plain view and verification becomes difficult. Attempts are made to check the habits of the card user (e.g., to check unusually large purchases or purchases made overseas). In such cases, a cardholder may get a telephone call from the card issuer or the credit card company, asking for verification of identity. In such a case, the verification may be done by intelligent software agents automatically.
- **Address verification.** A vast majority of merchants (better than 86%) use the **Address Verification System (AVS)**, which detects fraud by comparing the address provided by the buyer at checkout with the card address on file. Unfortunately, this method may result in a number of false positives, meaning that the merchant may reject a valid order. Cardholders may have a new address or simply make mistakes in inputting numeric street addresses or zip codes. AVS is available only in the United States and Canada.
- **Customer order history.** The purchases made with a particular card (and card holder) tend to follow regular patterns with respect to place, amounts, types, and velocity. Order data from the cards used can be mathematically and statistically mined to discern these patterns. Current card purchases can be matched against these patterns to detect anomalies in real time in order to flag them as potential fraud. Close to 78% of merchants employ this process.
- **Negative lists.** Close to 70% of the merchants use negative lists. A negative list is a database of card

numbers that could potentially be used by fraudsters. It is also a database of card numbers used to avoid further fraud from repeat offenders. The merchants can match each customer's card against this database to find customers and cards with known problems.
- **Postal address validation service.** Checks to see if the shipping address received with an order is a valid postal address. Just under 70% use this technique.

While automated procedures are key to fraud detection, the CyberSource survey indicated that close to one out of every four card transactions is flagged as potentially fraudulent, requiring manual review. The average length of a manual review is about 5 min. This adds up to a lot of time and labor expense. In fact half of the money spent combating card transaction fraud goes to these costs. The future key to reducing these costs is clearly better automated procedures.

SECTION 11.2 REVIEW QUESTIONS

1. Describe the three types of payment cards.
2. Describe credit card readers.
3. List the major participants in processing cards online.
4. Describe the key processes in card settlement and authorization.
5. What options does a merchant have in setting up an e-payment system?
6. What costs does an online merchant incur if it accepts a fraudulent card transaction?
7. What steps are often taken by online merchants to combat fraudulent orders?

11.3 SMART CARDS

A **smart card** is a plastic payment card that contains data in an embedded microchip. The embedded chip can be a microprocessor combined with a memory chip or just a memory chip with nonprogrammable logic. Information on a microprocessor card can be added, deleted, or otherwise manipulated; a memory-chip card is usually a "read-only" card, similar to a magnetic stripe card. The card's programs and data must be downloaded from, and activated by, some other device (such as an ATM). Smart cards are used for a wide variety of purposes including:

- Telecom—SIM cards
- Financial—cards issued by banks, retailers, and service providers for payment services (debit, credit, prepaid), loyalty, and social cards with payment apps
- Government and healthcare—cards issued by governments for citizen identification and online services and cards issued by private health insurance companies
- Device manufactures—mobile phones, tablets, navigation devices, and other connected devices including secure element without SIM application
- Other—cards issued by operators of transport, toll, car park, pay TV, and other services, as well as cards providing physical and logical access.

A little over 9.2 billion smart cards were shipped in 2015, a 12% increase over the previous year. In 2016, the number is expected to only grow about 6% to 9.8 billion units. The majority of smart cards are currently found in telephones (5.4 billion out of the 9.2 billion) cards used for payments (which is 2.6 billion). The growth that has been experienced is being driven primarily by the migration of payment cards from swipe to (EVM) chips, the rise in mobile devices (excluding SIM cards), and increasing e-government services.

Types of Smart Cards

There are two distinct types of smart cards. The first type is a **contact card**, which is activated when it is inserted into a smart card reader. The second type of card is a **contactless (proximity) card**, meaning that the card only has to be within a certain proximity of a smart card reader to process a transaction. On the front or back of the contact smart cards there is a small gold (or silver) plate about one-half inch in diameter that contains a chip. When the card is inserted into the card reader, the plate makes electronic contact and data are transferred to and from the chip. A contactless card has an embedded antenna that facilitates data transfer to another antenna (e.g., attached to another device). Contactless cards are especially useful where data must be processed (e.g., paying toll road fees, bus or train fares) or when contact may be difficult. Most proximity cards work at short range (just a few inches). For some applications, such as payments at highway tollbooths, longer range proximity cards are available.

In 2015, over 50% of the smart cards shipped to the USA and Europe were contactless. For Asia Pacific, the figure was close to 75%.

With both types of cards, *smart card readers* are crucial to the operation of the system. Technically speaking, a smart card reader is actually a read/write device. The primary purpose of the **smart card reader** is to act as a mediator between the card and the host system that stores application data and processes transactions. Just as there are two basic types of cards, there are two types of smart card readers—*contact* and *proximity*—that match the particular type of card. Smart card readers can be transparent, requiring a host device to operate,

or stand alone, functioning independently. Smart card readers are a key element in determining the overall cost of a smart card application. Although the cost of a single reader is usually low, the cost can be quite high when they are used with a large population of users (e.g., passengers traveling on a metropolitan mass transit system).

Hybrid cards and *combi cards* combine the properties of contact and proximity cards into one card. A hybrid smart card has two separate chips embedded in a card: contact and contactless. In contrast, a combi card (dual-interface) smart card has a single chip that supports both types of interfaces. The benefit of either card is that it eliminates the need of carrying both contact and contactless cards to use with different applications. In addition, you need only one card reader.

Stored-Value Cards

The **stored-value card** is a card where a monetary value is prepaid and can be loaded on the card once or several times. From a physical and technical standpoint, a stored-value card is indistinguishable from a regular credit or debit card. In the past, the money value was stored on the magnetic strip, but recently, most stored-value cards use the technology of smart cards. With stored-value cards, the chip stores the prepaid value. Consumers can use stored-value cards to make purchases, off-line or online, in the same way that they use credit and debit cards—relying on the same networks, encrypted communications, and electronic banking protocols. What is different about a stored-value card is there is no need for authorization, but there is a limit set by how much money is stored on the card. The most popular applications of stored-value cards are the transportation cards that are very popular in the large cities in Asia. It is a necessity for the citizens in Seoul, Hong Kong, and Singapore to hold smart cards that pay for subways, buses, taxis, and other applications. The transportation cards do not require any fees, but the bank that initiates prepaid cards may require fixed monthly fees or a registration fee. Stored-value cards are also popular to pay for telephone calls and texting.

Stored-value cards come in two varieties: *closed-loop* (single purpose) and *open-loop* (multiple purposes). Closed-loop cards are issued by a specific merchant or merchant group (e.g., a shopping mall) and can be used to make purchases only from the card issuer. Mall cards, refund cards, some toll-pay cards, prepaid telephone cards, and Internet use cards are all examples of closed-loop cards.

Among closed-loop cards, gift cards have traditionally represented a strong growth area, especially in the United States (CardCash 2015). Over 90% of U.S. consumers purchase or receive a gift card annually. In the USA over $100 billion is spent annually on gift cards. The figure has been averaging about a 6% annual increase over the last 5 years.

An open-loop card is a multipurpose card that can be used for transactions at several retailers or service providers. Open-loop cards also can be used for other purposes, such as a prepaid debit card or for withdrawing cash from an ATM. Financial institutions with card-association branding, such as Visa or MasterCard®, issue some open-loop cards. They can be used anywhere that the branded cards are accepted. *Full open-loop cards* (e.g., the MasterCard Mondex® card) allow the transfer of money between cards without the bank's intervention.

Stored-value cards may be acquired in a variety of ways. Employers or government agencies may issue them as payroll cards or benefit cards in lieu of checks or direct deposits. Merchants or merchant groups sell and load gift cards. Various financial institutions and nonfinancial outlets sell prepaid cards by telephone, online, or in person. Cash, bank wire transfers, money orders, cashier's checks, other credit cards, or direct payroll or government deposits fund prepaid cards.

Applications of Smart Cards

In many parts of the world, smart cards with magnetic stripes are used as credit cards for retail purchases and paying for transportation. They also are used to support nonretail and nonfinancial applications. A general discussion of all types of smart card applications can be found at **globalplatform.org**.

Retail Purchases

Credit card companies and financial institutions are transitioning their traditional credit and debit cards to multiapplication smart cards. In many parts of the world, smart cards have reached mass-market adoption rates. This is especially true in Europe, where the goal was to have all bank cards be smart cards with strong authentication and digital signature capabilities by 2010.

In 2000, the European Commission established an initiative known as the Single Europe Payment Area (SEPA), encompassing 33 European countries. To bring this initiative to fruition, all the EU banks agreed to use the same basic bank card standard, enabling the use of credit and debit cards throughout the EU. The standard (EMV) is named after the three major card associations that developed its initial specifications (Europay, MasterCard, and Visa). It is based on smart cards with a microprocessor chip. The chip is capable of storing not only financial information, but other applications as well, such as strong authentication and digital signatures. The history of SEPA along with its key principles is detailed in Wikipedia (**en.wikipedia.org/wiki/Single_Euro_Payments_Area**).

Originally, the 33 countries agreed to convert all their magnetic strip cards to EMV smart cards by December 2010. None did. Today, European adoption varies by region. In Western Europe, 97% of all card transactions are EMV. For Eastern Europe it's around 65%. Outside of Europe, there have also been high rates of adoption in the Middle East, Africa, Canada, and Latin and South America. In these areas, it is 85% or higher. In Asia Pacific, reception has been modest with around 35% of the card transactions involving EMV. Likewise, in the U.S. adoption has been very slow.

In the USA, the major card associations had self-imposed October 1, 2015 as the date for mandatory adoption of EMV cards. On that date, those merchants who had not adopted the format would be held liable for any losses they incurred from credit card fraud. The date came and went. By the end of last year, the estimate was that less than 40% of the merchants had EMV terminals and around 40% of card holders have cards with EMV chips. While the USA has been slow to move, the rate of adoption has picked up substantially over the past year. The exception is gas stations which aren't expected to accept EMV cards until 2017.

The impetus for smart card versus standard usage is that they are more secure. Because they are often used to store more valuable or sensitive information (e.g., cash or medical records), smart cards often are secured against theft, fraud, or misuse. In contrast, if someone steals a regular payment card, he (she) can see the card's number, the owner's signature, and the security code. In many cases only the card number and the security code are required to make a purchase. However, criminals can use the cards up to the authorized value, which is a loss to the bank and Visa or MasterCard.

On the other hand, if someone steals a smart card, the thief is usually out of luck (with the major exception of contactless, or "wave and go," cards used for retail purchases). Before the smart card can be used, the holder may be required to enter a PIN. The other benefit of smart cards versus standard payment cards is that they can be widened to include other payment services. In the retail arena, many of these services are aimed at those establishments where payments are usually made in cash, and speed and convenience are important. These include convenience stores, gas stations, fast food or quick-service restaurants, and cinemas. Contactless payments exemplify this sort of value-added service.

A few years ago, card companies began piloting contactless payment systems in retail operations where speed and convenience are crucial. All these systems utilize the existing POS and magnetic strip payment infrastructure used with traditional credit and debit cards. The only difference is that a special contactless smart card reader is required. To make a purchase, a cardholder simply waves his or her card near the terminal, and the terminal reads the financial information on the card. Despite their convenience and speed, the overall uptake of contactless payment cards in retail stores has been relatively slow until recently. For example, according to data from the Smart Payment Association (2016), 40% of the 1.5 billion smart payments cards shipped in 2014 were contactless. That's a 35% increase from the year before.

Transit Fares

In the USA, several European countries, and large Japanese cities, commuters need to drive to a parking lot near a train station, board a train, and then change to one or more subways or buses to arrive at work. The entire trip may require several payments. Many major transit operators in the United States and Asia have introduced smart card fare-ticketing systems to help these commuters. The transit systems in Washington, DC, Seoul, Hong Kong, San Francisco Bay area, Singapore, and most other major cities all use smart card payment systems. In addition to handling transit fares, the public transport smart cards and other e-payment systems (e.g., smartphones) are being used for paying parking fees and even for purchasing certain goods. For an example, see the Philadelphia Parking Authority (**philapark.org**). Similarly, many of the major toll roads in the United States and elsewhere accept electronic payments rendered by devices called *transponders* that operate much like contactless smart cards but from a much larger distance. Singapore's ERP (Electronic Road Pricing) system, shown in Figure 11.3, monitors the roads in downtown Singapore to control traffic, especially during rush hour, by using remote transponders in the car.

SECTION 11.3 REVIEW QUESTIONS

1. What is a smart card? Contact card? Contactless card?
2. Describe some of the general where smartcards are used?
3. What is a stored-value card? Closed-loop card? Open-loop card?
4. What is the EMV standard?
5. Why is a smartcard more secure than a regular credit card?
6. Describe the use of smart cards in metropolitan transportation systems.

11.4 EC MICROPAYMENTS

Micropayments or **e-micropayments** are small payments made online, usually under $10. From the viewpoint of many vendors, credit cards are too expensive for processing small payments. The same is true for debit cards, where the fixed transaction fees are greater, even though there are no percentage charges. These fees are relatively small (in percentage) only for card purchases over $10. Regardless of the vendor's

Figure 11.3 Singapore electronic road pricing system. (Source: Photo taken by J. K. Lee March 2013)

point of view, there is substantial evidence, at least in the off-line world, that consumers are willing to use their credit or debit cards for small-value purchases. In the online world, the evidence suggests that consumers are interested in making small-value purchases, but not with credit or debit card payments. A good example is Apple's iTunes music store and their App Store. There have been more than 35 billion songs downloaded from iTunes (Lee 2014) and over 100 billion apps downloaded from their App store (Statista-1 2015). A substantial percentage of the songs that were downloaded cost $1.29 a piece, while many of the apps cost somewhere between $.99 and $5. Although most of Apple's customers paid for these downloads with a credit or debit card, the payments were not on a per-transaction basis. Instead, their customers created accounts with Apple, and Apple then aggregated multiple purchases before charging a user's credit or debit card.

Other areas where consumers have shown a willingness to purchase items under $5 using a credit card are cell phone ringtones, ring-back tones, and online games. The annual market for ringtones and ring-back tones is in the billions of dollars. The download of both types of tones is charged to the consumer's cell phone bill. Similarly, the annual market for online games is in the billions of dollars. Like songs and tones, downloading a game is usually charged to the consumer's account, which is paid by a credit or debit card.

Currently, there are five basic micropayment models that do not depend solely or directly on credit or debit cards, and that have enjoyed some amount of success. Some of these are better suited for off-line payments than online payments, although there is nothing that precludes the application of any of the models to the online world. The models include:

- **Aggregation.** Payments from a single consumer are accumulated and processed periodically (e.g., once a month), or as a certain level is reached (e.g., $100). This model fits vendors with a high volume of repeat business. Both Apple's iTunes and App stores use this model. The transportation card used in Seoul, Korea, and many other places is of this nature.
- **Direct payment.** In this case, an aggregation is used but the micropayments are processed with an existing monthly bill (e.g., a mobile phone bill).
- **Stored-value.** Funds are loaded into a debit account from which the money value of purchases is deducted when purchases are made. Off-line vendors (e.g., Starbucks) use this model, and music-download services use variants of this model. This system is being used by several online gaming companies and social media sites.
- **Subscriptions.** A single payment (e.g., monthly) provides access to content. Online gaming companies and a number of online newspapers and journals have used this model.
- **À la carte.** Payments are made for transactions as they occur; volume discounts may be negotiated. This model is used in stock trading, such as at E-Trade.

The world of micropayments has been billed as $13 billion opportunity being driven by the rapid growth in digital content (news, music, videos, etc.), mobile apps, and the social network and online gaming communities (LPT Team 2014). In spite of this opportunity, the micropayment arena continues to be a graveyard filled with the remains of companies who expired in their infancy. Some companies and payments options that support micropayments and seem to have some staying power are: Amazon Payments, PayPal Micropayments, and the mobile payment companies Boku (**boku.com**) and Fortumo (**fortumo.com**). Prior to their acquisition by PayPal, Zong was a relatively successful mobile payment company that specialized in micropayments for online gaming and social networking.

Except for a handful of situations, all of these options still cost the merchants and consumers money depending on nature of the purchases and on how the customer backs the payment (by credit cards, bank accounts, mobile accounts, etc.). So, the long-term answer to the issues with micropayments may ultimately rest with the credit card associations. In some cases the solution might be for the card associations to adjust their fees, which Visa and MasterCard have done for some vendors with high transaction volumes. In other cases it may require changes in the way that the cards are traditionally processed by the vendors. A good example of this is found in Case 11.1 which discusses the use of credit cards for real-time payment of transit fares in South Korea.

CASE 11.1: EC APPLICATION INNOVATIVE CREDIT CARD MICROPAYMENTS FOR THE KOREAN METROPOLITAN UNIFIED FARE SYSTEM

In many Asian countries, daily commuters often use a combination of public trains and buses to travel to and from work, necessitating the use of a combination of stored-value or regular credit cards for each mode. This was the situation facing commuters in Seoul, Korea, a few years ago. As the details of this case explain, the eventual solution was the creation of a unified transportation smart card.

The Problem

Boram, a banker in Seoul, Korea, commutes by MRT and public buses. She uses a credit card that allows her to pay for both MRT and buses, not only in Seoul, but also in other major Korean cities without having to recharge the card. The accumulated monthly charges are automatically paid by the bank. Boram recalls the days when she had to carry two different transportation cards in addition to credit cards.

In the past, Boram used to pay for the subway by using a Seoul MRT Card, which is a stored-value card. The card is issued by the city-owned Seoul MRT Corporation and could be recharged only at MRT stations. To ride a bus, she had to use a Seoul Bus Card that is another stored-value card issued by the private Seoul Bus Transport Association (SBTA). The Seoul Bus Card was introduced in 1996 as the first RF-type bus card in the world. Thus, she had to recharge both cards individually because they could not be used interchangeably. Other cities have similar governance structures. Therefore, to take the subway in another city, Boram had to buy one-time subway tickets at the subway station.

Credit cards, as described in this chapter, are not cost-effective enough to be used for the micropayment of transportation because the card company could not justify its service fee. Therefore, as described earlier, Boram needed to carry at least one credit card and two transportation cards in her wallet.

Large cities in Asia such as Seoul, Hong Kong, and Singapore have adopted similar types of stored-value transportation cards. As such, credit cards and stored-value cards coexist as two major card services. The two types of card issuers compete to expand their application territory. The transportation card company wants to extend the card's application so users can pay for parking fees, various toll fees, and at restaurants and stores. However, the users have to load the cards for prepayment.

At the same time, for credit cards issuers to expand their application to include payments for transportation, they need to simplify the authorization process and reduce the service fee for the participating transporters. The question is: which business model will eventually win? In Seoul, it is the credit card issuer that includes payments for transportation.

The Solution

In order to pay transportation fares quickly, credit card payments for subways and buses must be processed without the full authorization procedure. This risk is tolerable because the frequency and amount of micropayment abuse is low in Korea. Therefore, the transportation ticket gate merely automatically checks whether the card is valid and not on a "blacklist." The gate displays not only the fare, but also the charges incurred during the current month as shown in Figure 11.4. The first credit-based MRT card was adopted by Kookmin Bank in 1998. Today, several issuers support this type of card.

The credit-based transportation card has revolutionized the recharge service process. In the early stage, both MRT cards and bus cards had to be recharged at manned booths. To reduce the expense of the recharge service, unmanned

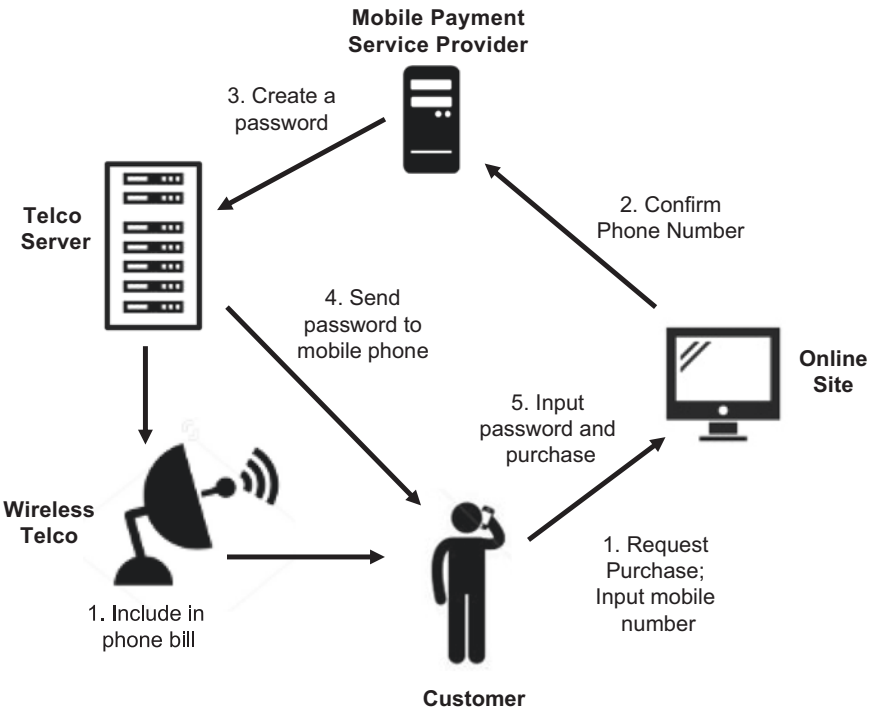

Figure 11.4 Process of mobile payment service. (Drawn by D. King & J. K. Lee)

booths were installed at MRT stations. However, with the credit card, recharge booths can be eliminated altogether and users do not have to spend time recharging their cards. Therefore, both the users and the city transportation authority benefit.

Another benefit of the smart transportation card is that it can restructure the city's transportation system by aligning and coordinating the routes of subways and buses. In the past, bus routes were designed in consideration of the departure and destination points of citizens' trips. This approach intended to make it convenient for citizens to take only one bus to reach their destination. However, too many buses created bottlenecks in busy streets, causing traffic jams. To avoid such congestion, the MRT and main bus companies planned to design the transportation system so that bus branch routes are connected to the subway and to the main bus routes. However, if citizens are required to pay an additional fee for branch routes, they may resist the new structure. Therefore, the transportation fare card should be interconnected.

To solve this problem, the transportation card, credit or stored-value, is designed to memorize the departure time from the MRT station so that the connecting buses do not charge passengers again if the elapsed time is less than 30 min. Taking a branch bus is regarded as a transfer for single trip. This means that the owners of transport systems need to agree on about how to allocate the collected fees. Therefore, the city of Seoul adopted the Metropolitan Unified Fare System in 2009.

The Results

Due to the national standardization and integration effort, nationwide transportation cards are now unified using smart cards. Credit card companies do not really make enough money through transportation payment services, but this service is essential for them to gain new customers and retain existing ones.

The city also can collect data about commuters so that additional buses can be dispatched depending upon the passenger load by route and time. Note that, at midnight, regular bus services stops. For midnight bus service, the control center analyzes the frequency of mobile phone usage in certain areas to estimate the number of potential commuters and dynamically determine the routes of midnight buses.

Another lesson that can be learned from Korea's experience is the C2C payment system use of credit cards. In C2C auction markets, escrow services that are based on credit cards allow individual buyers to pay eBay Korea directly. The sellers can receive payment through eBay Korea if delivery is confirmed by the buyer. Therefore, there is no need for an e-mail payment system such as PayPal that charges high service fees. The function of a debit card, combined with a credit card, has also virtually replaced the function of electronic checks, so e-checks are no longer needed. In this manner, payments by credit cards in Korea are electronically integrated for e-commerce, physical stores, and micropayments for transportation.

Sources: Case written by Jae K. Lee, Seoul, Korea.

Questions

1. How can credit cards be processed as quickly as stored-value cards at the ticket gate?
2. What is the major benefit of owning a credit-based transportation card for commuters?
3. What is the major benefit of credit-based transportation cards to the city government?
4. How can the Metropolitan Unified Fare System enable the restructuring of public transportation infrastructure?

SECTION 11.4 REVIEW QUESTIONS

1. What is a micropayment?
2. List some of the circumstances where micropayments can be used.
3. Besides credit or debit cards, what are some alternate ways that an online merchant can process micropayments?

11.5 PAYPAL AND OTHER THIRD-PARTY PAYMENT GATEWAYS

While credit and debit cards dominate e-commerce payments, one alternative that has succeeded is PayPal (and its clones). PayPal was formed in the late 1990s from the merger of two small start-up companies, Confinity and X.com. Their initial success came from providing a payment system that was used for eBay transactions (PayPal is now an eBay company). How did the system work? Essentially, eBay sellers and buyers opened up PayPal accounts that were secured by a bank or credit card account. At the completion of an auction, the payment transactions were conducted via the seller's and buyer's PayPal accounts. In this way, the bank or credit card accounts remained confidential. It is important to remember that in those days, buyers were often wary of revealing their credit card numbers online. For the seller, it also eliminated the transaction fees charged by the credit card companies, although PayPal eventually began charging similar, though somewhat lower, transaction fees.

Even though eBay had a payment system called Billpoint, PayPal became so successful that eBay eventually decided to close Billpoint and acquired PayPal in October 2002. Why did eBay select PayPal over Billpoint? This is a tough question that has generated a multitude of answers. PayPal had a better user interface, better marketing, and a better mix of services. Regardless, neither Billpoint nor PayPal had to find the market of potential buyers and sellers; eBay had already done this. What Billpoint and PayPal had to do was convince eBay consumers and merchants to use their systems. PayPal was simply more successful at it than Billpoint.

Because of their ongoing success and the percentage of their non-eBay business, PayPal was spun off from eBay in July 2015. According to their 2015 annual report, PayPal operates in 203 global markets and has 184 million active user accounts. PayPal supports payments in 26 currencies. As a standalone company, their 2015 revenue was about $9.2 billion up 15% from the prior year. Part of this growth comes from the acquisition of a number of key payment companies focused on the future of digital payments including:

- Braintree—payment gateway with key customers in the sharing economy space (e.g., Airbnb and Uber)
- Venmo—mobile P2P company that was part of Braintree (see Section 11.6 for details of mobile P2P)
- Xoom—international remittance (the closing case in this chapter discusses and illustrates new approaches to digital remittance)
- Padiant—technology for creating branded (private-label) mobile e-wallets for retail chains

While PayPal provides a number of services, at their core they are a full-service third-party payment gateway (discussed earlier in Section 11.2). Basically, they eliminate the need for a merchant to deal with the intricacies and complexities of authorization and settlement in online payment. They also eliminate the need for merchants to handle card information and for customers to provide their financial information with every transaction. The way it works is that in a given purchase transaction the customer is presented with a payment webpage containing PayPal as an option. If the customer selects this option, they are directed to a Web page on PayPal's site. If the customer has a PayPal account, they simply confirm the purchase and payment instrument (e.g., card). If not, they provide information about their card, and PayPal takes it from there. In both cases, the customer is returned to the merchant site along with approval of the payment. At this point, PayPal transfers the settlement payment to the merchant's bank.

Domestically, PayPal is the leading third-party payment gateway. In recent years, Amazon, the leading online retailer, has started to make forays into this third-party payment arena with their Amazon Payments system (**payments.amazon.com**). It is a comprehensive set of online payment tools and APIs that enable businesses and developers to offer Amazon's payment capabilities as an alternative to paying with credit or debit cards or Paypal. Like PayPal this alternative is surfaced by incorporating a "Pay with Amazon" button on the merchant's checkout Web page or mobile app. If a customer clicks the button, they are taken to Amazon's familiar "Login and Pay" screen. If he or she already has an account with

Amazon, then the customer will be asked to confirm or select from the cards and shipping addresses that are associated with the account. If he or she doesn't have an account, they be guided through the enrollment process. While Amazon is not an immediate threat to PayPal, they may be in the future. It is estimated that are over 50 million U.S. Amazon Prime members, which represents close to 50% of U.S. households. Amazon already has their payment information on hand and these customers are all familiar with the simplicity of their patented "By now with 1-Click" button.

Globally, PayPal is also the market-leading gateway. PayPal is used extensively throughout the world. In a number of countries PayPal is one of the preferred payment methods behind cards, often handling between 10 and 15% of all payments (Adyen 2015). This is the case, for example, in France, Germany, the UK, and Australia. However, in select countries there are other gateways that are used more often. Included in this group are:

- Sofort (**sofort.com**) in Germany. Gateway that relies on direct bank transfers rather than cards.
- Wirecard AG (**wirecard.com** in Germany. Offers cashless payment and other payment services both within Germany and worldwide.
- Yandex.Money (**wirecard.com**) in Russia. Partnership between Srebank and the search company Yandex. Handles cash, bankcards, and e-money.
- Qiwi (**qiwi.com**) in Russia. Payment service that is publicly traded on NASDAQ and headquartered in Cyprus. It also operates in Kazakhstan, Moldova, Belarus, Romania, the United States, and the United Arab Emirates.
- Alipay (**global.alipay.com**) in China. Part of the Alibaba group discussed in the opening case of this chapter. Like PayPal it is a full-service payment gateway servicing domestic and cross-border transactions in China.
- Tenpay (**global.tenpay.com**) in China. Second largest payment service. It's owned by Tencent who also owns China's largest social network Weibo.
- iDEAL (**ideal.nl**) in the Netherlands. A payment service in the Netherlands that uses direct bank transfers.

With the exception of China, in each of these countries PayPal is still used.

SECTION 11.5 REVIEW QUESTIONS

1. What is PayPal?
2. Why was PayPal more successful than its competitors?
3. What is a third-party payment gateway? Describe how one works?
4. What is Amazon Payments? What competitive threat does it pose for PayPal?
5. What are some of the key gateways used in other regions of the world?

11.6 MOBILE PAYMENTS

Because of the strong growth in mobile usage worldwide (see Section 11.1), there continues to be a strong belief that mobile payments will emerge as a primary way to pay, potentially eliminating dependence on cash, cards, and other modes of EC payment. While mobile payments are growing rapidly, they will not supplant cash, cards, or even other forms of EC payments anytime soon. According to eMarketer (2016), mobile payments reached $450 billion in 2015 and will grow to $1 trillion by 2019. To put this in context, in 2015 mobile payments accounted for 24% of all EC retail sales and 1% of total retail sales. By 2019, they will account for 30% and 4%, respectively. These shifts reflect a substantial amount of growth in mobile payments that sellers cannot ignore, but it's important to remember that in relative terms usage is still low when compared to all other forms of payment.

Types of Mobile Payments

The term **mobile payment** refers to payment transactions initiated or confirmed using a person's mobile device, usually a smartphone although payments can be made with other mobile devices such as tablets and wearables. The term actually covers a number of different types of solutions, as well as different combinations of hardware and software technologies.

Just like online payments, there are many parties involved in any mobile payment system (see Figure 11.5). From the standpoint of the various parties, any successful mobile system needs to overcome the following sorts of issues:

For Buyer: Security (fraud protection), privacy, ease of use, choice of mobile device.

For Seller: Security (getting paid on time), low cost of operations, adoption by sufficient number of users, improved speed of transactions.

For Network Operator: Availability of open standards, cost of operation, inter-operability, and flexibility and roaming.

For Financial Institutions: Fraud protection and reduction, security (authentication, integrity, non-repudiation; see Chapter 10), and reputation.

Most of today's mobile payment solutions are designed to replace existing payment methods including non-digital

Figure 11.5 The credit-based transportation card displays the fare and accumulated charges for the current month at the ticket gate (Photos by J. K. Lee)

(cash or credit) and digital (PC-based). As such, they tend to fall into one of four payment types (distinguished by "who pays whom") including (Allum 2014):

- **Consumer**. Buyer pays a merchant for goods and services. This is the purview of most digital wallets (e.g., Apple Pay).
- **Merchant**. Receiving money from a customer in exchange for goods and services. Often enabled by mobile POS (e.g., Square).
- **Person-to-Person (P2P)**. Money exchange between two or more people, as a gift or payback (e.g., PayPal's Venmo).
- **Institutional**. Managing and paying bills from an institution (like a utility company) for services rendered (e.g., Finovera or Mint).

The fact that these payment types are all designed to supplant or cannibalize existing nonmobile payments systems may be one of the reasons for their slower than expected uptake. To many potential users, mobile payments applications are simply "credit card surrogates: they're a veneer over what already exists." So, why change especially since they are all underpinned by substantial technological ecosystems.

We won't discuss institutional payments in this chapter, but we will describe the other three types of mobile payments in this section along with their underlying technologies.

Mobile Consumer Payments: Wallets, Clouds, and Loops

As a recent Accenture (2015) survey of 4000 respondents in North America shows, the average consumer's exposure to mobile payments is through his or her mobile digital wallet. Among the more popular wallets are PayPal, Apple Pay, and the recently morphed Google Wallet (in that order).

The term **mobile digital wallet** refers to the combination of an electronic account along with a smart phone and mobile app designed to make purchases digitally and to redeem rewards from loyalty programs and targeted digital promotions. There are two main types of wallets—device-based and cloud-based.

Device-Based Digital Wallets

These are proximity payment systems enabled by near field communication (NFC) technology. On the consumer side, the system requires that the mobile device being used is equipped with NFC antenna and an integrated chip or a smartcard inside the phone that holds payment card information (credit or debit). On the merchant's side, it requires a specialized NFC reader used to recognize the chip when the chip comes within a short distance of the reader, and a network for handling the payment. Essentially, a buyer first enters his or her credit card information into the wallet app on the phone prior to shopping. At the time of the purchase, the buyer then "waves" the specially equipped mobile phone near a reader to initiate a payment. The reader collects the info and passes to the payment network. The card is charged and the purchase is complete. These proximity payments are also called *contactless payments* where the phone plays the surrogate roll of a contactless card with a chip (see Section 11.3).

In the past there were few wallets on the market. Today, while there a large number of device-based wallets (last count over 1000), the most popular are PayPal wallet (**paypal.com**), Apple Pay (**apple.com/apple-pay**), and Android Pay (**android.com/pay**).

Over the years, a number of protocols and technologies have been proposed to support proximity payments (e.g., from mobile devices). NFC has won out. It is now used for a wide variety of purchases including those in-store, from vending machines, and from transit ticket dispensers or fare

collection. As of 2015 (Statista-2 2016), around 13% of smartphone users in the USA were active users of these sorts of proximity payments. In that same year the total value of these transactions was about $27 billion. By 2019 this figure is projected to (magically) climb to $210 billion.

It will require extraordinary growth (a sevenfold increase in a 4 year period) in the number of installed NFC readers for these estimates to pan out. Thus far, many merchants have been hesitant to install the readers. Part of this hesitancy is due to the fact that while NFC is a standard, there is still disagreement about the specific handsets, chips, readers and networks to be used. A case in point is the Google Wallet. Originally, Google Wallet had a fixed set of operational partners (Sprint, Citibank, MasterCard, and FirstData), and was available only on the Sprint Nexus S 4 G handset, supporting two credit cards (Citibank MasterCard Paypass terminals and Google Prepaid cards). Then they shifted to MasterCard and MasterCard PayPass terminals. Just recently, they turned Google Wallet solely into a P2P application and shifted general purchasing to a newer wallet called Android Pay, which operates on both Android and Apple smartphones. This is simply another example of the "chicken-egg" problem (Section 11.1).

It is also an example of another reason why there is hesitancy to adopt a particular NFC configuration because the mobile payments field is changing so fast that there is no assurance that the current form of NFC proximity payments won't be supplanted by some other technology. A good case in point is the diminishing role of the integrated (payment) chips inside smartphones. These chips were used to bolster security. However, they only worked with specific readers. Today, wallets like Apple Pay and Android Pay store card and other information on the phone, not in a chip. During a purchase, card information is not transmitted to the reader; instead a secure numerical token (one-time payment number and dynamic security code) is generated and transmitted. This opens up the number of types of readers that the mobile wallet can work with.

Example: Wearable Wallets from MasterCard and Coin (onlycoin.com)

In October of 2015, MasterCard (2015) announced a new program—*Commerce for Every Device*—aimed at bringing mobile payment capabilities to a range of consumer products across the automative, fashion, technology, and wearable worlds. The goal is to provide consumers with the ability to shop and pay with the device or thing that is most convenient and secure. The announcement named a number of partners like Bulgari, GM, the Parsons School of Design, and Ringly (jewelry) along with a number of "wearables" companies, including Nymi, Atlas Wearables, Moov, and Omate. The program is an extension of the MasterCard Digital Enablement Service and the Digital Enablement Express programs and supports their vision to enable virtually every device for commerce.

From a technology standpoint, a key partner is Coin. Currently, the primary product that Coin provides is a combined EMV and NFC compliant smartcard called the Coin. The smartcard holds information of all the credit and debit cards that the card owner wants to use for purchases. A companion smartphone app is used for initial setup and for adding and changing cards. Given its combined EMV and NFC capabilities, purchases can be made with the Coin card by swiping, tapping, or waving like other EMV or NFC smartcard. The advantage is that the Coin eliminates the need to carry multiple cards or even a smartphone. The Coin card provides the means to switch from one card to the next depending on the owners' preferences at the time of purchase.

Initially, Coin was solely focused on using the technology for their own card. With the MasterCard partnership they have expanded their horizons and plan to provide other companies with their *Payment of Things* hardware and software platform (Cipriani 2016). This will enable these companies to embed Coin's smartcard payment capabilities into these devices. The fact that the partnership is nonexclusive means that Coin's platform will eventually be available to companies affiliated with the other card associations.

Cloud-Based Digital Wallets

An alternative to device-based mobile wallets is cloud-based mobile wallets. The infrastructure for these wallets is not as onerous as a system based on NFC. Basically, a customer enrolls his or her card with a secure Web service. Requests for payments are made to the service and charged to enrolled card(s). In this way no card information is transmitted during a purchase. Instead, transactions are initiated by scanning a barcode or Quick Response (QR) code created specifically for the customer and stored and displayed on the smartphone by the wallet app. A QR code is a 2D barcode consisting of a collection of black square dots placed on a square grid with a white background. What is required on the merchant's end is a barcode or QR code image reader that is networked into the service via the Web. The whole system operates much like the way PayPal operates without using a Web page with a PayPal button to start the process. Instead, it's started when the code is scanned. As a point of fact, PayPal employs a cloud-based mobile wallet instead of device-based.

This architecture is also being used to create Walmart Pay (**walmart.com/cp/walmart-pay/5998388**) and Chase Pay (**chase.com/digital/digital-payments/chase-pay**). Actually, both Walmart and Chase are using a cloud-based mobile platform called *CurrentC* being created by the Merchant Customer Exchange (MCX) consortium (**mcx.com**) which is

being funded by over 30 retailers who are its members. Not only will the platform support initiating a purchase by scanning a QR code on the customer's screen, but it will also support initiating a purchase by having the customer user his or her phone to scan a QR code on the merchant's screen.

Compared to device-based wallets, it's much simpler to create and develop a cloud-based wallet. Because these systems are basically hardware agnostic, the main barriers revolve around PCI security compliance, customer authentication, and integration with a settlement system. Of course, building it is one thing, having merchants adopt it is another. While these systems require a barcode and QR code reader hooked to the backend Web service (not too onerous), these transactions are "card not present." CNP transactions have higher authorization and settlement fees. Additionally, since a cloud-based wallet relies on the Web, a merchant will need uninterrupted and reliable Internet service with consistent speed throughout business hours—not a sure bet.

Closed-Loop Systems

Closely tied to the cloud-based wallets are the closed-loop payment applications. These systems are much like the closed-loop, stored-value or prepaid (gift) cards offered by a single retailer. The main difference is that the value is stored in an application on your phone and redeemed with your phone by again having an application barcode or QR code scanned by the merchant. In essence it is a cloud-based digital wallet that can only be used with a single retailer (although this isn't a hard and fast rule). One advantage of the phone is that you can reload the application at virtually anytime rather than having the retailer do it in the store.

Example: Starbucks Closed-Loop Wallet (starbucks.com)

One of the better known and most widely used closed-loop mobile payments system is the Starbucks Mobile Wallet app that works on Apple and Android smartphones. Because it is closed-loop, the app can only be used to do business with Starbucks. The card enables Starbucks' customers to use their smartphones to locate stores, buy gift cards online, to place an order for pickup at a designated local Starbucks, and most importantly to use their smart phones to pay for in-store purchases using an electronic version of the loyalty reward cards which are basically prepaid stored-value cards. The electronic version displays a QR code on the smartphone screen which is scanned by an image reader connected to a POS. Each time a purchase is made with the app, the stored value of the card is debited and associated Starbuck rewards are increased. The app is also used to automatically reload the card when the value falls below a customer specified minimum.

Automatic reload obviously encourages regular consumption, and it's working (Taylor 2015). Starbucks has 10.4 million loyalty card members. A third of all purchases are made with these cards. On initial rollout the mobile version was accounting for over 20% of all transactions. Given the demographic of their customers this will only increase.

Mobile Point of Sale

Up to this point the discussion has all been about supporting mobile purchases from the customer's point of view. Mobile payment apps are also used to meet the needs of the merchant during the purchase process. One key area where mobile payment applications are being employed by merchants is at the point of sale (POS). Instead of taking payments at a traditional POS register or computer that is stationary, mobile POS (mPOS) devices are used in their place. Initially, mPOS systems were designed to run on specialized hardware and networks, just like their tethered counterparts. Today, they run on tablets and smart phones and are cloud-based. The cost of these cloud-based mPOS is substantially less. Not only is the hardware less expensive but so are the network costs.

Because of their lower costs, mPOS were originally targeted at small businesses and independent operators such doctors, dentists, delivery companies, taxis, and retail kiosks. More recently, these devices are being used in-store by retailers of all sizes. They are also being integrated with mobile *clienteling* applications designed to help sales staff with in-store, personalized customer support and service.

Example: Square (squareup.com)

One of the leading vendors of mPOS hardware and software is Square, Inc. They are a "financial services, merchant services and mobile payment company" that was started in 2008 by Jack Dorsey (also the CEO and founder of Twitter). Square is probably best known for their Square *Magstripe Reader*, a small square dongle device that plugs into the headset jack of an iPhone, iPad, or Android and enables a merchant to accept payments made with credit cards. There are actually two parts to the reader. There's the card swipe device, and there's the Square Wallet application. The way it works for a merchant is the following:

1. Download the Square app from the Apple App Store or Google's Android Market.
2. Register with Square, providing U.S.-based bank account, U.S. mailing address and Social Security number and the business employer id (if there is one). Once the registration is accepted, Square will send the free card reader.
3. With the bank registration information, Square will next run a test to ensure that your bank account will accept deposits from the Square app. After that, funds from card transactions will be directly deposited to the account within 24 hours of the transaction.

4. Start using the reader and application. For each transaction, the amount and description of the product or service is input, then the card is swiped. The app transmits the information to Square's proprietary card service (via the Internet) for approval. Once approved, the customer signs with their finger. The receipt is then delivered by text message or e-mail to the customer. If the reader happens to fail, the information can be put into the application manually.

Square has a simple pricing policy. The reader is free and so is setup. There is a 2.75% fee "per swipe for Visa, MasterCard, Discover, and American Express."

The Square Magstripe Reader is used by major vendors such as AT&T, Walgreens, FedEx Office, Walmart, Starbucks, and Whole Foods. For example, Starbucks use the Square mobile POS in-store as well as allowing customers to pay with Square Wallet. Likewise, Whole Foods has Square checkout stands at the food venues (e.g., sandwich counters, juice and coffee bars, and beer and wine bars), see **media.wholefoodsmarket.com/news/square-and-whole-foods-market-partner-to-create-faster-easier-payment-and-c**.

More recently, Square has added additional input devices including a combined contactless NFC and EMV chip card reader and an iPad POS stand with a card reader (called Square Stand).

Square's success has generated a raft of competitors including various offerings from the major POS players like Oracle Micros and NCR. PayPal has essentially cloned Square's hardware and application with a service called PayPal Here. Just like Square, they provide a dongle and EMV chip card reader along with a mobile wallet app. They also have the same fee structure. For details, see **paypal.com/webapps/mpp/credit-card-reader**.

Person-to-Person (P2P) Payments

Financial transactions among individuals—friends, colleagues, family members, and the like—occur all the time. We lend money to a friend, we pay somebody back for lunch, we send or receive money from home, or we send money as a birthday present. Most of the time, these transactions involve cash or check.

Increasingly, these person-to-person (P2P) transactions are being handled by online payment systems using either a computer, tablet, smart phone or even prepaid cards. Many of the more popular P2P systems are actually provided by the major payment gateways (like PayPal) either as a component of the larger payment system or as a separate application. These online P2P systems transcend distance and time, eliminate the need carry cash and checks for smaller transactions of this sort, and in some cases offer the "unbanked" and "underbanked" an entry into the larger financial. They enable us not only to pay friends but also merchants for lower priced products and services. The closing case at the end of this chapter discusses in detail Kenya's M-Pesa system, which is an exceptional success story of how a mobile P2P system provides benefits of these sorts and much more.

SECTION 11.6 REVIEW QUESTIONS

1. What are the four types of mobile payment?
2. Who are the key players in a mobile payment system?
3. What is mobile wallet? Devised-based wallet? Cloud-based wallet? Wearable wallet?
4. Describe closed-loop payment systems? What is a good example of this type of system?
5. What is a mobile POS? Who is the leading provider of these systems?
6. What is a person-to-person payment?

11.7 DIGITAL AND VIRTUAL CURRENCIES

In some discussions the terms *digital currency*, *virtual currency,* and *e-money* are often used interchangeably. In other discussions, they are recognized as being different, although there seems to be little consistency about which is which. In this discussion, the definitions that are used come from the Financial Action Task Force (FATF 2014). This is an intergovernment body with 35 member countries (including all the major players in EC) charged with examining and addressing anti-money laundering and countering the financing of terroism (AML/CFT) worldwide. They are one of the few official bodies that has a critical stake in defining the differences among the concepts so they can craft language to be used by legal and regulatory bodies.

Types of Digital Currencies

To understand the differences among these three concepts, let's start at the other end of the currency spectrum—*fiat currency*. **Fiat currency** (aka real currency, real money, or national currency) is the "coin and paper money of a country that is designated as legal tender; circulates; and is customarily used and accepted as the medium of exchange in the issuing country." **Electronic money** (abbreviated e-money) is a digital representation of fiat currency used for purposes of electronic transfer (e.g., the digital representation funds used to settle a merchant account after an EC purchase is made). In contrast, **virtual currency** is the "digital representation of value that can be digitally traded and functions as (1) a medium of exchange; and/or (2) a unit of account; and/or (3) a store of value, but does not have legal status in any jurisdiction."

Basically, it only functions as a currency because there is a community of users willing to treat it as such. Finally, **digital currency** is a generic term that refers to the digital representation (0 s and 1 s) of either e-money (fiat) or virtual currency (non-fiat). So, e-money and virtual currency are types of digital currency but not vice versa.

Virtual currency covers two sub-types: *non-convertible* (closed) and *convertible* (open). According to the U.S. Treasury's Financial Crimes Enforcement Network (**fincen.gov**), **convertible virtual currency** is a virtual currency that has "an equivalent value in real currency, or acts as a substitute for real currency." Some examples include the cryptocurrencies like Bitcoin and most retail e-coupons. In contrast, a **nonconvertible virtual currency** is a virtual currency used in a specific virtual world or domain that cannot (theoretically) be exchanged for fiat currency. Many of the better known examples come from online games. Some examples of this would include: World of Warcraft Gold, Farm(ville) Cash, and Q Coin from TenCent QQ. In these games success is based on obtaining virtual money, which is earned by completing various tasks or purchased using real money (which is often the primary source of income for the game company). Technically, these currencies cannot be used or exchanged in the outside world. However, it many cases secondary markets (black or not) have arisen that are willing to exchange the nonconvertible currency into a fiat currency or some other virtual currency.

A key feature of nonconvertible, virtualized currencies is that they are *centralized*. This means that there is a single administrative authority in charge of regulating the currency—issuing the currency, establishing rules of use and exchange rates, tracking payments, and controlling the amount in circulation. In contrast, convertible virtual currencies can be either centralized or decentralized. A *decentralized* virtual currency is distributed, open-sourced, and peer-to-peer. There is no single administrate authority who oversees and monitors the currency. This is the nature of many of the *cryptocurrencies* like Bitcoin which we'll discuss momentarily.

Size of the Virtual Currency Market

A couple of years back, the Yankee Group (McKee 2013) accessed the size of the virtual currency market. Their analysis included both the mature virtual currencies like loyalty points, credit card points, air miles and physical coupons, as well as the up-and-coming (digital) virtual currencies including app-based coins and tokens, personal information and time (exchanged) for apps and tokens, and Bitcoins. At that time (2012), the total value of all the virtual currency markets was close to $48 billion with the mature currencies making up close to 97% of the total. They estimated that by 2017, the mature markets would grow steadily, while the up-and-comers would experience rapid growth (in the 130–200% range). Yet, the mature markets would still garner the lion's share.

However, the problem with the estimates are that, then and now, it is very difficult to assess the exact values associated with the game-based and Bitcoin currencies, although for different reasons. For game-based you not only have to calculate an exchange rate but many of the game companies don't provide the necessary data to do a reasonable assessment. For Bitcoin the number of coins in circulation is known, however their exact value is dependent on exchange rates that can fluctuate substantially at any given time. The value is subjective and based on market volatility and the going rates paid by the Bitcoin exchanges. For example, in the spring of 2016 the total number of Bitcoins in circulation was around 15.5 billion and the price was fluctuating between $400 and $450. That's a difference of around $6.2 billion to $6.7 billion which is fairly substantial.

Bitcoin and Other Cryptocurrencies

Among the (digital) virtual currencies, the one that has garnered the most attention is Bitcoin. From previous discussion, it was stated that Bitcoin is an encrypted, decentralized (peer-to-peer), convertible, virtual currency. Taken together it sounds complex, and it is. That's why we will simply touch the surface of how it works along with its advantages and disadvantages. For those who are interested, there are any number of books (e.g., Antonopoulos 2015) and Youtube videos devoted to various aspects of its history, underlying mathematics, structure, operation, and uses. Instead, in this discussion we'll hit the highlights of these elements.

Bitcoin Background

The origin of Bitcoin comes from a specification and proof of concept developed in 2009 by Satoshi Nakamoto and published in a paper entitled "Bitcoin: A Peer-to-Peer Electronic Cash System." That's not his real name, it's a pen name. The real identity of the inventor is still unknown. After the initial development, Satoshi left the project in the hands of a community of open source developers (see **bitcoin.org**), meaning that the development and maintenance of the underlying code is being done by a community in much same ways as projects like Linus and Apache.

Bitcoin was not the first system to propose a decentralized virtual currency. However, it was the first to come up with a decentralized system that offered a useable solution to what is known as the *double-spend problem*. As the concept implies, in a virtual currency double-spending refers to the result of spending the same money more than once. For

instance, if money is held in a digital file, what prevents a clever user from simply duplicating the file and using it again for a purchase or investment. In most systems this is handled by having a central (automated) authority review transactions before they are committed. In Bitcoin there is no central authority. Instead, it relies on an innovative *proof-of-work* scheme that uses consensus among peer-to-peer nodes to verify transactions and to protect against assaults like double-spending.

When we talk about the Bitcoin ecosystem, the term is capitalized. When we speak about the unit of currency in this system it is designated in small letters (bitcoin) which in abbreviated form is designated as BTC (similar to USD). There is an upper limit on the number of bitcoins that will can be produced (21 million BTC), a governor on the number of bitcoins that are produced on the average every 10 min (i.e., 1 block), and an end date for their production (2040). Like the dollar or any other currency, a bitcoin is a *unit of account* that possesses a number of the key characteristics (Tomaino 2015):

- Durable—This means that it retains its shape, form, and substance over an extended period of time, so that in the future it will still work as a medium of exchange. While bitcoins have only been around for 7 years, they are widely accepted at merchants, traded on currency exchanges, recognized (or tolerated) by many countries, and owned by sizeable numbers of individuals. There's no assurance about its future, but it has lasted longer that virtually all of its digital predecessors.
- Divisible—This characteristic means that a currency can be divided into smaller increments so that the sum of the increments equal the original value. In this way bitcoins can be used to purchase products and services of varying value. The smallest unit of the bitcoin is .00000001BTC (that's 1 hundred millionth). This unit is called a Satoshi. It serves the same role as $.01 or a penny in USD.
- Countable—This implies that the units are subject to the rules of mathematics so they can be added, subtracted, multiplied, and divided. In accounting terms it means we can employ these operations to measure profit, loss, income, expenses, debt, and wealth and determine the net worth of an entity possessing units.
- Transportable—Currency needs to be easily support transactions and exchanges across the world. Because bitcoins run on the Internet in a decentralized fashion, they are more transportable than most fiat currencies.
- Fungible—This means that one unit of a currency is interchangeable with all others regardless of when or where it was obtained. For example, in the corn commodities market, all No. 2 corn has the same value regardless of where it was grown. Similarly, one bit coin is the same as any other bitcoin regardless of how it was produced or who holds it.
- Verifiable (Non-counterfeitable)—Means that it is not easily counterfeited, and if it is, it's easily detected. This is one of the key characteristics and strengths of a cryptocurrency like bitcoins. Before any bitcoins are accepted for payment, there is a strong vetting process to ensure its authenticity.

How Does Bitcoin Work?

At its foundation, the Bitcoin currency is nothing more than a *public ledger*. Essentially, it is a digital file tracking every Bitcoin transaction—time, date, participants, amount, and transfer of ownership of bitcoins—that has ever occurred since the first bitcoin was issued. It's much like a company's general ledger that provides a complete record of all the transactions that have occurred over the life of the company except in this case the company consists of everyone worldwide who has ever owned some fraction of a bitcoin. At the present time, the ledger file is about 20GB.

The Bitcoin ledger is called the **blockchain**. As the name suggests, it is a collection of blocks each containing a grouping of bitcoin transactions that occurred around the same time, much like a single page in a ledger. These blocks are linked or chained together in the order in which they occurred.

Unlike a company ledger, the Bitcoin blockchain is *public*, as opposed to private or secret. This means that anyone can view it. In fact there are websites (e.g., **blockchain.info**) where you can watch the transactions in action. Also, unlike a company ledger, there is no central body (like the finance department) or trusted third party that is in charge of the ledger or central place where the official copy is held. Instead there is one digital file that is fully distributed across Bitcoins decentralized peer-to-peer network. Each node or computer on the network has a full-copy of the file. Using complex mathematical computations, the transactions are verified by *bitcoin miners* (computers and computer programs) that maintain the ledger. The computations also ensure that there is agreement among all the nodes on the network about the current state of the blockchain and every transaction in it. If an attempt is made to corrupt a transaction within a block, then the nodes will fail to reach consensus and the transaction and the associated block will not be verified.

With the right equipment and software anyone can run a node on the network and can be a bitcoin miner. The incentive for doing so is that miners can earn bitcoins for their "verification" efforts. Crudely put, verification is a bit like a "hackathon" or coding contest. There are very specific mathematical criteria and hurdles that are required to combine transactions into a block. The miner who does it first while adhering to criteria receives 25 new bitcoins. Doesn't sound like much, but remember there are a lot of transactions in a day (ergo a number of blocks created), and each bitcoin is

currently worth around $450 which is over $11,000. Also, if you are thinking about joining the ranks of the miners, these days it takes a lot of computing power to handle the computations. As a consequence, groups of miners have formed *Bitcoin mining pools* that share computing resources and split the bitcoin payoff.

There are easier ways to obtain bitcoins besides mining for them. Someone who has their own bitcoins could give some of them to you. You can buy them from any one of the commercial bitcoin exchanges (e.g., **coinbase.com** or **cex.io**) using another currency (e.g., USD). Also, you could sell someone goods or services in exchange for bitcoins. Regardless of the method, how do they "give" them to you, and where do they go after you get them? After all, bitcoins aren't physical, they are digital, and there is no bank where you can deposit them.

While Bitcoin is a payment system for exchanging value, at its technical base it is a messaging system built on its peer-to-peer (Internet) network. The messages that are sent are the transactions. These messages are sent and received in much the same way that encrypted message are sent and received over the Internet using asymmetrical public and private keys (similar to those described Section 10.6). However, in this instance the type of encryption that is used is called Elliptical Curve Digital Signature Algorithm (ECDSA).

In order to send or receive a message over the Bitcoin network, a user needs a private key and a Bitcoin address. A **Bitcoin private key** is a randomly generated number between 1 and 2^{256} (i.e., 2 raised to the 256th power) that is used by the owner to initiate and digitally sign transactions and used by the network to verify them. You can think of it like a password or PIN that is used to gain access to funds in a bank account, although in this case the funds are not stored in an account but are recorded in a ledger. Just like any password, this private key can be used by anyone who has it to gain access to the protected bitcoins whether they are the rightful owner or not. So it pays to keep it secret. Also, like any other password, if the owner loses or forgets it, then the funds it protects can no longer be accessed. In this case, however, they are lost for eternity because there is no way for anyone to reset it.

A **Bitcoin address** is an alphanumeric string that identifies the recipient of a Bitcoin transaction. You can think of the Bitcoin address like the bank account number that is password protected by the private key. Bitcoin addresses are generated in a two step process. First, elliptical curve mathematics are used to create a paired *public key* from the private key. Second, a special mathematical function called a "hash function" is used to generate a Bitcoin address from the public key. A Bitcoin address starts with either a 1 or a 3 and has between 27 and 34 alphanumeric characters (except for 0 or O and 1 or l because these pairs are easily mistaken for one another). The identifier can also be represented as a QR code which is easily displayed on a mobile device so the address can be scanned instead of typing the character representation.

When someone wants to execute a transaction, he or she uses his or her private key to digitally sign a message that includes:

- Input—the funds to be transferred or more specifically the source transactions that assigned ownership to the bitcoins being sent.
- Amount—the amount of bitcoins being sent.
- Output—the Bitcoin address of the recipient.

The message is broadcast to the nodes on the Bitcoin network at which point the verification process begins. Sometime later if it is verified by one or more machines it will be posted. Typically, this process takes about 10 min.

In reality, if a user had to remember and handle all of the details of a transaction, the Bitcoin ecosystem would have never gained much traction. Fortunately, most of these details are hidden by the Bitcoin wallets which is client software that is used to create the keys and addresses and to send and receive bitcoins. Electronic Bitcoin wallets come in three versions: Desktop, Mobile (Apps), and Web. Figure 11.6 displays the Web wallet for a dummy account. The first panel of this figure shows the initial screen which displays the Bitcoin address and its associated QR code, shows pertinent transaction data including the balance for this user, and menu selections for sending and receiving bitcoins. The second panel shows the entries required to send bitcoins. In this case you only need to enter an address and an amount. The address can either be the alphanumeric string or the scanned image of the associated QR code.

There are a lot of details about how the Bitcoin ecosystem operates. This discussion has only touched on a few. For those who are interested, refer to: Antonopoulos (2015), the diagram at **bitcoin.stackexchange.com/questions/4838/what-does-a-bitcoin-transaction-consist-of**, and **en.wikipedia.org/wiki/Bitcoin_network**.

Advantages and Disadvantages of Bitcoin

The adherents and supporters of Bitcoin, of which there many, point to number of advantages of Bitcoin over fiat currencies and other virtual currencies. Most of these revolve around it's decentralized structure. Some of the more frequently cited advantages include (Hochstein 2016):

- *Anonymity*. Even though transactions are public, there is nothing to tie a user's name to the particular encrypted address or signatures unless the user wants to make the connection public. It's also the case that users can have multiple addresses, even a new one for every transaction. This increases the anonymity. However, the shear fact that

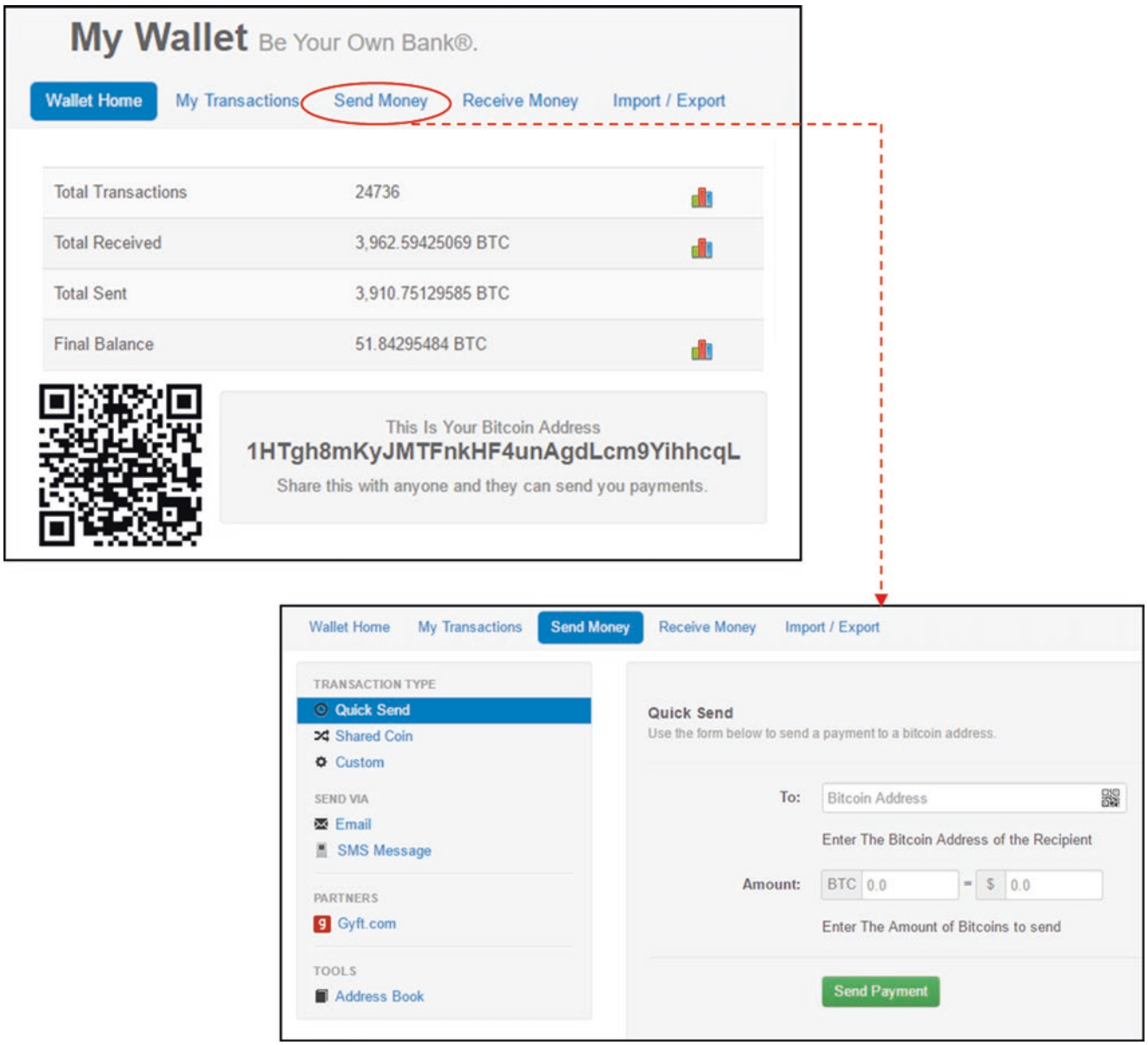

Figure 11.6 Bitcoin Web wallet (Drawn by D. King)

transactions and addresses are public leaves open the possibility of tying transactions to real-life identity. For this reason Bitcoin is often referred to as *pseudo-anonymous*.

- *Simplifies Financial Transactions*. There are no prerequisites and no minimum levels required to participate. Transactions between parties can transpire without the assistance of any bank or financial institution. Because transactions are basically frictionless, fees are held to a minimum.
- *Merchant Friendly*. For merchants, it's easy to set up a payment system without relying on third-party gateways or intermediaries. The setup costs are minimal and there are none of the chargebacks associated with cards.
- *Support Cross-Border Commerce*. Architecturally, Bitcoin can easily support cross-border transactions simply because it utilizes the Internet. Also, it's an open system that allows anyone to join regardless of their location. In most countries they can operate pretty much with impunity largely because of the regulatory confusion over virtual currencies. However, it is the case that Bitcoin is outlawed in a handful of countries (e.g., Russia) and is increasingly subject to the regulations governing banks and institutions in a number of countries, especially those dealing with money laundering and financing terrorism.

- *Free from Government Manipulation.* In many developing countries and a number of developed countries, the currencies have been subject to governmental fraud and illegal manipulation. On an individual level, accounts have been frozen or expropriated by national governments. On a national level, governments have illegally manipulated the circulation of currency, defaulted on debts, etc. all of which impact currency valuations. In Bitcoin no one, governments or otherwise, has direct control of accounts, the bitcoins in circulation, nor their valuation.

On the other side of the coin, Bitcoin has equally vociferous detractors and opponents. The list of disadvantages they cite include (CoinReport 2014):

- *Not yet widely accepted*. Even though there has been substantial growth in the number of merchants accepting Bitcoins, the number of transactions, and the valuations of the currency, it has yet to reach the "critical minimum." The pace may get increasingly slower as governments move to place regulatory controls on aspects like the anonymity of accounts which provides cover for money-laundering and the finance of terrorism.
- *Fluctuating valuation*. While all currencies have swings in valuation, the value of a bitcoin has had a history of volatile swings. This means there is substantial risk for owners, much like the risk associated with stock investments. For example, the value went from $120 in October 2013 to $600 in January 2014 to $225 in July 2015, to $408 in November 2015, to $367 in January 2016, to $462 in April 2016. While it's been on the rise lately, there's no assurance that it will continue this way in the future. Besides the risk, this also makes it hard for merchants to know how many bitcoins to charge and how to handle returns. For merchants it is more like dealing with the exchange rates for a foreign currency rather than the domestic currency.
- *Transactions are irreversible*. This is both good and bad. It's bad in the sense that if a buyer makes a purchase and the merchant fails to deliver the goods, there is no recourse because the transactions will already be committed. A variety of external controls have been suggested but many of them are an anathema to the underlying tenets on which the system operates.
- *Private keys can be lost*. As noted earlier, if a user loses his or her private key(s), they are simply out of luck. Keys can be lost in a variety of inadvertent ways (e.g., disk crashes, file corruption, stolen hardware, and the like). Even though the transactions and public account numbers are visible, there is no way to sign a message to execute a transaction, and there is no central authority or administrator who can issue a new key. It's not like losing a password. This is why users are encouraged to back up their private keys to paper or some other medium.
- *Problems with everyday use.* Traditional currencies and cards are easier to use both off-line and online and are accepted virtually everywhere. Virtually every online retailer who accepts bitcoins sets their prices in conventional currencies and determines the bitcoin cost based on exchange rates against those same currencies. So, from the perspective of everyday use, bitcoins offer little advantage.
- *Network latency and issues of scalability*. While the system is designed to verify transactions on average every 10 min, sometimes it can take hours. It is hard to image how this could support the transaction volume of even a reasonable sized retailer or replace a system like Visa that handles thousands of transactions per second.

Bitcoin Competitors and the Future of Math-Based Currencies

There are over 700 cryptocurrencies being traded in online markets. Only ten of them have market caps above $10 million and only three have market caps above $100 million (recall that Bitcoin's was about $7 billion). The three include (**coinmarketcap.com**):

- *Ethereum* (**ethereum.org**). Valued at close to $750 million, Ethereum was crowdfunded in 2014 and developed by Ethereum Foundation, a Swiss nonprofit. While Ethereum is a decentralized blockchain technology that is traded as a virtual currency, it is actually a development platform with its own language that can be used to create other distributed applications like SmartContracts that can be run "without any downtime, fraud or third party control." In contrast to Bitcoins, it confirms blocks in seconds not minutes. Recently, Ethereum has partnered with Microsoft to offer Ethereum Blockchain as a service on Microsoft's Azure cloud.
- *Ripple* (**ripple.com**). Ripple has 35 billion shares versus Bitcoin's max of 21.5 million. Each share is valued at $.007 per share for a market cap close to $230 million. Ripple was originally targeted as a distributed, open source, consensus ledger with its own currency XRP (ripples). More recently, the system has been repurposed for banks and payment networks as a real-time cross-currency settlement system that can support applications like international money transfer.
- *Litecoin* (**litecoin.com**). Valued at $170 million, this distributed, peer-to-peer cryptocurrency is almost a clone of Bitcoin. Where it differs is its speed (about 4X faster), its proof-of-work algorithm (called "scrypt" vs. 'SHA-256'), and the maximum units of currency (84 million vs. 21.5 million).

While individual cryptocurrencies (including Bitcoin) may fade away, the underlying platforms and algorithms will likely morph to other uses similar to the types of shifts that have occurred with Etherum and Ripple. For other potential uses in banks, see Roberts (2016).

SECTION 11.7 REVIEW QUESTIONS

1. Distinguish electronic money, virtual currency, and digital currency.
2. What is the difference between convertible and nonconvertible virtual currency?
3. What are the major product categories in the virtual currency market?
4. What characteristics does Bitcoin possess that make it a currency?
5. What is a blockchain?
6. What is a bitcoin miner?
7. How are a Bitcoin private key, public key, and address interrelated?
8. What are the key advantages of Bitcoin? Key disadvantages?
9. Who are some of the main competitors of Bitcoin?

11.8 ORDER FULFILLMENT AND LOGISTICS: AN OVERVIEW

Comparatively speaking, taking orders and payments over the Internet may be the easy part of B2C. Fulfilling orders and delivering the ordered items to the customers' doors can be the tricky part. For example, consider Amazon.com that initially started out as a totally virtual company accepting orders and payments but relying on third parties to fulfill and deliver the orders. Eventually, they came to realize that they needed physical warehouses with thousands of employees in order to expedite deliveries and substantially reduce order fulfillment costs. In order to understand the importance of order fulfillment and delivery in EC, as well as the complexities and problems associated with each, you first have to have a general understanding of these concepts.

Basic Concepts of Order Fulfillment and Logistics

Regardless of the type of product and the type of commerce involved—online or off, **order fulfillment** refers to all the operations a company undertakes from the time it receives an order to the time the items are delivered to the customers, including all related customer services. For example, a customer must receive assembly and operation instructions with a new appliance. This can be done by including a paper document with the product or by providing the instructions on the Web. In addition, if the customer is dissatisfied with a product, an exchange or return must be arranged.

Order fulfillment encompasses a number of *back-office operations*, which are the activities that support the fulfillment of orders, such as packing, delivery, accounting, inventory management, and shipping. It also is strongly related to the *front-office operations*, or *customer-facing activities*, such as advertising and order taking, that are visible to customers.

Obviously, the overall objective of order fulfillment is to deliver the right product, to the right customer in a timely, cost-effective, and profitable manner. The way these objectives are achieved varies between e-tailing and off-line retailing because e-tailers are focused on delivering smaller numbers of items directly to the individual consumer, while many retailers are focused on delivering volumes of products to the store shelf. Of course, these days e-tailing and conventional retailing are intertwined because most retailers have multiple sales and services channels—Web, mobile, in store, call center, etc. This requires them to integrate the various channels, enabling customers to order anywhere and pick up or receive anywhere.

The EC Order Fulfillment Process

In order to understand why there are problems in order fulfillment, it is beneficial to look at a typical EC fulfillment process, as shown in Figure 11.7. The process starts on the left, when an order is received, and after verification that it is a real order, several activities take place, some of which can be done simultaneously; others must be done in sequence. These activities include the following steps:

1. Order and pay
2. Payment authorization
3. Check for in-stock availability. Notify if and when available
4. Determine whether inventory should be replenished (and whether additional production is required)
5. Locate warehouse where order can be handled. Transmit order to warehouse
6. Pick and pack order for shipment
7. Dispatch order
8. Receipt of goods
9. Manage returns

Order fulfillment processes may vary, depending on the types product (e.g., by size, perishability), whether third parties are involved in warehousing and shipping, whether the business is primarily B2C or B2B, and on the company's

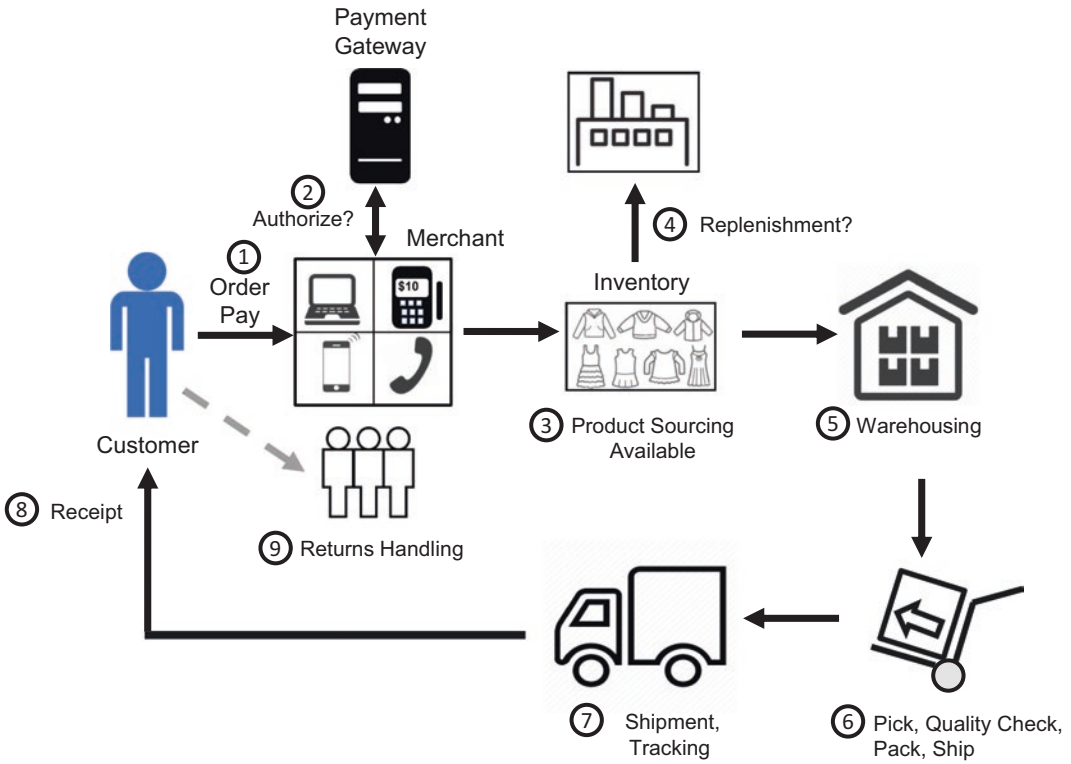

Figure 11.7 Order fulfillment (Drawn by D. King)

strategies and operations models. Often retailers and the manufacturing partners are differentiated by these strategies and models. The basic operations models, which predate EC by 20 years, are well known to supply chain experts and practitioners and include:

- **Engineer-to-Order (ETO).** Here, the product is designed and built to customer specifications; this approach is most common with one-off products (e.g., customized jewelry).
- **Make-to-Order (MTO)**. Aka *Build-to-Order* (BTO) is used with low demand products that are manufactured to customer specifications. They are only built after the order is actually in hand.
- **Assemble-to-Order (ATO).** Aka *Assemble-to-request*, these are products built to customer specifications from a stock of existing components. This requires a modular product architecture for the finished products. The best known example of this approach is the way in which Dell manufactures their computers.
- **Make-to-Stock (MTS).** For standardized products that sell in high volumes. The product is built against a sales forecast and sold to the customer from finished goods. This means that demand can be quickly met. For example, many of the CPG in the goods in grocery stores are of this sort.
- **Digital Copy (DC)**. Where products are digital assets and inventory is created from a digital master. Copies are created on-demand, downloaded to a customer's storage device.

Because clothing and apparel, (packaged) food, and electronics equipment are the largest selling B2C categories, the most frequently used models are MTS and ATO. While managing and fulfilling orders for these types of products would seem straightforward, they too can suffer from the vagaries of the supply chain because of spikes in demand (e.g., Black Friday), or disruptions caused by a shortage of source component parts or materials, or the sudden comings and goings of popular styles.

Order Fulfillment and the Supply Chain

The nine-activity order fulfillment process is an integral part of the *supply chain*. The flows of orders, payments, information, materials, and parts need to be coordinated among all the company's relevant department participants, as well as with and among all relevant external partners. The procedures of supply chain management (SCM) must be considered when planning and managing the order fulfillment process, which due to its complexity may have problems. Many of these factors are covered in Case 11.2 which describes how Amazon.com fulfills its orders. It provides a brief look at their underlying strategies, the processes

involved and some of the issues that are encountered. These issues are discussed in detail in Section 11.9 and the solutions to many of these issues are found in Section 11.10.

CASE 11.2: EC APPLICATION AMAZON THE "KING OF SUPPLY CHAINS"

The Problem

With traditional retailing, customers go to a physical store and purchase items that they then take home. Large quantities are delivered to each store or supermarket; there are not too many delivery destinations. With e-tailing, customers want the goods quickly and to have them shipped to their homes. Deliveries of small quantities need to go to a large number of destinations. Also, items must be available for immediate delivery. Therefore, maintaining an inventory of items becomes critical. Maintaining inventory and shipping products costs money and takes time, which may negate some of the advantages of e-tailing. Let us see how Amazon.com, the "king" of e-tailing, handles the situation.

In 1994, Amazon started with "virtual retailing" as a business model—no warehouses, no inventory, and no shipments. The idea was to take orders and receive payments electronically and then let others fill the orders. It soon became clear that this model, although appropriate for a small company, would not work for the world's largest e-tailer.

The Solution

In 1997, Amazon.com decided to change its business model and handle its own inventory and logistics. Furthermore, for a fee the company provides logistics services to any seller even its competitors. The company spent billions of dollars to construct their own distribution network around the USA and the world and in the process became a world-class leader in warehouse management, warehouse automation, packaging, and inventory management.

In 1994, they began by opening their own fulfillment centers (warehouses) in Seattle and Delaware, both occupying a few 100 thousand square feet. This rapidly expanded to eight more in 1999 including three centers in Europe. Because of economic issues, they slowed their growth until 2005 when they began a period of incredible facility expansion.

The expansion started with a series of larger distribution centers that were located in states with favorable tax breaks and incentives, especially states where they did not have to pay sales tax because technically they were not a retail store. This provided them with a substantial economic advantage over the "brick and mortar" retailers until the states started reinterpreting their laws and treated Amazon like any other retailer. In 2013, Amazon shifted their supply chain strategy to optimize their delivery speed so they could support new programs aimed at 1 day delivery and home delivery of food items.

Picking and Packing

How is Amazon.com able to efficiently fulfill many millions of orders every month? Part of the answer lies in the way they operate their centers. For the larger facilities, fulfillment of an order goes sort of like this:

- **Step 1.** When you place an order at Amazon.com and designate a destination, the computer program knows from where it is going to be shipped. It is usually shipped from Amazon's fulfillment center, or from the sellers' locations. Sellers have an option to ship their merchandise to Amazon.com for storage and processing. Amazon lists the products in its online catalog and may advertise the product(s). When an order arrives, a computer program will route the order to where it will be fulfilled. Amazon.com has dozens of distribution centers. In general, a typical Amazon.com distribution center operates in the follow way:
- **Step 2.** All orders received are routed electronically by the dispatcher to specific parts pickers for fulfillment.
- **Step 3.** The items (such as books, games, and CDs) are stocked in the warehouse in bins. Each bin is equipped with a red light. When an item in the bin needs to be picked up, the red light turns on. Pickers then pick up the items from the bins with red lights and then turn off the lights.
- **Step 4.** Each picked item is placed in a basket with a barcode designating the order number. The baskets are placed on a 10-mile long winding conveyor belt in the warehouse. Each basket is directed automatically to a specific destination point guided by barcode readers.
- **Step 5.** Each full basket is checked to assure that the barcodes are matched with a specific order. Then the items are moved to appropriate chutes, where they slide into delivery boxes. The system arranges for multiple items to reach this same box if there are several items in one order.
- **Step 6.** The boxes are then sealed for delivery. If gift wrapping was selected, this is done by hand.
- **Step 7.** The full boxes are then taped, weighed, labeled, and routed to one of the truck bays in the warehouse for shipment; some are owned by UPS, the U.S. Postal Service (USPS), and other shippers.

Del Rey (2013) provides a photo slideshow of the operation of one of Amazon.com's largest centers located in Phoenix, AZ.

Specialization of Distribution Centers

Yet, that's only part of the story. The real optimization comes from the division of labor and specialization of the various centers, especially their new "sortation" centers. For a detailed discussion of the changes, see Wulfraat (2014, 2016).

Today, the facilities include:

- *Fulfillment Centers* differentiated by the size of the products being packaged
- *Replenishment Centers* for receiving incoming goods from vendors
- *Customer Return Centers* obviously dedicated to returns
- *Sortation Centers* receiving pallets of packages from Fulfillment Centers, then aggregating and sorting the pallets by zip code so they can be distributed to the USPS facility handling the associated zip codes. The USPS is the one who delivers the packages the "last mile"
- *Delivery Stations*, which are mid-sized centers, networked together with smaller *Amazon Fresh and Pantry* sites to handle same-day home delivery in urban areas of groceries and general merchandise
- *Speciality Sites* for dealing with smaller packages of textbooks, clothing, jewelry, and shoes
- *Prime Now* and *Flex Hubs* that are smaller facilities for handling a limited number of high demand items (especially for *Prime* customers) to be delivered in 1–2 h in urban areas

The Results

Table 11.2 provides some sense of the distribution of the centers across the various types, as well as the size of the various facilities. Overall, there are around 290 facilities occupying over 110 million square feet. The majority of these (160) are *Fulfillment Centers* taking up the majority of the square footage (around 100 million).

Table 11.2. Amazon distribution center network

	Type	Active	SqFt (M)	Future	FSqFt (M)
US	Fulfillment	76	59.9	17	12.7
	Sortation	26	7.1	3	0.8
	Prime Now	43	0.7	0	0
	Delivery/sort	16	1.3	0	0
	Subtotal	161	69.0	20	13.5
RoW	Fulfillment	83	41.4	6	5
	Prime Now	23	0.1	1	0.1
	Delivery/sort	24	1.6	0	0
	Subtotal	131	43.1	7	5.1
Global	Total	292	112.1	27	18.6

Source: Based on data from Wuulfraat (2016)

While all of these serve key roles, the ones with probably the greatest impact have been the (26) *Sortation Centers*. These have not only helped Amazon to accomplish their goal of same-day delivery, but, more importantly, they have also enabled Amazon to substantially reduced their reliance on UPS and FedEx transportation and gain control over their shipping and delivery. Unlike off-line retailers who have their own carriers and fleets, Amazon has had to utilize UPS, FedEx, and other third-party carriers. During peak selling seasons (e.g., the winter holidays) this means that they have to vie with other retailers for UPS and FedEx services. The *Sortation Centers* have cut much of that reliance by substituting USPS delivery. The cost reductions have been massive and there is no competition with other retailers. There is little doubt that they are laying the ground work for their own fleet—not only on the ground but also in the air.

The success of Amazon's supply chain has been amazing. They have been a first mover on a number of supply chain fronts, especially in the EC world, and continue to do so (see Section 11.10). This past year, not only did they become the fastest company to reach $100 billion in annual sales, but they were recognized (by their peers) as #1 on the Gartner (2015) rankings of the Top 25 supply chain companies. They are also packaging this success in a program called *Fulfillment by Amazon*. In their words, "You sell it, we ship it." Amazon has created one of the most advanced fulfillment networks in the world, and your business can benefit from our expertise. With Fulfillment by Amazon (FBA), you store your products in Amazon's fulfillment centers, and we pick, pack, ship, and provide customer service for these products. Best of all, FBA can help you scale your business and reach more customers." Toward this end they have recently taken a large minority stake in Atlas Air who has the largest fleet of 747 freighter aircraft.

Sources: Del Rey (2013), Wulfraat (2014 and 2016, and the Amazon *Annual Report* 2015 at **services.amazon.com/fulfillment-by-amazon/how-it-works.htm** (accessed May 2016).

Questions

1. What were the drivers of the centralized warehousing?
2. Amazon.com is using third-party companies for delivery. Can you guess why?
3. Can Amazon.com use RFID in its warehouses? If yes, where and when? If no, why not?
4. Find how Amazon.com handles returned merchandise.
5. Draw Amazon.com's supply chain for books.
6. Where do you think there are intelligent (software) agents in Amazon.com's order fulfillment/logistics?

SECTION 11.8 REVIEW QUESTIONS

1. Define order fulfillment and logistics.
2. Compare traditional logistics with e-logistics.
3. List the nine activities of the order fulfillment process.

11.9 PROBLEMS IN ORDER FULFILLMENT ALONG SUPPLY CHAINS

Order fulfillment is considered a critical success factor for e-commerce. A relatively recent study of close to 600 top supply chain executives conducted by Peerless Research Group (2013) revealed the order fulfillment was much more intricate and that management and delivery performance is slipping. As a consequence, customer satisfaction has suffered. The main challenges that these executives and their companies are facing include (VanLandingham 2014):

- **Order Expectations**. EC orders require higher levels of service and attention. The delivery times are much shorter, and the order changes and cancellations are usually last minute.
- **Order Accuracy**. If the deliveries to a store are off by a couple of units either way, it is no big deal. If the same thing happens to an EC customer, a merchant might lose the customer's business.
- **Multi-Channel Order Management**. Because most companies have separate systems for the various channels, it is very difficult to present one view of the company to consumers.
- **Complex Distribution**. In contrast to off-line orders and deliveries, each EC order is usually small with a few units, and there are many more of them. Packing and shipping is harder. Because consumers cannot "touch, see, and feel" the products before they buy, there are numerous returns.

As a consequence, surveys (e.g., Kinnison 2015) frequently show that customer satisfaction suffers because of the fulfillment process. Dissatisfaction is usually the result of: (1) inaccurate orders; (2) the lengthy time of the order process; (3) missed delivery schedules; and (4) the lack of visibility as the order moves as it move across the process.

These issues and problems are typical of the types of challenges that continue to confront both off-line and online businesses. The problems are exacerbated in EC, especially omni-channel EC, because of the mismatch between standard supply chain structures and processes and the special nature and requirements of EC. For example, most manufacturers' and distributors' warehouses are designed to ship large quantities to a set number of stores; they are not designed to optimally pack and ship small orders to a large number of customers' doors. Improper inventory levels are typical in EC, as are poor delivery scheduling and mixed-up shipments.

At the root of many of the problems and challenges are deficient planning and execution practices. These are some of the key causes:

- **Uncertainties in Demand.** Many problems along the EC supply chain stem from demand uncertainties and the difficulties that ensue across the supply chain in trying to meet this uncertain demand. This is where demand forecasting comes into play. Here the major goal is to forecast at a very detailed level the number of products (at the SKU level) of a certain type that will be needed to meet the demand at specific locations at particular points or time intervals in the future. These forecasts rest on statistical (time series) estimates from historical patterns, trends in sales or order data, and causal factors like the weather or promotions. These factors can all change quickly, which is why demand forecasting is as much an art as it is a science. The basic issue is that if the demand plan is wrong it will ripple across the chain impacting that planned needs for inventory, raw materials, works in progress, factory capacity, etc. Companies try to address these problems by making adjustments to the forecasts and by sharing the forecasts with the major players in the chain.
- **Lack of Information Sharing.** In today's world the flow of information across the supply chain is almost as critical as the flow of goods and services. Information systems support this flow, enabling communication and coordination of the various players and systems in the chain. A good example of the types of issues that arise with poor information flow is the *bullwhip effect* which is a mismatch between the actual demand for goods and the inventory supplied upstream in the supply chain to meet the assumed demand. The mismatch results in excess inventory and safety stock that is used as a buffer against underestimated demand. In practice the mismatch grows as you move up the chain from the retailer to the distributor to the supplier to the manufacturer so that variability in inventory and safety stock increases along the way. One way to reduce the mismatch is to ensure that information and, thus visibility, about demand flows to all the parties involved, so that there is only "one version of the truth." The bullwhip effect is described in Online File W11.1.
- **Inadequate Logistical Infrastructure.** Pure play EC companies are likely to have more problems because they do not have a logistics infrastructure already in place and are forced to use external logistics services rather than in-house departments for these functions—much like Amazon has done with UPS and FedEx. These external

logistics services are often called **third-party logistics suppliers (3PL)**, or *logistics service providers*. Outsourcing logistics services can be expensive, and it requires more coordination and dependence on outsiders who may not be reliable. For this reason, large virtual retailers usually have their own physical warehouses, shipping and distribution systems.

- **Inefficient Financial Flows.** Note that supply chain problems and improvements refer not only to the flow of goods but also to the flow of information and money. Money flow includes invoicing, payment, collection, and so forth. In spite of the availability of computer-based systems, many suppliers, manufacturers, distributors, and retailers rely on manual and paper-based systems to conduct financial transactions. These inefficient financial processes not only slow the flow of cash across the supply chain but halt the flow of goods and services and put the various partners at a competitive disadvantage.

SECTION 11.9 REVIEW QUESTIONS

1. What are some of the challenges facing order fulfillment?
2. What are the results of these challenges?
3. What are some of the root causes of poor order fulfillment?
4. Describe the bullwhip effect.
5. Describe the role of 3PLs.

11.10 SOLUTIONS TO ORDER FULFILLMENT PROBLEMS ALONG THE SUPPLY CHAIN

Many EC logistics problems are generic; they can be found in the non-Internet world as well. Therefore, many of the solutions that have been developed for these problems in brick-and-mortar companies also work for e-tailers. IT and EC technologies facilitate most of these solutions. They also provide for automation of various operations along the supply chain that usually improve its operation. In this section, we will discuss some of the specific solutions to EC order fulfillment problems along the supply chain.

Improvements in the Order-Taking Activity

One way to excel in order fulfillment is to improve the order-taking activity and its links to fulfillment and logistics. Order taking can be done via e-mail or on a webstore and it may be automated. For example, in B2B, orders can be generated and transmitted automatically to suppliers when inventory levels fall below a certain threshold. It is a part of the *vendor-managed inventory* (VMI) strategy described in Chapter 4. The result is a fast, inexpensive, and more accurate (no need to rekey data) order-taking process. In B2C, Web-based ordering using electronic forms expedites the process, making it more accurate (e.g., automated processes can check the input data and provide instant feedback), and reduces processing costs for sellers. When EC order taking can interface or integrate with a company's back-office system, it shortens cycle times and eliminates errors.

Order-taking improvements also can take place within an organization, for example, when a manufacturer orders parts from its own warehouse. When delivery of such parts runs smoothly, it minimizes disruptions to the manufacturing process, reducing losses from downtime.

Warehousing and Inventory Management Improvements

Although it seems like a misnomer, one way to manage inventory is with a **warehouse management system (WMS)**. On the surface, WMS refers to a software system that helps manage warehouses, which it does. However, any market-leading WMS also provides:

- **Inbound functions** such as yard management, appointment scheduling, multi-method receiving, cross-docking, put-to-store, quality assurance, staging, and put-away.
- **Inventory functions** such as inventory visibility, lot-serial control, multi-level holds, counts, replenishments, value-added services (VAS) processing, work order processing, internationalization, and slotting.
- **Resource management** such as dynamic pick location assignment, equipment utilization, facility utilization, task management, automation interfaces, and workforce management.
- **Outbound functions** such as shipment order management, multi-method order picking, retail in-store and dark-store picking and processing of e-commerce orders, cartonization, shipping and parcel manifesting, sequenced staging and loading, and compliance of shipping documents.
- **3PL/divisional support** such as multi-client architecture, client billing, client-based process modeling, cross-client optimization, client visibility and reporting.

See, for example, **jda.com** for a description of the detailed capabilities of a WMS.

A WMS is useful in reducing inventories and decreasing the number of out-of-stock incidents. Such systems also are useful in maintaining an inventory of repair items so repairs can be expedited; picking items out of storage bins in the

warehouse; receiving items at the receiving docks; and automating the warehouse operations. For example, introducing a make-to-order production process and providing timely and accurate demand information to suppliers can minimize inventories and out-of-stock incidents. In some instances, the ultimate inventory improvement is to have no inventory at all; for products that can be digitized (e.g., software), order fulfillment can be instantaneous and can eliminate the need for inventory.

Changing the Structure and Process of the Supply Chain

An efficient solution to many supply chain problems is to change the supply chain structure from a linear to a hub structure as illustrated in Figure 11.8. Notice that in a hub structure connection between supply chain partners and elements is much shorter. Also, coordination and control is done at the center of the hub, making the management more efficient, and the structure increases visibility. Long supply chains are usually more susceptible to problems. Also, the hub structure management is usually fully digital, making order fulfillment faster, less expensive, and less problematic.

Speeding Up Deliveries: From Same Day to a Few Minutes

As discussed earlier, a major success factor in EC is the speed within which shoppers receive their orders. And indeed, the competition for fast delivery is intensifying.

FedEx initiated the concept of "next day" delivery in 1973. It was a revolution in door-to-door logistics. A few

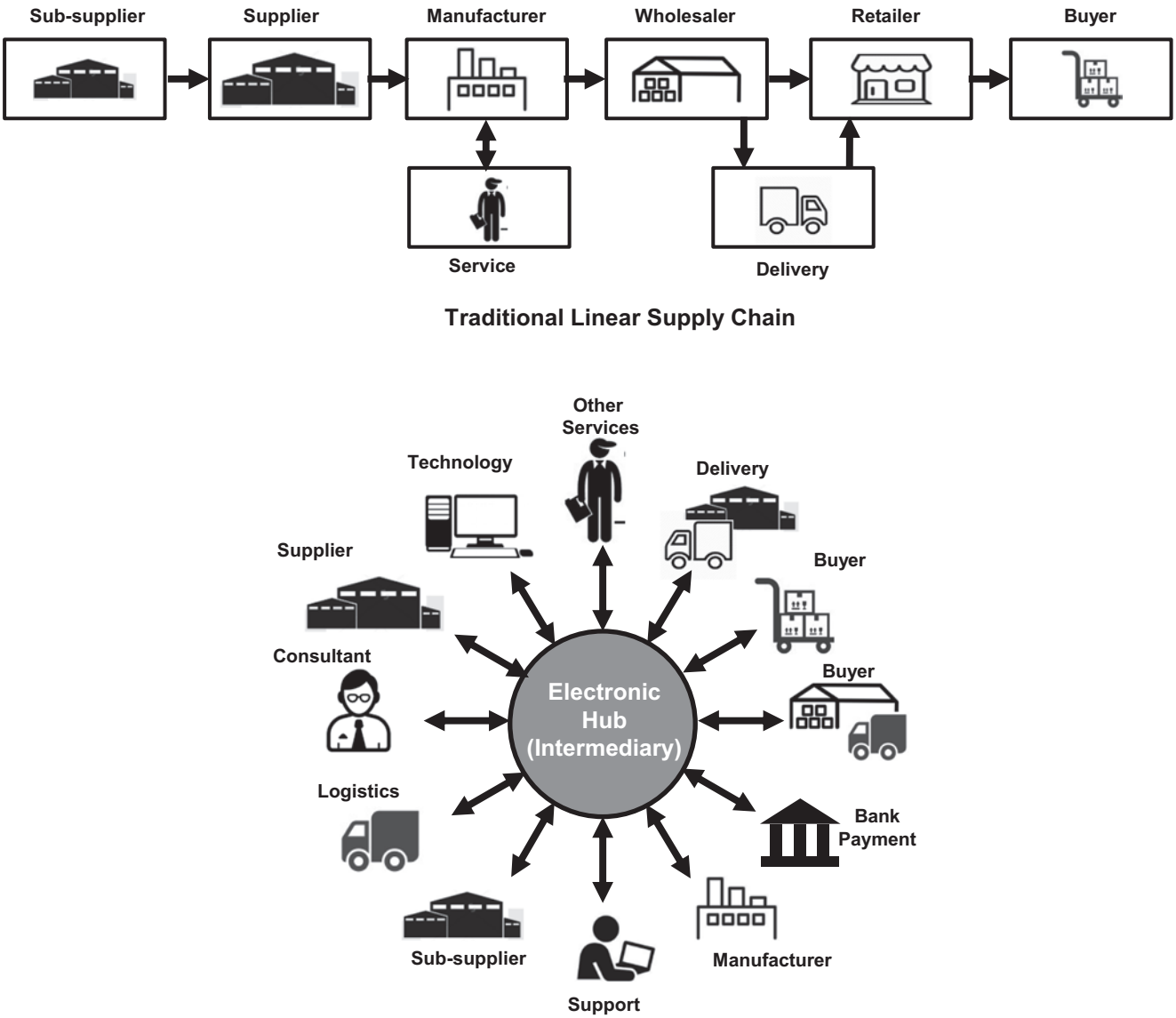

Figure 11.8 Changes in the supply chain (Drawn by D. King)

years later, FedEx, introduced its "next-morning delivery" service. In the digital age, however, even the next morning may not be fast enough. Today, we talk about same-day delivery and even delivery within an hour. Deliveries of urgent materials to and from hospitals, shipping auto parts to car service shops, and delivering medicine to patients are additional examples of such a service. Case 11.2 described the restructuring of Amazon.com's distribution centers for the expressed purpose of achieving same-day and even hourly delivery service for most U.S. households. Two other newcomers to this area are eFulfillment Service (**efulfillmentservice.com**) and OneWorld Direct (**owd.com**). These companies have created networks for the rapid distribution of products, mostly EC-related ones. They offer national distribution systems across the United States in collaboration with shipping companies, such as FedEx and UPS.

Delivering groceries is another area where speed is important, as discussed in Chapter 3. Quick pizza deliveries have been available for a long time (e.g., Domino's Pizza). Today, many pizza orders can be placed online. Also, many restaurants deliver food to customers who order online. Examples of this service can be found at **gourmetdinnerservice.com.au** and **grubhub.com** company. Some companies even offer aggregating supply services, processing orders from several restaurants and then making deliveries (e.g., **dialadinner.com.hk** in Hong Kong).

Supermarket deliveries are often done same day. Arranging and coordinating such deliveries may be difficult, especially when fresh or perishable food is to be transported. Buyers may need to be home at certain times to accept the deliveries.

Delivery by Drones

Ideally, e-tailers want to deliver faster than you can get products by going to a store and buying them. The futuristic solution is delivery of packages by drones in minutes. A dream? Amazon originally touted that it would come true in 2015. However, 2015 has come and gone and still no drone delivery. Obviously, this is going to take longer because of legal, technological (sensors' capabilities), and other constraints.

Example: Amazon Prime Air

One day we may see a fleet of Prime Air vehicles in the sky, delivering packages to customers' doors. For how the delivery is envisioned, see the video and text at **amazon.com/b?node=8037720011**. With Amazon Prime Air, drone delivery is currently being designed and test for commercial outdoor use under an exemption from FAA regulations. Amazon's current models are designed to deliver packages under 5 lbs. within a 15–20 mile radius. The weight limit covers about 85% of the products they deliver and the 20 miles covers about 50–65% of the "retailer's core" "same-day addressable market" (French 2015a).

At the present time, commercial use is banned under FAA regulations unless they have given a company an exception. A few years back, Congress asked the FAA to come up with a new set of rules for commercial use. They are expected to issue the rules by mid-year 2016.

Amazon is not alone in their quest. Other companies are working on their own tests for small parcel delivery. Some of the more notable efforts include:

- Matternet (**mttr.net**). Working with groups like Unicef and Doctors Without Borders, a Bay area start-up called Matternet, has been using drones to deliver medical supplies and specimens in Switzerland, Haiti, and the Dominican Republic since 2011. Drones provide autonomous transportation. They don't need drivers, aren't impeded by traffic congestion, and are low cost and efficient. Currently, their drones can handle loads up to 2 lbs., transport items about 10 miles at 40 mph so that the journey takes just under 20 min. Matternet thinks that the medical uses my sway regulators to approve the technology for commercial uses. For a step-by-step description of how the Matternet drones are used, see (French 2015b).
- Walmart (**walmart.com**) has some of the same interests in drones as Amazon. They have already tested their use inside their warehouses, and now they have applied for a permit to test them for outdoor package delivery. Initial tests will be focused on deliveries from their retail distribution centers to their own store parking lots within the same locale. From there the tests will grow to include delivery in small residential neighborhoods. These latter deliveries are of interest because there is a Walmart within 5 miles of 70% of the U.S. population. Walmart is using Chinese-made DJI (**dji.com**) drones in their tests.
- Flirtey (**flirtey.com**). An Australian start-up recently conducted the first FAA-approved drone delivery in the USA. Using GPS guidance, the drone delivered bottled water, emergency food supplies, and a first aid kit to an unoccupied house in Hawthorne, NV. The delivery tested the drone's ability to navigate around buildings, power lines, and streetlights to make the drop in a populated area. Flirtey drones have previously been used to deliver textbooks in Australia and auto parts in New Zealand (Boyle 2016).
- Google Project Wing. Google X has been working on drone delivery since 2014 under the umbrella of a project called Project Wing (Grothas 2016). Recently, they were awarded a patent for a "mobile receptacle on wheels." The basic idea is to have the drones deliver packages to the receptacles which will in turn deliver them to the recipient.

Same-Day Delivery

We covered this topic in Chapter 3 as it related to groceries. Also cited there is the increased competition. In addition to Amazon Fresh many other companies are active in the market. Notable are Instacart, Postmates, and Google Express. But, same-day delivery does not only apply to groceries. Amazon is starting same-day delivery of everything in several large cities. Google Shopping Express is active too, and so are eBay, Uber Rush, and others (Bowman 2014). For a discussion of one hour delivery, see Halkias (2015).

Partnering Efforts and Outsourcing Logistics

An effective way to solve order fulfillment problems is for an organization to partner with other companies. For example, several EC companies have partnered with UPS or FedEx; others with Fulfillment by Amazon and Alibaba's Tmall (as discussed in the Opening Case of this chapter).

Logistics-related partnerships can take many forms. For example, marketplaces may be managed by one of many freight forwarders such as A & A Contract Customs Brokers, a company that helps other companies find "forwarders." Forwarders help prepare goods for shipping and work with carriers to determine the optimal way to ship. Forwarders can also find the least expensive prices on air carriers, and the carriers bid to fill the space with forwarders' goods that need to be shipped.

Using Robots for Order Fulfillment

In 2012, Amazon bought a robot company called Kiva Systems for $775 million. Today, 30,000 Kiva robots have been deployed to about 15 of Amazon's larger fulfillment centers. The robots are used to assist workers with picking and packing activities. There are several videos on the Web that illustrate how they go about their work (e.g., **vimeo.com/113374910**).

They operate a bit differently than one might think (Valerio 2015). The items to be picked and packed reside in bins on moveable pallets called pods. A single pod can hold hundreds of items. Fully loaded the pods can weigh up to 3000 lbs. At first blush, the logical thing to do would be to use the *man-to-goods* method. In other words, if you need an item, simply send a bot to retrieve it. In reality, Kiva works the other way around—the *goods-to-man* method.

There are two types of bots both of which look sort of like big Roombas, the robot vacuum cleaners, except they are square not round. One type, the S model, is 2 × 2.5 × 1 foot and can lift close to 1000 lbs. The other type, a G model, is a bigger version and can lift up to 3000 lbs. Both of them can fit under the bottom section of the pods. When an item order is received, it is entered into a database on the computer that controls the robots. Software on the same computer searches for the bot that is closest to the pod, and directs the bot via wifi to retrieve the pod holding the item. At this point, the bot follows a series of QR code reflectors placed on the floor (like lane markers on a road) to find the correct pod, the bot slides under the pod, lifts it, and carries it back to a specified human operator. The operator picks out the correct item and puts it in a shipment package. Hence, the moniker *goods-to-man*. At this point the bot is ready to go again. Bots travel about 1.3 m a second and require recharging about every hour for 5 min.

Kiva's approach to automated handling systems for e-fulfillment also works well with in-store re-stocking, parts distribution, and medical device distribution operations. Thus far, the system has proven to be more accurate and efficient than humans.

At the time Kiva was originally purchased, it was also being used by other retailers like Walgreens, Staples, Crate & Barrel, and The Gap. Almost immediately, Amazon ended Kiva support for these outside companies. In the interim a series of new robot competitors moved to fill the void. Some examples are Swisslog's CarryPick (**swisslog.com/carrypick**), GrayOrange's Butler (**greyorange.com/products/butler**), and Grenzeback's Carry AGV (**grenzebach.com**). While there are some differences in terms of speed, strength, and delivery targets (e.g., conveyors), almost all operate on the same goods-to-man principle. See Tobe (2015) for details about these and other systems.

Another area where these seems to be interest in using robots is with make-to-order fulfillment. Robots have long been involved in manufacturing, especially in the auto industry. Most of the older versions deployed in auto factors were large, cumbersome, and dedicated to a single task like welding or painting. More recently, smaller bots are being produced that are "smarter, more mobile, more collaborative, and more adaptable" (Hagerty 2015). Some of these have been designed to handle the tricky job of assembling consumer-electronic items from standard parts (MTO) which is now mostly done by hand in Asia. They are also designed to assist humans rather than replace them. A case in point is a bot product from the partnership of ABB Ltd. and Rethink Robots, Inc. They are designed to handle small parts and to sense when parts are being assembled incorrectly. They are also more programmable so they can adapt very quickly to new requirements and uses. To see the bot in action, go to **rethinkrobotics.com**.

There is a strong belief among the proponents of these sorts of robotic applications that they enable small companies to better compete against larger companies, and for companies in higher wage countries to better compete against the likes of China and other lower wage countries.

Integrated Global Logistics Program

An increase in global trading created a need for an effective global logistics system. Order fulfillment problems described earlier tend to be even larger in longer supply chains that cross country borders. The number of partners in such situations is usually larger than in domestic logistics (e.g., customs brokers, global carriers), and so is the need for coordination, communication, and collaboration. Furthermore, such systems require a high level of security, especially when the Internet is the centric technology platform. Integrating separate segments of the supply chain can be very beneficial for minimizing problems in long global chains.

Order Fulfillment in Make-to-Order (MTO) and Mass Customization

As you may recall from Chapter 1, one of the advantages of EC is the ability to easily customize products and personalize services. Although taking customized orders is easily done online, the fulfillment of such orders may not be simple. Mass production enabled companies to reduce the price per unit. Customization is usually expensive, since each item must be handled separately. Customization also requires time, especially for large products like cars. However, consumers usually want customized products to be delivered in a timely fashion at price points that are not much higher than those of a similar product that is mass produced. So, the question is: how does a supplier, manufacturer or retailer do this at a reasonable cost to themselves and in a reasonable time for their customers?

Dell was a pioneer in providing customized products to end consumers in a timely and cost-effective fashion. They were able to do this using mass produced components that were assembled to meet the customized orders of their customers. This approach has been adopted by many other manufacturers. Most customized cars, shoes, toys, textbooks, and wedding rings are made this way. Of course, when you talk about millions of computers at Dell, the supply chain, the logistics, and the delivery of components were critical to its success and survival. For a detailed description of Dell's MTO system, see Online File W11.2.

With MTO you also need to closely collaborate with your suppliers. In addition, you need to have flexible production lines where changes are made quickly and inexpensively (e.g., painting cars at Toyota), and you need tools that enable quick and not-so-expensive changes (usually driven by computerized systems). This is usually a part of an *intelligent factory* or production line like those at Siemans AG, IBM, and General Electric. It's also like the distributed mass customization approach used at Etsy (**etsy.com**). Etsy is an online market for goods that are custom made by small producers and sold online in one electronic marketplace. For sources on intelligent factories and mass customization, see the *International Journal of Mass Customization* and Smart Factory KL (**smartfactory.eu**).

Handling Returns (Reverse Logistics)

Allowing for the return of defective or unsatisfactory merchandise and providing for product exchanges or refunds are necessary to maintaining customers' trust and loyalty. Some time ago, it was found that the absence of a good return mechanism was the number two reason for shopper reluctance to buy online. A good return policy is a must in EC.

Dealing with returns is a major logistics problem for EC merchants. Several options for handling returns are:

- **Return the item to the place of purchase.** This is easy to do with a purchase from a brick-and-mortar store, but not a virtual one. To return a product to a virtual store, a customer needs to get authorization, pack everything up, pay to ship it back, insure it, and wait up to two billing cycles for a credit to show up on his or her credit card statement. The buyer is not happy and neither is the seller, who must unpack, check the paperwork, and resell the item, usually at a loss. This solution is workable only if the number of returns is small or the merchandise is expensive (e.g., Blue Nile). Some vendors (e.g., Amazon.com) enable customers to print prepaid UPS or USPS shipping labels that make returns easier for the customers.
- **Separate the logistics of returns from the logistics of delivery.** With this option, returns are shipped to an independent returns unit and are handled separately. This solution may be more efficient from the seller's point of view, but it does not ease the return process for the buyer.
- **Completely outsource returns.** Several outsourcers, including UPS and FedEx, provide logistics services for returns. The services deal not only with delivery and returns but also with the entire logistics process. FedEx, for example, offers several options for returning goods.
- **Allow the customer to physically drop the returned item at a collection station or at a physical store of the same vendor.** Offer customers locations (such as a convenience store or the UPS Store) where they can drop off returns. In Asia and Australia,

returns are accepted in convenience stores and at gas stations. For example, BP Australia Ltd. (gasoline service stations) teamed up with **wishlist.com.au** (now closed), and Caltex Australia to accept returns at the convenience stores connected to its gasoline stations. The accepting stores may offer in-store computers for ordering and may also offer payment options, as at Japanese 7-Elevens (**7dream.com**). In Taiwan and some other countries, you can order merchandise (e.g., books), pay, pick up the item ordered, and return unwanted items, at a 7-Eleven store. Brick-and-mortar stores usually allow customers to return merchandise that was ordered online to their physical stores (e.g., **walmart.com** and **eddiebauer.com**).

- **Auction the returned items.** This option can go hand-in-hand with any of the previous solutions.

For strategy, guidelines, and other information on returns, see The Reverse Logistics Executive Council (**cscmp.org/product-type/reverse-logistics**).

Order Fulfillment in B2B

According to recent forecasts by Forrester Research (reported by Demery 2015), online revenues for B2B EC in 2015 were substantially higher than online revenues for B2C EC. The figures in the USA were close to $780 billion and $304 billion, respectively. The estimate is that B2B will climb to $1.1 trillion in 2020, while B2C will move to $500 billion. In spite of the sizeable difference, B2B EC is far less developed than B2C EC. The differences are found not only in the front-end experience but also in the back-office functionality including information management, Web content management, and order management.

Some of the major differences in order management capabilities were pinpointed in an earlier survey sponsored by Honeywell and conducted by Peerless Research Group (2013) for *Logistics Management* and *Supply Chain Management Review*. Based on responses from 469 supply chain managers, most of whom were responsible for either B2B or a combination of B2B and B2C EC systems across a range of industries, the survey revealed that:

- The most important missions for their systems were increasing the volume and speed of fulfillment while reducing costs per order, increasing profitability, and improving customer service.
- Many of the inefficiencies and increased costs in order fulfillment were due to increased transportation, packaging, and materials costs.
- The keys to addressing the inefficiencies and costs rest with improved supply chain software applications, re-engineered (fulfillment) operations, and adoption of supply chain analytics.

B2B fulfillment tends to be more inefficient than B2C because it is usually more complex. Typically, the shipments are larger, there are multiple distribution channels, the shipment frequency is more varied, the breadth of the carrier services is more uneven, there are fewer EC carrier offerings, and the EC transaction paths are much more complicated. The types of improvements in applications and re-engineering of processes needed to resolve these sorts of complications revolve around the automation of physical systems, as well as the use of business process management (BPM) software to automate processes.

Using E-Marketplaces and Exchanges to Ease Order Fulfillment Problems in B2B

In Chapter 4, we introduced a variety of e-marketplaces and exchanges. One of the major objectives of these entities is to improve the operation of the B2B supply chain. Let us see how this works with different business models.

- A company-centric marketplace can solve several supply chain problems. For example, CSX Technology developed an extranet-based EC system for tracking cross-country train shipments as part of its supply chain initiative, and was able to effectively identify bottlenecks and more accurately forecast demand.
- Using an extranet, Toshiba America provides an ordering system for its dealers to buy replacement parts for Toshiba's products. The system smooths the supply chain and delivers better customer service.
- HighJump Software suggested taking into account a number of key elements for optimal order fulfillment including the automation of picking, packing and shipping, the transformation of paper-based processes, and the inclusion of sales and marketing input into various supply chain processes.

For additional discussion on how fulfillment is done in B2B, see **fedex.com/us/supply-chain/services/fulfillment-services** and Demery (2012).

Order Fulfillment in Services

Thus far, we have concentrated on order fulfillment with physical products. Fulfilling service orders (e.g., buy or sell stocks, process insurance claims) may involve additional information processing, which requires more sophisticated EC systems.

Innovative E-Fulfillment Strategies

Several innovative e-fulfillment strategies exist. For example, supply chain partners can transmit information flows and hold off shipping physical goods until a point in time when they can make more direct shipments. An example of logistics postponement is merge-in-transit.

Merge-in-transit is a model in which components for a product need to arrive from two or more physical locations. For example, in shipping a desktop PC, the monitor may come from the East Coast of the United States and the CPU from the West Coast. Instead of shipping the components to a central location and then shipping both together to the customer, the components are shipped directly to the customer and merged into one shipment by the local deliverer (so the customer gets all the parts in one delivery), reducing unnecessary transportation.

Supply Chain Planning and Execution Software

Order fulfillment is only one segment of the overall supply chain planning and execution processes carried out by organizations. Many companies—off-line, online, and hybrid—rely on commercial enterprise software systems to support these processes, rather than building the capabilities in house. In this case there are usually three systems involved. First, there are systems that support the SC planning aspects—like demand planning, fulfillment, inventory optimization, etc. In the software market these are now called Supply Chain Planning Systems of Record (SCP SOR). Next, there are systems that support supply chain execution. Some of these deal with warehouse management, appropriately named Warehouse Management Systems (WMS), which we discussed earlier. Others deal with various aspects of transportation and shipping management, also appropriately named Transportation Management Systems (TMS). While there are other major aspects of supply chain planning and execution (e.g., procurement), these three systems cover much of the supply chain landscape. A detailed description of the capabilities of each of these systems, as well as the software companies selling them, can be found in the associated Gartner Magic Quadrant report including:

- **SCP SOR**—*Gartner's Magic Quadrant for Supply Chain Planning System of Record* (**gartner.com/doc/reprints?id=1-2VC3GOR&ct=160105&st=sb**)
- **WMS**—*Gartner's Magic Quadrant for Warehouse Management Systems* (**gartner.com/doc/reprints?id=1-2WV2YCO&ct=160122&st=sb**)
- **TMS**—*Gartner's Magic Quadrant for Transportation Management Systems* (**gartner.com/doc/reprints?id=1-2WTC5VO&ct=160121&st=sb**)

Some software vendors have offerings in all three areas. Others provide one or two. Whether a company should buy all three from the same vendor is an open question—there are pros and cons both way.

Regardless, it is a multi-year undertaking to implement even one of these systems because they each touch so many areas of a company's operations, as well as a company's other information systems (e.g., their sales systems, customer systems, finance systems, merchandising systems, manufacturing systems). Even when many of these other systems are managed by a single enterprise resource planning system (ERP) that can be more easily integrated with a SCSOR, WMS, or TMS, it is still a long, time consuming and expensive undertaking.

SECTION 11.10 REVIEW QUESTIONS

1. What are some general ways that order fulfillment can be improved?
2. What is a warehouse management system? List some of its key functions.
3. List solutions for improved delivery.
4. What is Amazon Prime Air?
5. How are robots being used in order fulfillment?
6. How does mass customization impact order fulfillment?
7. What are some of the options for handling returns?
8. How does B2B order fulfillment differ from B2C order fulfillment?
9. Give an example of how e-marketplaces are used to alleviate problems with B2B order fulfillment.
10. What are the major enterprise software systems used to support supply chain planning and execution?

MANAGERIAL ISSUES

Some managerial issues related to this chapter are as follows:

1. **How will you address the omni-channel imperative?** Today, most "brick and mortar" retailers have multiple sales channels—stores and branches, catalogs, call centers, kiosks, vending machines, websites, and mobile apps. Historically, these channels have been managed as silos with separate personnel, practices, and information systems (both front office and back) with the lead channel getting preferential treatment. In the past this was sufficient because the customers were less demanding. This has changed. Customers expect a seamless experience across all these channels. They want to buy what they want, where they want, receive it when and where they want, and return it where they want. To meet these expectations retailers will have to accept orders and payments

from any channel, as well as fulfill orders from anywhere (e.g., distribution centers, stores and branches, manufacturers (drop-ships), 3PLs, and vending machines). For most retailers, this will obviously require substantial redesign of their payment and order fulfillment systems, as well as the redesign a number of processes and systems along their supply chains.

2. **What payment methods should you support?** Many EC merchants in the USA who are focused primarily on domestic sales can get by supporting only payments made by card or PayPal. It's the same way for many merchants in other parts of the world, although the alternative to cards is likely to be some other digital payment system besides PayPal. However, there are a number of exceptions like China where cards are rarely used and other countries where cash payments (COD or direct withdrawals) are widely used. The implication is that if you plan to expand your EC business by encouraging cross-border purchases, then at a minimum you will need to accept a variety of payment methods. The studies also point out that successful sites support multiple languages, currencies, and access devices along with pages customized for particular countries, simplified checkout processes, and free shipping to name a few.
3. **What micropayment strategy should your e-marketplace support?** If your EC site sells items priced less than $10, credit cards are not a viable solution. Many digital content products cost less than $1. For small-value products, micropayments should be supported. Fees may be taken from a prepaid account that is connected to the buyer's bank account or credit card, or the fee may be charged to the buyer's cell phone bill. The use of stored-value smart cards on the Internet has emerged, but has not widely penetrated the market because buyers need to install the card reader/writer. Companies should support multiple options so that customers can choose their preferred payment method.
4. **Which mobile systems could influence your business?** Over the next few years, the market for smartphones will continue to grow and may eventually become the primary way that people pay for digital and physical goods, both online and off. Mobile payments have the potential to replace the direct use of credit and debit cards, as well as cash. At the present time, mobile payment technologies and protocols are in a state of flux, making it difficult to decide which systems to adopt. The key is to determine which forms of mobile payment are required for a particular business—remote or proximate—and, in the short term, rely on those vendors and organizations that already have a strong presence in the online world (for instance, PayPal or the protocols and systems supported by major credit card vendors).
5. **Should we outsource our payment gateway service?** It takes time, skill, money, software, and hardware to build and maintain a comprehensive self-payment system. For this reason, even a large online business usually outsources its e-payment service. Many third-party vendors provide comprehensive payment gateways. Furthermore, if a website is hosted by a third party (e.g., Yahoo! Stores), an e-payment service will already be provided by the host.
6. **Should we accept virtual currencies as a form of payment?** Even though there a variety of virtual currencies, this question really translates into "should we accept Bitcoin?" A number of merchants have answered in the affirmative because the transaction fees are minimal and there are no charge backs. Yet, the lower cost does not eliminate the facts that bitcoins are not backed by any government agency, that there are potential issues with determining the taxes assessed to bitcoin payments, and that the exchange rates can fluctuate substantially and depend on the usage and country of payment. Bottomline, if you plan to accept bitcoins, then you need to carefully determine the associated risks.
7. **How secure are e-payments?** Security and fraud continue to be major concerns in different online e-payments. This is true with regard to the use of credit cards for online purchases, especially for cross-border purchases. B2C merchants are employing a wide variety of tools (e.g., address verification and other authentication services) to combat fraudulent orders. These cannot be used in isolation but need to be an integral part of a business security program (Chapter 10). For more on payment security, see European Banking Authority (2014).
8. **If you are an EC vendor, what are the bottlenecks in your order fulfillment process?** Order fulfillment is an important task, especially for e-tailers. Issues arise with order fulfillment along the entire supply chain, not just with the physical shipment of the order. To enhance the order fulfillment process, vendors need to identify the specific bottlenecks impeding various steps in their process. Potential issues are delayed delivery date, high return rate, high inventory cost, high shipping cost, and poor integration along the supply and demand chains.
9. **How should we manage returns?** Dealing with returns is important for CRM, yet may not be simple. Reverse logistics is very costly, and most companies will fail if the return rate is too high. Use the CRM system to identify the items with higher return rates and resolve the reason or stop the online sales of these items. A company should estimate its percentage of returns and plan a process for receiving and handling them. The logistics of returns may be executed through an external logistics service provider.

SUMMARY

In this chapter, you learned about the following EC issues as they relate to the chapter's learning objectives.

1. **Cross-Border EC.** Many B2C companies are looking to grow their businesses by increasing sales to international customers. These sales are part of what is called cross-border EC. The problem is that most B2C companies are ill-prepared to engage in cross-border commerce. As demonstrated by B2C companies that already have strong international sales, those companies that want to successfully engage in cross-border EC will have to "think local," meaning that they need to treat international customers as if they were domestic. More specifically, their online sites will need to: (1) provide support for multiple languages, currencies, payment systems, and input devices (especially mobile); (2) customize Web pages based on country (e.g., handle international addresses and phone numbers); (3) simplify checkouts by eliminating the need for detailed user profiles; and (4) offer free shipping and rewards to encourage repeat traffic. Because this is such a daunting task for most companies, they usually rely on third-party partners who have successfully done this to assist with the transition. For example, this was what Costco did a couple of years back when they decided to start selling online to Chinese consumers. Instead of establishing their own in-country operation, they partnered with Alibaba's Tmall Global EC marketplace which provided access to a substantial percentage China's online consumers, immensely simplified the handling of payments from these consumers, and eliminated many of the logistical issues that confront businesses trying to deliver orders originating from outside the country to Chinese consumers. Besides removing many of the barriers to cross-border EC, working with a partner enables a business to more easily test an international market and experiment with its product offerings without having to make very large up-front investments and incurring substantial card usage fees and logistical costs.
2. **Changing retail landscape**. In the rapidly changing retail landscape, retailers are faced with a series of conundrums. First, while EC retail sales are growing much faster than in-store sales, the overwhelming majority of sales are not online. This means that those retailers who support multiple sales channels will have to determine how to best combine the channels so that customers are provided with a seamless omni-channel experience. Second, cards continue to be the payment method used in most EC transactions. Yet, cash is still used in the vast majority of retail sales, and in some regions of the world other forms of EC payment predominate. The implication is EC retailers who sell worldwide will have to support alternative methods of payment including cash on delivery and cash transfers. Finally, although payment by smartphones is growing substantially faster than payments by other devices, overall purchases made by PCs swamp the number of purchases made by smartphones. This suggests that for the near term, most EC retailers will have to provide interfaces that support different devices including smartphones, tablets, and PCs.

   The various dilemmas facing e-tailers indicate that the models on which EC was originally built are undergoing rapid transformation. This has given rise to a literally hundreds of new payment initiatives, especially in the areas of closed-loop cards and mobile payments, digital wallets, mobile money of all sorts, and virtual currencies. Unfortunately, the vast majority will suffer the same fate as most of the predecessors—death from failure to reach a critical mass of buyers and sellers who are willing to adopt the new schemes and technologies.
3. **Using payment cards online**. The processing of online card payments is essentially the same as it is for brick-and-mortar stores and involves essentially the same players and the same systems—banks, card associations, payment-processing services, and the like. This is one of the reasons why payment cards are predominant in the online world. Even so, this doesn't mean that EC card payments don't present challenges to online merchants who accept them. First, the discount rate and interchange fees charged with each card transaction are substantial. This is one of the reasons merchants are always looking for ways to reduce these fees (like using third-party digital gateways such as PayPal). Second, online merchants experience more card fraud than off-line merchants. Surveys, such as those conducted annually by CyberSource, indicate that over the past few years, merchants have adopted a wide variety of methods including card verification services, address verification, customer order history, negative lists, and postal address verifications.
4. **Smart cards.** A smart card is a plastic payment card that contains data in an embedded microchip. Some cards have memory chips for read/write data. Smart cards can be rechargeable. Applications include telecom SIM cards, contactless financial payments and services, paying for mass transit, identifying cardholders for government services, verifying eligibility for healthcare. There are two types of smart cards—contact and contactless. With both types smart card readers are critical and a key element in determining the cost of a smart card application.

   Stored-value cards are a particular type of smart card where a monetary value is prepaid and can be loaded on the card once or several times. They can be used like a credit or debit card to make purchases online or off. They come in two forms—closed-loop and open-loop.

Closed-loop stored-value cards are issued for a single purpose by a specific merchant (e.g., a Starbucks gift card). In contrast, open-loop stored-value cards are more like standard credit or debit cards and can be used for multiple purposes (e.g., a payroll card).

5. **EC micropayments**. In the online world, most purchases are made with credit and debit cards. When the value of a purchase is under $10, it is called a micropayment. The problem is that the fees associated with card purchases make these low value transactions cost prohibitive. As an alternative, most merchants rely on one of five methods such as aggregation, direct payment, stored-value card, subscription, and à la carte to avoid the individual transaction costs. Aggregation adds the value of a number of purchases before submitting the transaction to the card companies; direct payments aggregates payments by adding them to an existing bill (e.g., mobile phone bill), a stored-value card enables upfront payments to a debit account from which purchases are deducted as they are made; a subscription is a single payment that covers access to content for a defined period of time; and with à la carte payments are made as they occur with reduced fees based on pre-negotiated volume discounts. Companies like Amazon and PayPal support micropayments and, while their fees are lower, they're still costly. More recently, Visa and MasterCard have started lowering their fees on low cost transactions primarily for those merchants with high volumes of card sales.
6. **PayPal and third-party payment gateways.** A third-party gateway is a company that provides electronic connections and transaction services among all the parties involved in electronic payments. Essentially, they eliminate the need for a merchant to deal with the intricacies and complexities of authorization and settlement in online payment. Among these gateways, PayPal is oldest and most successful worldwide. Recently, other gateways have started gaining market share in specific regions of the world including, for example, Alipay in China, Sofort in Germany, Yandex.money in Russia, and iDEAL in the Netherlands. In the USA, Amazon has recently entered the gateway market with their Amazon Payments which is modeled after their extremely successful "one click" payment system used by Amazon customers.
7. **Mobile payments.** The term refers to payment transactions initiated or confirmed using a person's mobile device, usually a smartphone although payments can be made with other mobile devices such as tablets and wearables. They generally fall into one of four payment types (distinguished by "who pays whom") including: (1) Consumer where a buyer pays a merchant for goods and services, often using either a device-based digital wallet like Apple Pay or a cloud-based wallet like Walmart Pay that is built on the cloud-based mobile platform called *CurrentC*: (2) Merchant mobile POS, such as Square's *Magstripe Reader*, that is used by merchants to take customer card payments instead of relying on stationary POS, and (3) Person-to-Person (P2P) systems, like Kenya's M-Pesa (see closing case), used for exchanging money between people both within and across country boundaries, and (4) Institutional used for managing and paying bills from an institution like a utility company (e.g. Finovera).
8. **Digital and virtual currencies.** Digital currency refers to the digital representation of money or currency. Electronic money is the digital representation of a national (fiat) currency. Virtual currency functions as a digital medium of exchange but has no legal status as a fiat currency. Virtual currencies are either convertible or nonconvertible meaning that either it can be converted thru exchange into a fiat currency (like Bitcoin) or it cannot be converted and only has value in a particular virtual world (like World of Warcraft Gold). Among the multitude of virtual convertible currencies, Bitcoin has garnered the most attention for a couple of reasons. First, it was the first decentralized virtual currency which means there is no central authority that issues or administers the currency, and as a consequence there are only very minimal fees even for international transactions. Instead, it is administered by a distributed peer-to-peer network of computers (called bitcoin miners). Second, the currency is pseudo-anonymous. This means that while all Bitcoin transactions are displayed in a public digital ledger call the blockchain, the recipients of any exchange are denoted by their encrypted public keys generated from their private keys, and the senders are designated by encrypted digital signatures again generated by their private keys. There is virtually no way to decipher these keys. Finally, through the combination of the distributed network along with the public (private) key cryptography Bitcoin has addressed the "double-spend problem" which prevents any participant from digitally copying their coins and spending them twice. Because of its success, Bitcoin has spawned a number of competitive currencies. None of these has attracted the same volume of investment. As a consequence, these groups have started ignoring the currency side and started promoting the use of these distributed, decentralized architectures for other types of transactions (e.g., legal contracts or international remittances).
9. **Order fulfillment process.** Once an item has been ordered and purchased online, the next major phase of the process is order fulfillment. Order fulfillment, encompasses all the activities a company undertakes from the time it receives an order to the time the items in the order

are delivered to the customer. These can include: checking inventory for availability; determining completeness and accuracy of order; locating a warehouse with the inventory; picking the items at the warehouse; arranging for shipment; loading and transporting items ordered; and receiving acknowledgement of receipt; as well as, handling returns (reverse logistics). These activities are part of a larger supply chain that also deals with demand planning, procurement, manufacturing, and replenishment to name a few of the other major activities. Ensuring that order fulfillment is well executed so that the right products are delivered to the right person and place in a timely and profitable manner is a complex task whose difficulty varies by the types of product, whether third parties are involved, and on the company's strategies and operations models (i.e., whether the company primarily engineers-to-order, makes-to-order, assembles-to-order, or makes-to-stock).

10. **Problems in order fulfillment.** Survey results indicate customer satisfaction has declined as a direct result of problematic order fulfillment. It is a challenge to companies because customers expect very short delivery times, as well as very accurate orders. They also want a seamless experience across all of a company's sales channels both online and off-line. In B2C retail most of these problems arise because of uncertainties in demand, lack of information sharing across all the companies supply chain, inadequate logistical infrastructure, and inefficient financial flows (invoicing, payment, collection, etc.).
11. **Solutions to order fulfillment problems.** There are a large number of solutions that are aimed at addressing the problems in order fulfillment. These involve major changes to the order-taking process, improvements to the warehousing and inventory systems, as well as major changes to the structure and process of the broader supply chain. It also involves solutions targeted to specific problems. A case in point is the changes designed to enable much faster fulfillment including novel approaches like Amazon Prime Air which envisions small package delivery by drones, or faster warehouse picking, packing, and delivery enabled by using robots to assist in the process, or using mass customization in make-to-order fulfillment, or even faster and more efficient handling of EC returns (e.g., return to store or special collection stations).

    While some of these solutions apply equally well to B2B EC, B2B tends to be more inefficient because it is more complex—larger shipments, multiple distribution channels, varied shipment frequency, more complicated transaction paths, to name a few. Often solutions to these complexities require major changes to business processes, as well as the incorporation of software systems that can automate the processes.

    Regardless of the type of EC or source of the problems, many companies rely on supply chain planning and execution software systems to help address the problems—both structure and processes. Included among the key systems are supply chain planning system of record (SCP SOR), warehouse management (WMS), and transportation management (TMS). Given the complexity of most supply chain problems (order fulfillment included), it can be a multi-year undertaking even with the aid of these systems.

KEY TERMS

Address Verification System (AVS)
Authorization
Bitcoin address
Bitcoin private key
Blockchain
Card verification number (CVN)
Contact card
Contactless (proximity) card
Convertible virtual currency
Cross-border e-commerce
Digital currency
Discount rate
Electronic money
Fiat currency
Interchange rate
Merge-in-transit
Micropayments (e-micropayments)
Mobile payment
Mobile (digital) wallet
Non-convertible virtual currency
Order fulfillment
Payment cards
Settlement
Smart card
Smart card reader
Stored-value card
Third-party logistics suppliers (3PL)
Virtual currency
Warehouse management system (WMS)

DISCUSSION QUESTIONS

1. Five years from now do you think credit and debit cards will still be the primary payment method for online purchases? What about cash for off-line purchases? In both instances explain why or why not.
2. What type of payment service does Boku (**boku.com**) provide? How does it work? What are some of the countries where it works? Who are some of the companies

that utilize the service? What is their chance of success? What factors do you think will pay a role in its success or failure? Start by reading the press release at **boku.com/#merchants** and **boku.com/#carriers**.

3. In B2C EC criminals may use fake or stolen credit cards to pay merchants. What steps should the merchants take to combat the fraud?
4. A metropolitan area wants to provide users of its public transportation system with the ability to pay transit fares, and make retail purchases, using a single contactless smart card. What sorts of problems can it encounter in setting up the system, and what types of problems could the riders encounter by using the cards?
5. Discuss the differences between Litecoin and Bitcoin? How likely is it that Litecoin will become a widely used global virtual currency? What will be the key reasons for its success or failure.
6. A retailer wants to move into cross-border commerce. What types of payments will they need to accept and why?
7. Discuss the problem of reverse logistics in EC. What types of companies may suffer the most from this problem?
8. Differentiate order fulfillment in B2C from that of B2B.
9. Watch **youtube.com/watch?v=OTnSXMhqQ-g** to gain a better understanding of the *bullwhip* effect and potential factors that cause can cause it. Based on your understanding, what sorts of factors should demand forecasting incorporate to mitigate these factors?
10. Describe the importance of providing a single demand forecast for improving control along the entire supply chain.
11. Investigate and discuss how artificial intelligence can be used to manage warehouse operations. Begin with **yahoo.com/tech/meet-the-new-boss-the-worlds-first-128660465704.html**.

TOPICS FOR CLASS DISCUSSION AND DEBATES

1. Several years ago Facebook declared that all Facebook applications, including games, would have to use Facebook Credits as their currency. A short time later they rescinded this policy. Why would Facebook issue such a policy? Why did they rescind it? Do you agree with their actions?
2. Besides music and apps, what are some of the other places where EC micropayments could be used?
3. Which would you prefer, paying for goods and services with a physical debit or credit card or paying with your smartphone? What are some of the benefits and limitations of each?
4. What is MasterPass™ and how does it work? Some question the longer-term viability of MasterPass™. Find pro and con information and debate the issue.
5. Discuss the differences between convertible and nonconvertible virtual currencies. What are some examples of each? Contrary to the strict definition, are there some instances where the nonconvertible virtual currencies have actually been used as a medium exchange in the "real" world?
6. Chart the supply chain portion of returns to a virtual store. Check with an e-tailer to see how it handles returns. Prepare a report based on your findings.
7. Some say outsourcing B2B services may hurt the competitive edge. Others disagree. Discuss.
8. Which activities are most critical in order fulfillment of B2C (check Table 12.1). Which are for B2B? Discuss the differences.
9. Write a report about the status of Amazon.com's same-day delivery projects.

INTERNET EXERCISES

1. Select a major retail B2C merchant in the United States and one outside of North America. Detail the similarities and differences in the e-payment systems they offer. What other payment systems could the sites offer? Write a short report.
2. A number of companies are providing digital (mobile) wallet systems. What is a digital wallet? Make a list of these companies and their products. Compare their various capabilities. Do you think any of these products will be popular in the near future? Why or why not?
3. Go to **smartcardalliance.org/smart-cards-applications-transit-open-payments-resources**. The site lists a number of existing transit systems that are using contactless smartcards effectively. Select two of the systems and compare and contrast them.
4. Read about Starbucks' gift cards and stored-value mobile app. In recent years these have been victimized by cybercriminals. What types of cybercrimes have been committed, what has been the impact, and how have the problems been addressed?
5. Download the lastest version of the CyberSource Fraud Benchmark Report at **cybersource.com**. In the report, is mobile commerce more or less susceptible to fraud than nonmobile EC, which mobile operating systems are most susceptible to fraud, and what techniques are most often used to combat it.
6. The U.S. Postal Service (USPS) has working relations and special programs with Amazon, UPS, Fedex, and most recently with the Chinese firm Alibaba. What is the

nature of these relationships, how do they differ, and are they successful?

7. Visit **freightquote.com** and the sites of two other online freight companies. Compare the features offered by these companies for online delivery.
8. Enter **efulfillmentservice.com**. Review the products you find there. View the video about their operation. How does the company organize the network? How is it related to companies such as FedEx? How does this company make money?
9. Enter **kewill.com**. Find the innovations offered there that facilitate order fulfillment. Compare it with **shipsmo.net**. Write a report.
10. Visit **b2b-today.com**. Go to the B2B Communities area and identify the major vendors there. Then select three vendors and examine the services they provide to the B2B community.
11. Go to **ariba.com**. What is Sap Ariba and what supply chain solutions does it provide? Prepare a report describing the solutions they offer in the procurement arena.
12. "The food industry has been the slowest major consumer sector to expand into e-commerce." First, read **foodlogistics.com/article/12021908/food-and-beverages-push-into-e-commerce-raising-questions-for-the-supply-chain**. Based on the article what are some of the major issues that the food industry faces with EC? What are some of the solutions that have tried to address these issues?

TEAM ASSIGNMENTS AND PROJECTS: ASSIGNMENT FOR THE OPENING CASE

1. Read the opening case and answer the following questions:
   (a) What is cross-border research and under this definition is trade between two member countries of the European Union cross-border or not? Explain.
   (b) Describe the current and estimated size of the cross-border market.
   (c) What are the key elements of success for a EC company wanting to expand into global markets?
   (d) What is the basic approach that Costco used in entering the Chinese EC market?
   (e) Would the approach used by Costco work for a company like Walmart? Explain.
2. The competition within the mobile payment reader industry is very intense. Each team selects a company in this field (e.g., Square, PayPal, Groupon) and presents the company's capabilities and weaknesses.
3. Write a report comparing smart card applications in two or more European and/or Asian countries. In the report, discuss whether those applications would succeed in North America.
4. Have one team represent MasterCard® Pay Pass™ (**mastercard.us/paypass.html**) and another represent Visa payWave (**usa.visa.com/personal/security/card-technology/visa-paywave.jsp**). The task of each team is to convince a company that its product is superior to the other.
5. Research and write a report on the differences among the cloud-based and device-based digital wallets, giving examples of each and noting the pros and cons of each approach.
6. Each team should investigate the order fulfillment process offered at an e-tailer's site, such as **gap.com**, **staples.com**, or **walmart.com**. Contact the company, if necessary, and examine any related business partnerships. Based on the content of this chapter, prepare a report with suggestions for how the company can improve its order fulfillment process. Each group's findings will be discussed in class. Based on the class's findings, draw some conclusions about how companies can improve order fulfillment.
7. FedEx, UPS, the U.S. Postal Service, DHL, and others are competing in the EC logistics market. Each team should examine one such company and investigate the services it provides. Contact the company, if necessary, and aggregate the team's findings into a report that will convince classmates or readers that the company is the best. (What are its best features? What are its weaknesses?)
8. The competition on "same-day delivery" is intensifying with more and more competitors entering the race. Investigate the status of the competition including delivery by drones (e.g., FAA's approval). Start with Bowman (2014). Write a report.
9. Read about the warehouse management systems provided by JDA and Manhattan Associates (including some of their warehouse case studies) and answer the following:
   (a) What supply chain processes are supported by both systems?
   (b) What are the major benefits of each system?
   (c) What are the major differences in the capabilities provided?

CLOSING CASE: SEND MONEY HOME—M-PESA AND THE KENYA EXPERIENCE

The slang term *unbanked* refers to people who do not use banks or other financial institutions. Instead of using checks and cards, they conduct most of their financial transactions in cash. While there are many reasons for people to be unbanked, most of them are poor and either lack the credit standing to have a bank account or they are located in poorer regions where there are no banking services. In many countries around the world, moving from the ranks of the unbanked is almost a necessary step for getting out of poverty.

From 2011 to 2014, the number of "unbanked" adults declined an astounding 20% to two billion (World Bank 2015). The drop was not the result of declines in the number of unbanked living in the more advanced or growing economies. Instead it was almost solely attributable to shifts in the number unbanked residing in sub-Saharan Africa and more specifically in Kenya. It was due to a program called M-Pesa originally intended to provide person-to-person international remittances conducted via cell phones. This closing case describes in detail the M-Pesa program including the problems it was designed to address, the structure and operation of the program, and its long-term results on the unbanked poor in Kenya and other parts of the world.

The Problem

In developing countries, immigration is "a way of life." When done voluntarily, people often migrate for the express purpose of finding work or taking advantage of opportunities outside of the countries or areas where they live. Worldwide, this migration results in a massive transfer of money from workers to their families and friends back home. These transfers are known as remittances. While any single remittance is usually small, the aggregate amounts are substantial. For example, according to figures from the World Bank (2016), "official" global remittances involving foreign workers from developing countries totaled over $430 billion in 2015. To put this in perspective, for many developing countries the yearly total is often more than the development assistance they receive from all sources and larger than the monies from direct foreign investments.

These sums not only represent big money from the developing countries perspective, they also represent big money for the Money Transfer Operators like Western Union who handle these transfers. The MTOs charge fees for their services, as well as making money from currency conversion. While most of these operators follow strict guidelines and rules, even small charges can have a major impact on the amounts received by the individual families.

In addition to these global remittances, developing countries also have sizeable "internal" remittances generated by workers who have moved from the rural parts of the country to take jobs in the cities. Because the workers and their families are unbanked, most of these remittances take place the old fashion way. Either the workers take the cash home themselves or they have someone do it for them. While this certainly avoids the fees charged by the MTOs, it still a costly and dangerous undertaking—it takes time to transport the money (usually by bus) and places both the person and the money at risk given the high rates of robbery in many of these countries. Also, because the transfers occur outside any formal financial system, there is no way to measure the numbers of people, cash, and transactions involved.

In the past a number of countries have sought to address either directly or indirectly the issues and inefficiencies in global and domestic remittances. Many of these programs revolved around the idea of somehow turning the "unbanked" into the "banked." Theoretically, if both the sender and the receiver had bank accounts, this could certainly simplify the domestic transfers of funds, and would open other possibilities for international transfers. It might also address the larger issues of poverty, thus alleviating the need for family members to separate in the first place. Ignoring the fact that it cost money to have a bank account and the fact that banking systems in many developing countries are suspect, this approach is a massive, costly, and long-term undertaking. As the last few years have demonstrated, the real answer might be in mobile money and the "un-banking" of the banking system. At least, that is what the experience in Kenya over the last few years has shown.

The Solution

The history of the M-Pesa is well documented in *Money, Real Quick* by Omwansa and Sullivan and touched on more recently by Runde (2016). The discussion that follows briefly covers some of the key events that these discussions highlight.

Kenya is an east African country of approximately 40 million people with high unemployment and poverty. Approximately 10 years ago, an in-depth survey of the Kenyan financial sector found, much to the surprise of their Central Bank of Kenya, that only 20% of the adults in the country were "banked." Basically, the bank was servicing urban elites and slowly dying in the process. The same could be said for the government owned telecom system which historically had provided landlines in urban areas. As a result, only 2% of the population had phone service. In contrast, Kenya's mobile operators, of which Safaricom Network Company was by far the largest, had managed in a relatively short period of time to get ten million mobile phones in the hands of the Kenyans (for a 35% penetration rate). So, instead of thinking about how to spread a dying landline business or branch banking business to the rural populace, or for that matter to the slums of the cities, maybe it would be easier to figure out how to use mobile phones to help bring financial services to the poor?

The original pilot for Kenya's mobile money system was run under the auspices of Britain's governmental development agency (DFID) and focused on reducing the costs of microfinance-loan repayments and lowering the associated interest rates. After the initial foray, control of the program was shifted to Safaricom and the focus morphed away from loan repayments toward person-to-person money transfer. The new system was called M-PESA—the "m" stands for Mobile and "pesa" is the Swahili word for money. The marketing slogan for the

new system was simply "Send money home," although the system had broader financial capabilities.

The task of sending money was relatively straightforward. First, the sender and the receiver had to have mobile phones that supported texting, which virtually every mobile phone has regardless of the underlying technology. Next, they had to get Safaricom SIM cards. Once they had the SIM cards, they had to register with an M-PESA agent. All that was required to register was an identity card, something that every Kenyan had. Once registered, the network sends an updated menu to the registered customer's mobile phone. At this point, the system is ready to go. To actually send money, a registered customer first deposits cash to his or her account. This is done by giving cash to an M-PESA agent who immediately credits it to the customer's account. The network sends a text message to verify the deposit. Once, it's in the customer's account, he or she can send money at any time by selecting "Send money" from the M-PESA menu and then entering the recipient's phone number. At this point, the sender is prompted for his or her M-PESA pin number and then selects "Ok." Next, the system sends a message to the sender confirming the transfer and the recipient's name. In turn the recipient receives a message with the sender's name and the amount transferred to his or her account.

On the other end, a recipient can now go to a local M-PESA agent to pick up the money. Actually, the recipient is basically making a cash withdrawal from his or her account. It's done by showing the agent his or her identity card, choosing "Withdraw" cash from the menu, entering the agent's ID number, and then entering his or her M-PESA pin number. Once the transaction is confirmed, the agent distributes the cash.

Obviously, a major key to the success of the system is the M-PESA agent network (Stahl 2015). It has been described as a network of "human ATMs." An agent might be a local grocer, or gas station owner, or a post person, etc. They were recruited through a thorough selection and vetting process. Many of them were also selling mobile airtime for Safaricom. They receive regular training and are frequently monitored. They are also restricted from doing business with other mobile operators. Outside of the due diligence process, the major hurdle for an agent is monetary. Agents have to prepurchase mobile money so they can sell it to customers for cash. Likewise, they have to sell cash for mobile money so customers can withdraw funds. Both the cash and the mobile money they manage are theirs, not M-PESA's. Some agents do well, but for the majority it is a part-time job.

Less obvious is the fact that M-PESA is modeled after a "prepaid" mobile phone system where consumers pay up-front for minutes rather than relying on credit and paying for minutes after they are used. In M-PESA you don't need credit approval up-front to open and use the system. Essentially, you open an account and then deposit money. There are no fees for making deposits nor are there fees for adding airtime to a phone. There are fees for transferring and withdrawing funds. They pale in comparison to fees charged by the MTOs and by ATM machines. There are also restrictions on the maximum amount of money you can store in your account and the amount of money you can transfer at any given time. There are a variety of reasons for these restrictions. First, a majority of customers are poor so the system is focused on their needs. Second, they don't want the system to be used for illegal purposes (e.g., money laundering). Third, and most importantly, M-PESA is not a bank. Monies that are held in a trust owned by Vodafone (the major shareholder) and deposited in commercial banks.

The Results

By virtually every measure, M-PESA has been a major success (Vodafone 2016). The program started in Kenya but now operates in 11 countries. In 2014/2015 it had 23.4 million customers, 240 K agents, and handled 3.4 billion transactions. In Kenya there are over 20 million subscribers (which is about 50% of the entire population and 90% of the adults). There are also over 80,000 M-PESA agents. The value of transactions flowing through the system in Kenya is around two trillion Kenyan Shillings (which converts to about 20 billion dollars U.S.).

The capabilities of the system have also expanded and now include: sending money to another M-PESA customer; paying bills (e.g., utilities); buying goods from merchants; withdrawing money from ATMs; receiving money from abroad; and receiving or paying salaries. Essentially, M-PESA has become a mobile e-wallet.

Additional systems have also been integrated to M-PESA to provide other financial services. For instance, the M-SHWARI system and a new entry (KCB M-PESA) offer M-PESA customers savings and loan capabilities. By early 2015, M-SCHWARI had about ten million customers.

As noted above, M-PESA now operates in other countries besides Kenya. This includes places inside of Africa (e.g., Tanzania), as well as outside of Africa like Afghanistan, India, South Africa, and Romania. In virtually all of these other countries, the Kenyan success has not been replicated, although the jury is still out in some of these (e.g., India). A number of critics have suggested that the success M-PESA of Kenya rests on a series of circumstances that are hard to replicate in other countries, including (Economist 2013):

1. The financial sector basically had a hands off policy that eliminated a number of regulatory hurdles encountered in countries.
2. Safaricom was close to a mobile monopoly in Kenya. In the other countries the competition is much greater which makes it harder, for example, to control things like the SIM cards used in phones or the mobile airtime.

3. Unlike a number of similar projects, Safaricom recognized that the biggest hurdles were people related not technological in nature. This was the reason for the original marketing theme, the simplified phone capabilities, and the establishment of network of agents located close to the potential customer base.
4. Finally, the percent of the "unbanked" population was close to 90% at the beginning of the project. In most of the other countries where M-PESA is present today, the percent is much higher (e.g., 30–50%).

Sources: Economist (2013), Omwansa and Sullivan (2012), Runde (2016), Vodafone (2016), and World Bank (2016).

Questions

1. What are remittances and why are they important in developing countries?
2. What is an MTO? What role have they historically played in remittances?
3. What is M-Pesa? Briefly describe how M-Pesa works.
4. What evidence is there that M-Pesa was successful?
5. What is the major benefit of owning a credit-based transportation card for commuters? What role did the M-Pesa agent network play in this success?
6. What has M-Pesa been successful in Kenya but not other countries?

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